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Technical measures and agri-food trade between traditional economic partners: emerging issues from the EU-Africa trade relations

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Abstract

Purpose – Africa's exports to the EU markets have been plummeting, which in part has been attributed to the applied technical measures that impact Africa's sustainable economic development. However, the trade measures have stimulated the EU food export base to Africa. The intensiveness and extensiveness of the EU technical measures have a double-edged impact on Africa's food system competitiveness. Thus, this study investigates Africa's cocoa, coffee and vegetable export effects of the EU technical measures.

Design/methodology/approach – The empirical strategy adopts an augmented gravity model derived from Melitz's firm heterogeneous framework that measures the extent to which the exporting trade costs, such as the technical measures, affect the heterogeneous exporting firms' market access.

Findings – The findings suggest contrary outputs to the dominant contextual perspective that the EU trade policies adversely impact Africa's agri-food trade competitiveness. This study proposes extensive investments in food system-related quality infrastructure and improved development finance to propel the sustainable transformation of the food system.

Research limitations/implications – This study is limited to technical measures of the agri-food trade. Further studies could evaluate other trade policy measures.

Originality/value – This article contributes to the frontier of knowledge with the extension and update to the study that has investigated these selected agri-food effects of the EU food safety regulations by exploring the combined effects of sanitary and phytosanitary measures and the technical barriers to trade. It also utilises the unexplored technical measures data in an augmented gravity model derived from the Melitz theoretical framework. Moreover, this study departs from the previous country-specific studies by exploring panel data and updating the technical measures dataset for a combined 37 African countries that export vegetables, coffee and cocoa to the EU.

Keywords Technical measures, Agri-food trade, Gravity model, The EU, Africa

Paper type Research article

1. Introduction

The evolving economic and socio-political landscape, especially at the global level, has made it inevitable for countries to rejig, modify and/or repurpose their trade policies that govern trade interaction with partner countries. The tremendous multiple and overlapping crises, such as climate change, the wars in Ukraine and Gaza, the health pandemic, energy and food price spikes, recession scares and rising geoeconomic tensions faced by the global economy have been catastrophic (Rudloff *et al*., 2024; Kareem and Kareem, 2024). In response to these global challenges, countries have been tweaking their trade policy measures to protect national interests and security. OECD-WTO-UNCTAD (2023) posits that advanced countries have been adjusting their trade policies to reflect the recent global crises. Besides, the global impetus for a green and environmentally friendly economy as well as sustainable ecosystems has encouraged some countries, particularly the advanced countries, to implement socioeconomic policies that will ensure the achievement of their aspirations. These global challenges and the desire for green and sustainable economies among Member states have led to the introduction and rejigging of trade and investment policies in the European Union (EU).

JEL Classification — C33, C87, F42

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The EU trade policy measures are influenced by its socio-economic-political orientations, which characterise its interactions with third countries. Fitzsimons and Hausemer (2024) argue that trade partners' domestic policies are influenced by the EU policies through the reshaping of these domestic policies to reflect the required market access conditions in the EU. Bilal and Hoekman (2020) assert that the EU is adapting its trade and external policies to better pursue not only economic interests but also geostrategic, environmental and principled-based objectives.

Furthermore, recently, the Green Deal, within which the Farm-to-fork and Biodiversity strategic policies are embedded, Voluntary Sustainable Standards, the Corporate Sustainability Due Diligence Directive, and Deforestation Regulations, among others, have been introduced and implemented in the EU. Aside from these trade-oriented policy measures, the extant trade policies such as sanitary and phytosanitary measures (SPS), technical barriers to trade (TBT), and other technical and non-technical measures have been tweaked in line with global economic realities, sustainability interests and geopolitics. This became conspicuous during the COVID-19 pandemic containment measures, which impacted food and medical products supply chains (Wieck *et al*., 2021; Das *et al*., 2021; Kareem *et al*., 2023). These trade policy measures have consequences and/or impact Africa's market access, particularly agri-food commodities, to the EU due to compliance issues (Fitzsimons and Hausemer, 2024). More so, the non-technical trade policy measures, such as support, subsidies, etc., also impact the competitiveness of Africa's agri-food commodities in both African and EU markets.

Nevertheless, the trade between the EU and Africa is traced back to the colonial era (Kareem, 2011) when Africa exported crude agri-food commodities while it imported finished products from the EU. This makes the EU member states Africa's traditional trade partners. The EU has granted trade preferences through different trade negotiations, arrangements and/or agreements, e.g. Everything But Arms, Lome I-IV Agreements, General System of Preference, Cotonou Agreements, etc., to Africa bilaterally, multilaterally and plurilaterally (Lodge, 2019; Kareem, 2011). The preferences are meant to boost and enhance their trade relations and, essentially, to improve market access of Africa's exports to the EU. Moreover, technical assistance is being rendered by the EU and some institutions from the EU to develop the capacities of Africa's producers and exporters for market access. However, despite these supports, there has been an oscillation in the intensity of Africa's market access to the EU owing to its inability to comply with the trade policy measures, particularly the non-price trade measures. The non-price measures, also known as non-tariff measures (NTMs), largely determine market access (Fugazza, 2013; Gourdon and Nicita, 2013), especially to the EU. While tariff measures have substantially decreased and the magnitude of their importance in the agri-food trade has fallen due to the trade agreements-induced preferential tariffs (Mutume, 2006; Kareem, 2016a), the preponderance of NTMs applications has been on a rising trend (Fugazza, 2013; Gourdon and Nicita, 2013; Kareem and Rau, 2018). The NTMs are the main obstacles, particularly the technical measures (SPS/TBT), militating against Africa's food exports' access to the EU markets (Mutume, 2006).

Furthermore, these EU technical measures and other trade regulatory measures and/or directives have also impacted the competitiveness of Africa's agri-food commodities at home and given credence and a competitive advantage to the EU agri-food products that are characterised by supportive agri-food policy measures. Although the agri-food products imported from the EU are characterised by subsidies which are affecting the competitiveness of domestic agri-food commodities (Bewley, 2019; Matthew and Soldi, 2019; Dekeyser and Woolfrey, 2021; Byiers *et al*., 2023), the agri-food imports contributed to the food insecurity resilience measures in Africa (Knoesslsdofer and Qaim, 2023; Kitenge, 2023; Zamani *et al*., 2022), especially for agri-food import-dependence and agri-food supply short-fall countries. More so, the competition from these agri-food imports is stimulating Africa's agri-food system's transformation and the development financing of the underdeveloped agricultural and food systems in Africa. Thus, the trade measures implemented in the EU have unintended consequences on the competitiveness of Africa's agri-food exports in the EU market and

Africa's market, which impacts its economic development. The sustainable development aspirations of Africa have been linked to its trade sector performance, especially agri-foods, owing to its multiplier effects on households as consumers, producers and income earners. To this end, this study investigates Africa's agri-food effects of the EU technical measures.

A perusal of the literature indicates that the empirical analysis of Africa's agri-food competitiveness effects of the EU technical measures in the EU and African markets is scanty (Bewley, 2019; Goodison, 2007; Hathie, 2024). These scanty studies were mostly qualitative and/or normative economics-oriented, which this study departs from by exploring quantitative empirical analysis that deductively induced policy options. Besides, some studies have investigated competitiveness from the point of view of Africa's EU market access or Africa's domestic market (FAO/LEI, 2015; Boysen *et al*., 2016; Blanco, 2018; Kareem, 2019; Woolfrey and Karkare, 2021; Dekeyser and Woolfrey, 2021; Amaroli *et al*., 2024). For instance, Woolfrey and Karkare (2021) analyse the development and trends that impact Africa's exports to the EU market. They find the EU measures are a double-edged sword for Africa because they not only promote sustainability but also inhibit exports to the EU. FAO/LEI (2015) investigates the supply side by determining the impact on sub-Saharan Africa (SSA) of the EU trade policies using the Modular Applied General Equilibrium Tool, in addition to a baseline business-as-usual scenario, to find overall welfare losses in SSA.

Furthermore, an adverse effect on Africa of the EU farm-to-fork and biodiversity policies was projected in the review carried out by Dekeyser and Woolfrey (2021) due to the likely resultant higher global food prices that will affect food security. Moreover, given the recent changes in the global trading system due to the successive global crises, studies such as Wieck *et al*. (2021), Rudloff *et al*. (2024) and Fitzsimons and Hausemer (2024) have evaluated the consequences of the trade measures in the EU and its Member states, isolated policy measures on its trade partners, including Africa. These studies did not explore the impact of the EU technical measures as investigated in this study. More so, the quantification of the magnitude of the effects of the EU technical measures on Africa is essential for possible policy responses that could stimulate market access to the EU.

2. The context

2.1 Facts and figures on the EU-Africa agri-food trade

The trade interaction between Africa and the EU has been long-established, tilted towards Africa supplying crude commodities, such as agri-food commodities (Kareem, 2025). The EU is the main trade and investment origin in most African countries (Bellora *et al*., 2022), despite the recent decline in economic relations. During the pre- and immediate post-colonial era, Africa's agri-food export base was extensive and intensive, such that it was the mainstay of the economy; however, with the advent of mineral resources in commercial quantities, the importance of the agricultural sector plummeted due to neglect. The neglect, coupled with the change in taste and preferences, increased population and urbanisation, as well as the quest for dietary diversity, led to food insecurity in many African countries, which necessitated demand for agri-food imports to augment domestic food supply. These agri-food imports to a large extent come from Europe, particularly from the EU, and have been increasing over the past decades.

Figure 1 shows an increasing agri-food trade between the EU and Africa, but with an oscillatory trend, indicating the presence of certain constraints such as the global food crisis in 2008/2009, the global economic meltdown and the oil glut in 2012 and 2016, respectively. Moreover, domestic production challenges such as inadequate technology adoption in Africa, food quality and safety, insecurity, etc., also affected staple food volatility. Figure 2 indicates that since the turn of this millennium, the EU agri-food exports to Africa have been increasing; they increased more than quadrupled from $5.7 billion in 2000 to over $24 billion in 2023. Although this rise in agri-food imports from the EU is due to advancements in the adoption of science and technology in agricultural and food production, evidence has also shown that supports, such as subsidies, have enhanced their competitiveness (Interreg Europe, 2022; Beck *et al*., 2024).

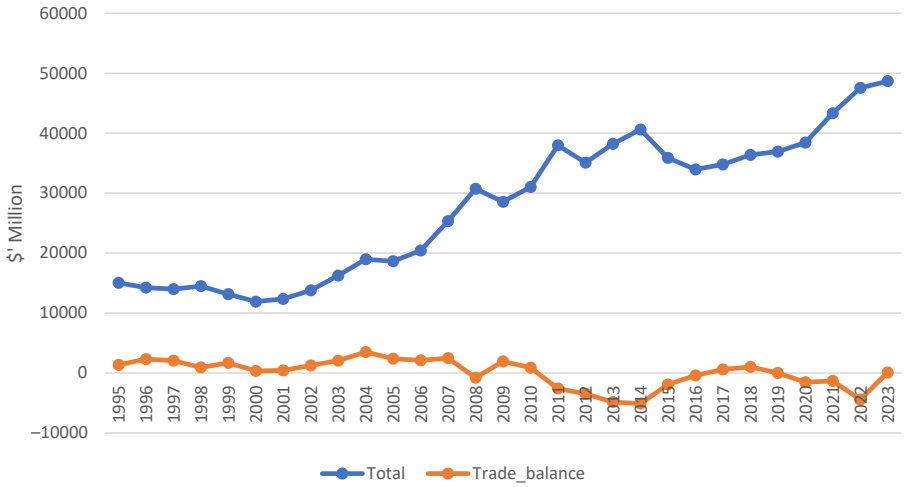

Figure 1. Africa-European Union Agri-food Trade ($Million). Source: Author's calculations from the UNCTADStat (assessed in January 2025)

Figure 2. Africa-European Union Agri-food Export and Import ($Million). Source: Author's calculations from the UNCTADStat (accessed in January 2025)

The figures depict the volatility in Africa's agri-food exports to the EU, in which the trend has been oscillatory over the years. However, the largest food supply shortage that culminated in more agri-food imports from the EU was witnessed in 2013 and 2014, owing to domestic food production challenges such as insecurity, plagues, inadequate development finance, etc. This implies that the EU agri-food export to Africa serves to augment the food supply shortages in many countries, though it might have heterogeneous effects on producers and consumers.

2.2 Stylised facts on the non-tariff measures in the EU-Africa agri-food trade

The extant and evolving global crises have influenced countries' food and trade policies, especially the fear of food insecurity, food price hikes and food safety. Besides, geoeconomics and the drive for a green economy have motivated the tweaking of food trade policies,

particularly in developed countries. Given that tariffs are being negotiated downwards, except when the Trump administration in the United States of America rekindled tariffs, which are prohibitive and/or protective, with retaliatory actions from trade partners, the NTMs have been the main trade measures impacting agri-food trade. There has been a proliferation of NTMs due to the changing global trading system, reflecting continuous global crisis, changes in taste and preferences and food systems' sustainability. To this end, the EU has been tweaking its food and trade policies to reflect the drive for a sustainable food system, biodiversity, a sustainable ecosystem and a green environment. These policies and their preponderance have been impacting the extensiveness and intensiveness of the EU agri-food trade with its trade partners, particularly in Africa.

There is a gamut of applied EU NTMs to the agri-food trade – 38 of these measures are implemented – and compliance is required before accessing the market. Table 1 presents a summary of the applied and/or implemented top ten NTMs in the EU and their import coverage as of 2018. The labelling requirement constituted the most extensive coverage of imports, with about 73% which is applied to 3645 product lines. The pre-shipment inspection of imports accounted for 60% of import coverage for 2198 product lines, while the import coverage of the product quality requirement was more than 57% for 2445 product lines. Further, certification and registration of the import are required for about 55 and 50% of the EU imports that affected 2633 and 1580 product lines, respectively. The EU implementation of prohibitions, quotas, licences and other quantity controls affected 1705 products with an import coverage of about 43%. The measures imply that EU agri-food imports are subjected to extensive quality requirements before market access, which gives credence to the sophistication of this market.

Table 2 gives a specific application and coverage of the NTMs as applicable to the agri-food trade as of 2018. This table indicates that virtually all the NTMs were applied to the EU agri-food imports with a coverage ratio of 99.8%. The animal and vegetable, sub-categories of agri-

Table 1. Summary of the EU's top ten applied non-tariff measures

Measures[a]	Coverage ratio (%)[b]	Product affected[c]
Labelling	72.79	3645
Inspection	60.03	2198
Product quality	57.53	2445
Certification	54.86	2633
Registration requirement	50.87	1580
Prohibition, quotas, licences, etc	42.83	1705
Authorisation	37.51	1803
Testing	36.55	1833
Packaging	34.24	1278
Certain substance restriction	30.74	1520

Note(s): [a]The measures associated with the measure nomenclature, [b]The number of imports covered by NTMs,, [c]The number of traded commodities in H6-digit subjected to at least one NTM.

Source(s): Author's collations from the World Integrated Trade Solution database (assessed in February 2025)

Table 2. Summary of the EU's food import non-tariff measures by product group

Product group	Coverage ratio (%)	Product affected
Animal	99.91	321
Vegetable	99.88	348
Food products	99.82	210

Source(s): Author's collation from the World Integrated Trade Solution (assessed in February 2025)

food import, were confronted with the NTMs that cover 99.91 and 99.88% and applied to 321 and 348 product lines, respectively. The statistics indicate that agri-food products were the most regulated, with virtually all the measures required for compliance before market access, which means these are hurdles to pass for Africa's agri-food exporters with heavy quality infrastructure investment needs.

Figure 3 presents the measures among the NTMs that stand out for Africa's agri-food export to the EU. It could be seen that the SPS measures and TBT are the most implemented NTMs with proliferation as of 2018. Approximately all animal and vegetable imports to the EU are subjected to SPS and TBT measures, indicating the importance of these measures and their compliance, while all the agri-food products are required to comply with the TBT, about 92% of them must be checked for SPS measures. The pre-shipment inspection has the lowest SPS measure of import coverage ratio for animal imports at 6%, while it was about 5% for all agri-food products. Similarly, the quantitative restrictions and financial measures were applied to only about 10% of animal and vegetable imports, indicating the measures were applied as countervailing measures, seldom implemented as direct market access restrictions.

The proliferation of the EU technical measures is, to a certain extent, driven by the frequency of the application of the "precautionary principle" that allows countries to prevent market access to a commodity/product when there are health concerns and insufficient scientific evidence to ascertain the extent or otherwise of the concerns. During the period of concern, the country can trigger restrictive food safety measures, pending when scientific evidence on the concerns is ascertained. The EU has been applying this principle to the maximum residual limit requirements in pesticides, which is 0.01. mg/kg on pesticides whose scientific risk assessment evidence is incomplete. Figure 4 shows the incidences of the EU pesticide regulations of the maximum residual limits (MRLs), which were 32,408 between 1995 and 2015, and it affected 538 agri-food commodities' imports at HS 6. The ratio of these incidences of MRLs to the affected agri-food commodities' imports is 61, implying an average of 61 pesticide MRL regulations per agri-food import (Figure 5).

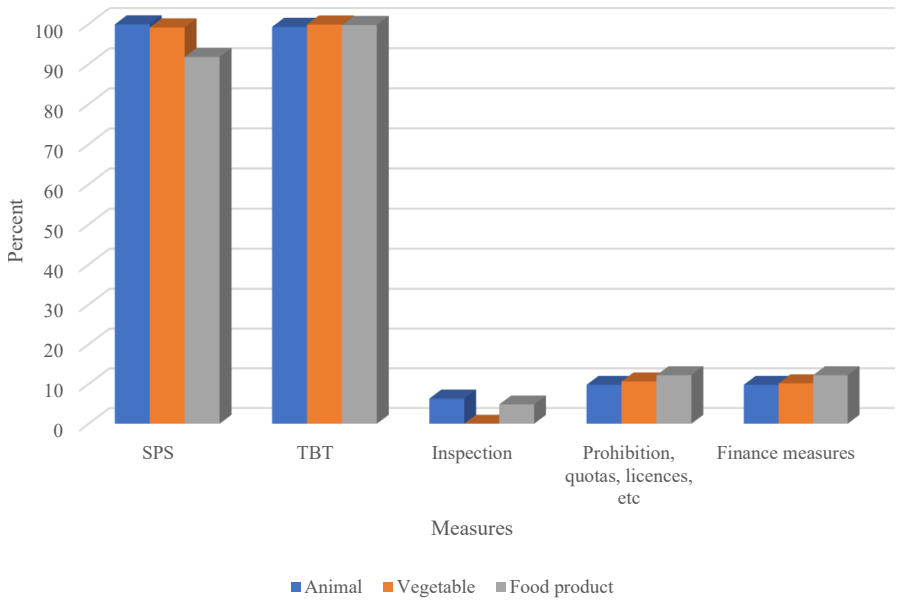

Figure 3. The EU non-tariff measures import coverage ratio. Source: Author's calculations from the World Integrated Trade Solution database (assessed in January 2025)

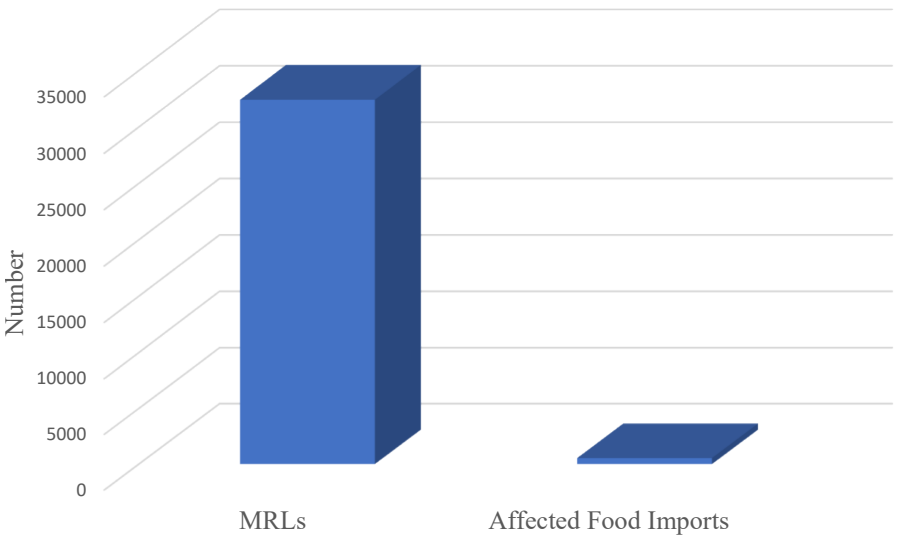

Figure 4. The incidences of the EU pesticide regulations of maximum residual limits. Source: Author's calculations from Kallummal and Gurung (2020)

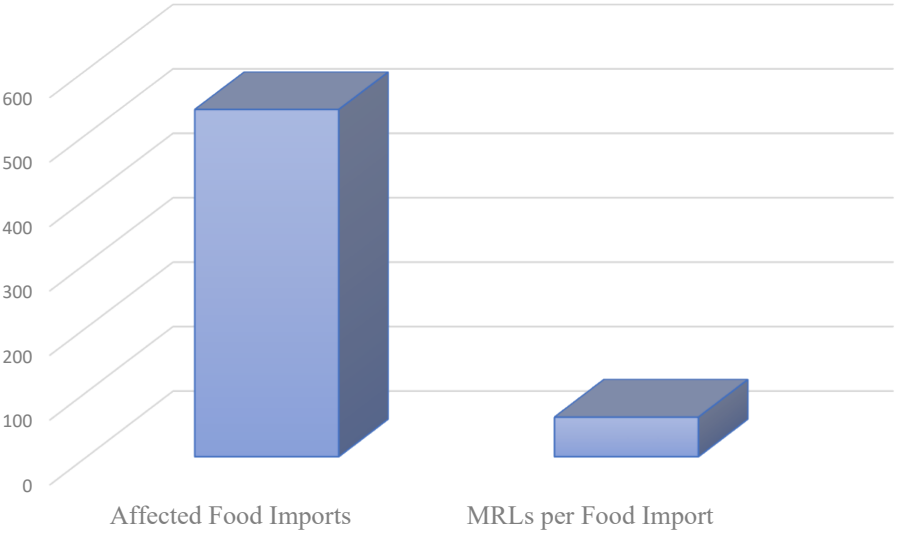

Figure 5. The number of food imports subject to the EU pesticide regulations. Source: Author's calculations from Kallummal and Gurung (2020)

3. Overview of the NTMs theoretical propositions on trade

The increasing implementation of trade liberalisation policies in many countries has propelled global trade through downward negotiations of tariffs. However, in the past 2 decades, there has been a preponderance of NTMs – non-price trade measures. The NTMs are measures that regulate the intensity and extent of the traded goods' market access, which, in principle, are

implemented in a non-discriminatory manner. The measures are applied technically due to certain concerns; however, they could have both micro and macro socioeconomic effects as well as intended and unintended consequences. These policy measures entail measures that impact both external and internal sectors. The preponderance of NTMs often has implications for trade-participating partners, especially for sustainable economic development in developing countries. Although trade partners see NTMs as hurdles to pass to access the market, implementing countries take them as requirements that must be complied with to ensure conformity with the countries' development philosophy and aspirations. For NTMs not to be challenges to economic development, Melo and Nicita (2018) assert that the application of NTMs must not unnecessarily raise trade costs, and make trade partners uncompetitive and unsupportive of the sustainable development agenda.

In the global trading system, the NTMs have sometimes been applied as an alternative to outright market access restrictions. These NTMs, at times, are shrouded in transparency-deficiency such that clarity about all applied measures is uncertain. To this end, NTMs are heterogeneous across countries. Although they have been classified by UNCTAD with the support of the Multi-Agency Support Team (MAST) (UNCTAD, 2019), the implementations and enforcement are country-specific. Moreover, NTMs are applied at different product levels, i.e. generic (HS 2-digit), semi-generic (HS 4-digit) and product-specific (HS 6-digit). These layers of NTMs are challenges not only for the trade partners but also for economic impact analysis. These NTMs are predominant in the agricultural and food trade, which requires quality infrastructure that is characterised by high costs of compliance that impact trade partners, particularly those from developing countries.

The overall conclusions of the theoretical propositions about the trade effects of NTMs conclude that these measures could be trade-enhancing and/or trade-inhibiting, depending on the measures under investigation. This is because there is a gamut of measures embedded in the NTMs, in which each has a differentiating impact. For instance, rules of origin, subsidies, quotas, voluntary export restraints, etc., have been analysed to have trade-inhibitive effects (World Bank, 2023; Amaglobeli *et al*., 2024; Augier *et al*., 2005), while product standards and technical barriers to trade have been found to either impede or enhance trade (Otsuki *et al*., 2001; Beghin and Xiong, 2018). However, there are many other NTMs such as distribution restrictions, post-sale service restrictions, local content, licencing, etc., whose impacts are still empirical issues that have not been empirically ascertained, investigated and/or explored. Hence, the generalisation of the trade impact of NTMs is unrealistic as required in economic models, except on a case-by-case basis (Melo and Nicita (2018)). Hoekman and Nicita (2018) assert that NTMs do have diverse effects across economic agents because of the impacts they have on fixed or entry costs, depending on the size of the economic agents and their membership or otherwise in trade agreements. Apart from impacting the volume of traded products, NTMs also have consequences on prices and welfare (Melo and Shepherd (2018)).

Melo and Shepherd (2018) assert that quantity restrictions and other trade-impeding NTMs impact market structure through competition restrictions and thereby give market power to domestic producers. The distortions created by NTMs would lead to the exit of small firms, which would further empower large firms, at home and abroad. They also assert that the compliance costs of technical measures are fixed costs of market access. Melitz (2003) framework postulates that market access is guaranteed for the most productive firms that can cover the fixed costs, which include costs of compliance with the technical measures, while the number of exporting firms decreases as the fixed costs increase. Hence, export decreases at both the intensive and extensive margins. This framework asserts that firms will continue operations in either internal or external markets as long as they break even. The application of additional technical measures and/or other NTMs will increase the firms' fixed costs, raise the productivity benchmark upward and alter profitability. This will lead to the exit of some firms – especially small firms with inadequate capacity to absorb the additional fixed costs – and reduce the intensity and extensiveness of the exports. Only the highly capacitated firms, mostly large-sized, will continue exporting while the export-exit firms will operate in the internal market.

4. Material and method

The theoretical framework for this empirical strategy is derived from the Melitz (2003) framework that describes the extent to which applied NTMs, such as the technical measures, in the exporting market impact the market access of heterogeneous exporting firms. The framework asserts that the application of these technical measures raises fixed costs that might be difficult for small firms with inadequate capacity to comply with, to exit the market, thereby leaving only firms with adequate compliance capacity, which are often large firms. On this basis, an augmented log-linear gravity model is adopted from Kareem and Kareem (2014), whose specification is consistent with the intra-industry trade framework that is determined by the average levels of gross domestic product, per capita income and trade costs. The parameterised multiplicative gravity equation:

$$EX_{ijt} = \beta_1 \gamma_{it} \rho_{jt} \omega_t \pi TM_{jt} \theta_{ij} \vartheta \tau_{ij} \mu_{ijt} \tag{1}$$

Transforming equation 1 into a parsimonious log-linear gravity model by taking the natural logarithm of both sides yields:

$$InEX_{ijt} = \beta_1 + \gamma_{it} + \rho_{jt} + \omega_t + \pi InTM_{jt} + In\theta_{ij}\vartheta + \tau_{ij} + \mu_{ijt} \tag{2}$$

In equation 2, *In* indicates the natural logarithm of the applicable variables. The EX_{ijt} represents the export value from country i to j at time t. The β_1 is this equation's intercept; the two-way error component term is $\mu_{ijt} = \varepsilon_{ijt} + \delta_{ijt} + \omega_t$, where $\delta_{ijt} = \gamma_{it} + \rho_{jt}$; γ_{it} , ρ_{jt} and ω_t are the fixed effects for the importers, exporters and time, respectively, while ε_{ijt} is the remaining part of the stochastic disturbance term. These fixed effects correct the biases associated with panel data estimation (Baldwin and Taglioni, 2007), and they are measures of the multilateral trade resistance terms as proposed by Anderson and van Wincoop (2003). The θ_{ij} represents the vector of pair-varying control variables, i.e. the gross domestic product (GDP), distance, common language, the regional trade agreement (RTA) and consumer price index. The unobservable firm heterogeneity, which is the number of exporting firms from country *i* to *j* (that could be zero), is represented by τ_{ij}. The TM_{jt} represents the EU technical measures, which are the key variable of interest.

Given that the technical measures are non-discriminatory in line with the World Trade Organisation's (WTO) Most Favoured Nations (MFN) principle, this study envisages no issue of endogeneity in the model. More so, the relationship between increasing market access and technical measures is not bidirectional (see Kareem, 2016b). Tariffs as instruments of trade policy are not included because, in the trade relations, they have been negotiated downwards such that preferential tariffs have and some cases duty-free (Kareem, 2014b; Kareem, 2016a). The exchange rate is not included because its impact will be reflected in the price [1], which is part of the control variables. The exchange rate impacts trade only if it alters relative prices, and in gravity, it indicates changing the costs of international relative to domestic trade – exchange rate changes affect prices (Anderson *et al*., 2013).

To this end, this study adopts a feasible generalised least squares (FGLS) estimation technique based on Baltagi (2008). This estimation technique assumes an orthogonality between the independent variables and the unobserved heterogeneity. This random effect model is specified such that equation 2 entails the independent variables that are both time-invariant and time-variant variables. Where $\delta_{ijt} \sim IID(0, \sigma_\delta^2)$, $\sim IID(\sigma_\omega^2)$ and $\sim IID(\sigma_\varepsilon^2)$ and the explanatory variables (x_{ijt}) are independent of the unobserved heterogeneity δ_{ijt}, ω_t and ε_{ijt} for all i and t, hence,

$$E\left(x_{ijt} \middle| \delta_{ijt}, \omega_t, \varepsilon_{ijt}\right) = 0, t = 1, 2, \ldots, T \tag{3}$$

The technical measures are obtained from Perinorm International. The measures were in raw or crude form, such as laws, rules, regulations and directives, that are collated, coded and transformed into a dataset through calculations of those measures in force, withdrawn and suspended (see Kareem, 2016a). The World Integrated Trade Solution database [2] provided the trade data for the selected food commodities at the HS 6-digit commodity classification. The vegetables, coffee and cocoa are selected under the sub-headings 071,190, 090,710 and 180,100, respectively. The selected commodities are among the main food exports from Africa to the EU, as cocoa and coffee constitute about 36%, while vegetables account for 12% of the EU agri-food imports from Africa [3] (European Commission, 2024). The United Nations Trade and Development statistics provided the data on the economic size (GDP). Further, the Eurostat is explored for the consumer price index in the EU; the data on regional trade agreements is sourced from the WTO's Regional Trade Agreements database. The data on distance is obtained from www.timeanddate.com. The analysis in this study spanned the period 1995 to 2020 for 37 African countries with consistent information and/or data across the selected commodity estimations (see Appendix Table A3). The EU is disaggregated into member states and gradually included in the estimations in line with the year of member accession.

5. The results and discussion

The results of the baseline estimations across the selected commodities are presented in Table 3. The economic size of Africa has not been significantly used to promote vegetable export, despite its export potential and market accessibility, which resulted in the insignificance of the coefficient of GDP. However, the economic size stimulates cocoa exports to the EU such that this export responded by 0.14%% for every per cent increase in GDP, while coffee exports did not significantly respond to the increase in the economic size, such that the export plummeted by 2.2% for the same rise in GDP. The coffee subsector has

Table 3. The estimated results

	Vegetable	Coffee	Cocoa
GDP Exporter	0.2982	−2.2091***	0.1442***
	(0.2308)	(0.1508)	(0.0512)
GDP Importer	−0.03301***	−7.4980***	−0.0228
	(0.0106)	(0.3583)	(0.0482)
Technical Measures	3.0974***	2.7105***	−10.6916***
	(0.14444)	(0.4151)	(2.2307)
Distance	0.0007	0.0035	−0.5858***
	(0.0101)	(0.0137)	(0.1573)
RTA	4.4162***	0.3087***	1.5005***
	(0.1445)	(0.1059)	(0.1760)
Food CPI	−0.3195***	1.8380***	0.1170***
	(0.0285)	(0.0749)	(0.0277)
Constant	26.4236***	19.9239***	23.0684***
	(4.1831)	(1.2889)	(4.3264)
Wald Chi-sq	3254885.0	1.10e+07	154.01
	(0.0000)	(0.0000)	(0.0000)
Observation	5,574	6,480	1395
Importer-Time FE	Yes	Yes	Yes
Exporter-Time FE	Yes	Yes	Yes

Note(s): All variables are in logarithmic forms except the dummy and index variables. The standard errors have been corrected for heteroscedasticity and are presented in parentheses. The significant variables are denoted by the *, ** and *** at 10, 5, and 1% significance levels, respectively

Source(s): Author's own work.

been experiencing significant supply challenges in recent years owing to the geopolitical tension in the Red Sea and political impasse in East Africa, the rise in transportation costs and inadequate quality infrastructure. Besides, international coffee price volatility, inadequate production facilities and manpower, lack of access to finance, and low-quality seeds and seedlings are other factors that contributed to inadequate export supply. Blyth (2024) and AGRA (2024) affirm these challenges to Africa's coffee in its export markets.

The demand for Africa's vegetables, coffee and coffee exports in the EU increased, despite the recession experienced in some countries. The economic stagnation, slow growth and/or turmoil experienced in some European countries, such as Germany, France, the Czech Republic, Poland, etc, that contracted aggregate demand has not adversely impacted the demand for these African exports. Africa's exports of vegetables, coffee and cocoa increased by 0.03%, 7.50 and 0.02% as the economic size of the importing countries contracted by one per cent, respectively, though this is insignificant for cocoa, which affirmed Kareem (2016c). The cocoa harvest has been decimated owing to the swollen shoot virus infections, adoption of cocoa butter equivalent, and cocoa safety issues, particularly pesticide application, which contributed to this insignificance.

The technical measures implemented in the EU did not significantly impede the market access of vegetable and coffee exports. This implies that the applied vegetable and coffee technical measures in the EU were complied with by African exporters, such that vegetable and coffee exports rose by 3.10 and 2.71% for every technical measure imposed, respectively. Henson and Jaffee (2008) and Maertens and Swinnen (2009) also affirmed the export-enhancing impact of the product standards. The compliance of these commodities' exports from Africa was strengthened by the different technical supports received from development partners, retail firms and certification organisations, particularly those from the EU, that built the capacity and facilitated access to quality infrastructure. EuroAfri Link, AGRA, Spremo Coffee, Fairtrade and UTZ provide compliance support, based on certain agreements, for Africa's agri-food exporters and the necessary certification and documentation required for market access in the EU. On the contrary, the intensity of Africa's cocoa export to the EU is being hampered by the preponderance and the stringent cocoa technical measures, such that cocoa export plummeted by 10% for every additional applied technical measure. Kareem (2016c) and Foletti and Shingal (2014) find cocoa safety standards to be export-inhibitive for Africa's cocoa export to the EU. There have been technical measures compliance challenges in most of Africa's cocoa-producing countries owing to the issues of deficiencies in cocoa safety-facilitating quality infrastructure, cocoa tree infections, the ageing cocoa trees with the ageing producers and trust issues concerning adherence to appropriate cocoa safety measures. Climate change and cocoa swollen virus infections (Crellin, 2025) have affected cocoa quality, which has consequences on export supply.

Furthermore, the effects of another measure of trade costs, the distance, on the export of vegetables and coffee have been insignificant owing to the advancement in information, communication and telecommunication technology application in the supply chain systems in recent years, which has enhanced business-to-business, business-to-customer and firm-to-firm interactions and communication. However, the distance is a significant challenge in cocoa export to the extent that it adversely impacts the commodity by 0.59% for every per cent increase in distance between the trading partners. The trade agreements and/or arrangements that existed between these trade partners have significantly contributed to the improvement in the market accessibilities of vegetables, coffee and cocoa by 4.41%, 0.31 and 1.50% for every additional trade agreement and/or arrangement implemented, respectively. The results corroborated estimates of the technical measures, which imply that these trade agreements must have contributed to the negotiations and compliance with the technical measures. The contribution of the Task Force on Rural Africa, an initiative of the European Commission, could be highlighted. It is saddled with the responsibility of promoting agricultural policy and regulatory reforms in Africa to enhance their market access. This is to facilitate the inclusion of private investments and enhance intra- and extra-African agri-food trade, as well as share the EU technical know-how on agricultural and development policies (European Commission, 2019).

5.1 The robustness check

To ascertain the robustness of the baseline results in Table 3, a different estimation technique is applied as a robustness and sensitivity check. An improved and expanded Poisson Pseudo Maximum Likelihood (PPML) estimation technique that provides the state-of-the-art method to deal with many zeros and dummy variables, as well as makes provision for multiple sets of fixed effects, is estimated [4]. The robustness check estimates in Table 4 are to some extent different from the baseline estimates in terms of the degree of association, the magnitudes and the significance of the variables across the three agri-food commodities. While the robustness check estimations for some variables, such as economic size, price level and regional trade agreements, are a priori-compliant, variables such as the technical measures, distance and the absorptive capacity in the importing countries deviated. The baseline estimates, to a certain extent, comply with the reality of actual exporting, that is, export in practice. This indicates that in practice, the cocoa quality challenges are impacting the export intensity, while this is not the case for vegetable and coffee. Hence, the robustness check is somehow aligned with *a priori* expectation, while the baseline estimates are tilted towards the export in practice of selected African agri-food exports. Lu and White (2014) assert that the commonly implemented robustness checks give neither necessary nor sufficient evidence of structural validity of the coefficients.

The investment and development finance of the agri-food systems in Africa has been neglected, such that the positive economic size has not been reflected in the agri-food promotion, despite the agri-food export promotion strategy. The prioritised and foreign exchange-earning of the agri-food exports, such as cocoa, coffee and horticulture, have not been strengthened and/or fortified with the required investments in quality infrastructure, inputs, technical know-how, etc. The Comprehensive African Agricultural Development Programme enjoined all African countries to allocate at least 10% of the national budget to the

Table 4. The robustness check

	Vegetable	Coffee	Cocoa
GDP Exporter	0.1528***	0.1470***	1.5962***
	(0.0231)	(0.0197)	(0.0612)
GDP Importer	0.0065	0.0230	−0.0412
	(0.0448)	(0.0300)	(0.0275)
Technical Measures	−0.7681***	0.9531***	3.9271***
	(0.1816)	(0.1102)	(0.3189)
Distance	0.1809***	1.1182***	−1.4114***
	(0.0964)	(0.0731)	(0.1038)
RTA	0.2563***	0.2260***	7.8206***
	(0.2028)	(0.0658)	(0.2203)
Food CPI	−0.0474***	−0.2776***	−0.1674***
	(0.0150)	(0.0072)	(0.0064)
Constant	4.8786***	22.3040***	−10.0241***
	(1.7990)	(1.3592)	(2.0257)
Wald Chi-sq	1704.39	1997.88	3432.34
	(0.0000)	(0.0000)	(0.0000)
Pseudo R^2	0.4264	0.5574	0.7816
Observation	8,922	10,923	4,182
Importer-Time FE	Yes	Yes	Yes
Exporter-Time FE	Yes	Yes	Yes

Note(s): The standard errors have been corrected for heteroscedasticity and are presented in parentheses for the variables' coefficient, while the *p*-values are in parentheses for the Wald Chi-sq. The significant variables are denoted by the *, ** and *** at 10, 5, and 1% significance levels, respectively

Source(s): Author's own work.

agricultural sector (Malabo Declaration) [5]; however, this has not been realised by a lot of countries [6].

To this end, the robustness check results seem to have the expected coefficients and show *a priori* conformity, while the baseline estimates display the regressors in their economic reality, which conforms to these export-in practices. Hence, the baseline estimator, feasible generalised least squares, provides the basis for the study's empirical and policy inferences because it has superior inferences in practice (Lu and White, 2014).

5.2 Postestimation observation

The estimation of econometric models is sometimes characterised by certain econometric issues that need to be mitigated to ensure that results are reliable. In the estimations in Tables 3 and 4, a check is done to ascertain that the results are reliable and that meaningful inferences can be drawn. The variable descriptions and correlation estimations of the predictors are carried out (see Appendix Tables A1 and A2). The correlation matrices (Table A2) reveal that there is a high correlation between the technical measures and food prices in cocoa (−0.7998) and vegetable (0.9073) estimations, which points towards the issue of multicollinearity that causes estimated coefficients' standard errors to be inflated. Although multicollinearity poses little threat to a properly interpreted analysis, it shows some sort of linear relationships among the predictors that are not a perfect overlap (Voss, 2005), which impacts the reliability of the results (Kim, 2019). The variance inflation factor (VIF) is adopted in this study to test the presence or otherwise of multicollinearity. Table 5 presents the VIF and reciprocal VIF results. Given that none of the VIF explanatory variables' coefficients are above or in excess of 10, the rule of Thumb (Stata.com, 2025), that is, they are low, a maximum of 2.01 for cocoa and 5.95 for vegetable, it is concluded that the estimations are devoid of multicollinearity problems. Besides, the overall means of the VIFs in both cocoa and vegetables are not considerably larger than 1, which indicates the absence of multicollinearity. This implies that the estimated coefficients in this study are reliable and stable, as asserted by Kim (2019), while the standard errors of the coefficients are not inflated.

6. Conclusion

The global agri-food trading system in the past decades has been characterised by continuous and tremendous global crises such as climate change, locust plague, global health pandemic, economic sanctions and wars, which have affected agri-food value chains, and disrupted the supply chains and trade. Besides, endogenous factors such as the impetus for biodiversity, organic and safe food, sustainable agriculture and green economy that countries are adapting, especially those in developed economies, have also consequences on the global agri-food system. These global crises have led to food price spikes, inflation and fear of food security in

Table 5. Multicollinearity test

Variable	Cocoa		Vegetable	
	VIF	VIF reciprocal	VIF	VIF reciprocal
GDP Exporter	1.16	0.8622	1.22	0.8195
GDP Importer	1.02	0.9825	1.02	0.9770
Technical Measures	2.00	0.4997	5.75	0.1740
Distance	1.14	0.8753	1.13	0.8887
RTA	1.23	0.8132	1.05	0.9484
Food CPI	2.01	0.4984	5.95	0.1681
Mean	1.34		2.27	

Source(s): Author's own work

many countries. The challenges have intensified the preponderance of trade policy measures, particularly the technical measures, that will ensure a safe and quality agri-food system. The EU has implemented technical measures to protect human and animal health as well as safeguard the environment. However, these global crises have aggravated the implementation of these measures, which have impacted its trade partners, particularly in Africa. To this end, this study investigates the impact of the EU technical measures on Africa's vegetables, coffee and cocoa exports. The study adopts panel data from 37 African countries across the three agri-food commodities in an augmented gravity model derived from the Melitz firm heterogeneous framework.

The findings indicate that despite the proliferation of vegetable and coffee technical measures, they did not significantly inhibit the intensity of vegetable and coffee exports to this market. The compliance of the exporters to these technical measures, which are supported by some institutions from the EU, ensures market access. However, cocoa export is significantly restricted owing to the applied cocoa safety measures, which, among others, are due to the safety and quality emanating from the cocoa swollen virus infections that ravaged cocoa farms in West Africa, continuous ageing of cocoa trees, together with the farmers' and deficiencies in cocoa safety-quality infrastructure.

Contrary to some generalisations in the literature that the EU trade measures are agri-food trade-inhibitive, this study concludes that the impacts of these measures are agri-food commodity-specific, which is based on the fact that the intensity of Africa's vegetable and coffee exports was not affected. The implication of this is that compliance with the EU agri-food technical measures, influenced by quality upgrade to the required set of standardisation through upscaling available quality infrastructure, will largely ensure market access. Although there is a proliferation of technical measures in the EU, the ability to demonstrate conformity through quality upgrade and certification by appropriate and approved organisations will enable access to the market in the medium- and long-run. The results have provided insight into the need for intensive and massive development finance and investments in the agri-food systems in Africa to transform and upgrade every segment of the system. Besides, as another policy proposal, Africa must promote agri-food system inclusiveness not only for private sector investments but also for the teeming youths to key in and engage in the system to ensure sustainability and improved technical know-how.

Appendix

Table A1. Descriptive Statistics

Variable	Observation	Mean	Minimum	Maximum
Cocoa				
GDP Exporter	4,182	22.9103	20.00385	26.28781
GDP Importer	4,182	26.3454	22.45378	28.91851
Technical Measures	4,182	1.9577	1.609,438	2.302,585
Distance	4,182	8.5272	5.992,794	9.257,863
Food CPI	4,182	105.4895	90.2500	124.4000
RTA	4,182	0.8118	0.0000	1.0000
Coffee				
GDP Exporter	10,923	22.7249	−0.7319	26.7192
GDP Importer	10,923	26.2980	22.4538	28.9185
Technical Measures	10,923	0.7369	0.0000	1.3863
Distance	10,923	8.5283	5.9928	9.2579
Food CPI	10,923	111.6183	90.2500	126.3300
RTA	10,923	0.8297	0.0000	1.0000
Vegetable				
GDP Exporter	8,922	23.2801	20.0039	26.7192
GDP Importer	8,922	26.3022	22.4538	28.9185
Technical Measures	8,922	1.8690	0.0000	2.3979
Distance	8,922	8.4957	5.9928	9.2579
Food CPI	8,922	111.4794	90.2500	126.3300
RTA	8,922	0.7920	0.0000	1.0000

Source(s): Author's own work

Table A2. Correlation Matrices

	GDP exporter	GDP importer	Technical measures	Distance	Food CPI	RTA
Cocoa						
GDP Exporter	1.0000					
GDP Importer	−0.0344	1.0000				
Technical Measures	−0.1381	0.1982	1.0000			
Distance	−0.2122	−0.0299	0.0785	1.0000		
Food CPI	0.1421	−0.1520	−0.7998	−0.1039	1.0000	
RTA	−0.1783	0.0061	0.0328	−0.0076	−0.0435	1.0000
Coffee						
GDP Exporter	1.0000					
GDP Importer	−0.0101	1.0000				
Technical Measures	−0.0105	0.0265	1.0000			
Distance	−0.1722	−0.0375	−0.0009	1.0000		
Food CPI	0.0581	−0.1116	−0.0728	−0.0019	1.0000	
RTA	−0.0265	−0.0004	−0.0010	−0.1322	0.0055	1.0000
Vegetable						
GDP Exporter	1.0000					
GDP Importer	−0.0318	1.0000				
Technical Measures	0.2321	−0.1178	1.0000			
Distance	−0.2972	−0.0386	0.0005	1.0000		
Food CPI	0.2837	−0.1170	0.9073	−0.0011	1.0000	
RTA	−0.0021	0.0000	−0.0008	−0.2314	−0.0008	1.0000

Source(s): Author's own work

Table A3. African countries included in the empirical estimations

Commodity	Country	Country	Country	Country
Vegetable	Algeria	Eswatini	Togo	
	Benin	Gambia	Tunisia	
	Botswana	Ghana	Uganda	
	Burkina Faso	Kenya	Zimbabwe	
	Cameroon	Madagascar		
	Congo	Mauritius		
	Congo DR	Morocco		
	Cote d'lvoire	Nigeria		
	Egypt	Senegal		
	Ethiopia	South Africa		
Cocoa	Cote d'lvoire	Liberia	South Africa	
	Congo	Madagascar	Tanzania	
	Gabon	Niger	Togo	
	Ghana	Nigeria	Uganda	
	Guinea	Sao Tome Principe		
	Kenya	Sierra Leone		
Coffee	Algeria	Ethiopia	Nigeria	Zimbabwe
	Angola	Gabon	Sao Tome and Principe	
	Benin	Ghana	Senegal	
	Burundi	Guinea	Sierra Leone	
	Cape Verde	Kenya	South Africa	
	Central Africa Republic		Tanzania	
	Congo	Liberia	Togo	
	Congo DR	Madagascar	Tunisia	
	Cote d'Ivoire	Malawi	Uganda	
	Egypt	Morocco	Zambia	

Source(s): Author's own work

Notes

1. This can lead to multicollinearity.
2. The database provides extensive information and data trade and trade policies across different countries and regions. The database is put together by the World Bank, World Trade Organisation and UNCTAD.
3. For further reading on this food export structure see food trade statistical factsheet–Africa.
4. The ppmlhdfe has been used for the estimation.
5. See CAADP – Comprehensive Africa Agricultural Development Programme.
6. See rural2022_04-S20-21.pdf

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