ORIGINAL ARTICLE

Impact of tariff liberalization on economic and social benefits: Computable general equilibrium application to Kenya

Shadrack Muthami Mwatu ⓘ | **Nancy Nelima Nafula** | **John Gakuu Karanja**

Kenya Institute for Public Policy Research and Analysis (KIPPRA), Nairobi, Kenya

Correspondence
Shadrack Muthami Mwatu, Kenya Institute for Public Policy Research and Analysis (KIPPRA), Nairobi, Kenya.
Email: muthamimwatu@gmail.com, smwatu@kippra.or.ke

Abstract

This study employed computable general equilibrium policy simulations to examine the impact of import tariff liberalization on socioeconomic outcomes including living standards, cost of living, gross domestic product (GDP) from expenditure, total investment expenditure, intermediate input demand, output, value-added, tariff revenue, sales tax revenue, indirect tax revenue, direct income tax revenue, factor income tax revenue, and factor demand. Findings from the simulations have policy implications touching on a need to embrace reciprocal tariff liberalization under agreements like strategic trade and investment partnerships and economic partnership agreements as they are associated with welfare gains, reduction in cost of living, and GDP growth. Targeted policy incentives could be directed to specific domestic sectors since tariff liberalization has negative impacts on investment expenditure. Incentives regarding intermediate inputs should be directed to the manufacturing and services sectors for liberalization of agrifood commodities. Targeted policy incentives should be directed to the manufacturing and services sectors which experience decrease in output with tariff reductions. Liberalization of manufactured commodities should be accompanied by value-added incentives directed to the agrifood and home production–home consumption sectors. For the liberalization of manufactured commodities, targeted policy incentives should be directed to the services sector which experiences job losses while for the liberalization of tariffs on imports of agrifood commodities, targeted policy incentives should be directed to the agrifood and the home production–home consumption sectors, which also lose jobs.

These targeted policy incentives could support industrial activity and compensate for revenue loss, especially from customs duties.

Related Articles

Gruber, Lloyd. 2013. "Trade, Growth, Poverty, and Politics: Toward a Unified Theory." *Politics & Policy* 41(5): 723–64. https://doi.org/10.1111/polp.12034.

Onyango, Gedion, and Japheth Otieno Ondiek. 2022. "Open Innovation During the COVID-19 Pandemic Policy Responses in South Africa and Kenya." *Politics & Policy* 50(5): 1008–31. https://doi.org/10.1111/polp.12490.

Soto, Gloria. 2012. "Environmental Impact of Agricultural Trade Liberalization under NAFTA." *Politics & Policy* 40(3): 471–91. https://doi.org/10.1111/j.1747-1346.2012.00354.x.

Kenya's trade landscape is changing. Having graduated from its least-developed country status in 2014, it is now set to become a middle-income economy (Africa Research Bulletin, 2015; World Bank, 2022). This shift has sparked a debate about trade policy, with a growing focus on negotiating reciprocal trade agreements. These agreements, unlike Kenya's past preferential treatments under a generalized system of preference (GSP), require mutual tariff reductions by all participating countries (Davies & Nilsson, 2019; Muhammad, 2009; Muhammad et al., 2010; Olarreaga & Ozden, 2005; Sorgho & Tharakan, 2019). Examples include the proposed strategic trade and investment partnership (STIP) with the United States and the economic partnership agreement (EPA) with the United Arab Emirates.

However, despite the shift toward reciprocity, little analysis has explored its potential socioeconomic impacts on Kenya's economy (Akinboade, 1993, 2008; Karingi & Siriwardana, 2002; Thurlow, 2011; Tyler & Akinboade, 1992). This study bridges that gap by employing a policy analysis tool to examine how reciprocal tariff liberalization might affect crucial socioeconomic outs including living standards, cost of living, gross domestic product (GDP) from expenditure, total investment expenditure, intermediate input demand by sector, output by sector, value added by sector, tariff revenue, revenue from sales tax, revenue from indirect taxes, revenue from direct income tax, revenue from factor income tax, and sectoral factor demand. It focuses on imports of agrifood and manufactured commodities and demonstrates the impact of liberalizing imports of the commodities on the domestic industrial activities producing similar products.

The findings of this study provide valuable insights to inform the ongoing trade policy debate with a focus on: (a) whether Kenya should fully embrace reciprocity in agreements like STIP and EPA; and (b) the potential socioeconomic benefits and drawbacks that such agreements could bring to the Kenyan economy. By offering comprehensive analysis and clear implications, this study aims to equip policy makers with the information needed to navigate the evolving trade landscape and make informed decisions for Kenya's sustainable development.

The structure for the rest of the study is as follows: we next detail the current import tariff regime in Kenya; thereafter, we review the relevant existing research on similar issues, before

outlining the methodology used and presenting results from policy simulations; we then provide a conclusion summarizing the key findings and discuss the practical implications for policy makers.

GOVERNING POLICY FRAMEWORK

The policy framework governing the importation of goods into Kenya is outlined by the common external tariff (CET)[1] established by the East African Community (EAC). This tariff structure delineates the ad valorem tariffs that each member state within the EAC should impose on products originating from outside the union (East African Community, 2022). Within this customs regime, effective tariff rates are set at 0%, 10%, 25%, 35%, 50%, 60%, 75%, and 100%. Most goods entering the broader EAC market encounter ad valorem tariffs set at 0%, 10%, 25%, and 35%. A commodity with an effectively applied tariff rate of 0% indicates complete liberalization, predominantly applicable to high-technology, high-capital-intensive items, and essential raw materials supporting industrial activities. Recognizing the comparative disadvantage of developing countries in producing these goods, policy makers have deliberately chosen full liberalization to foster domestic industrial development. From a policy standpoint, complete liberalization of these commodities promotes the transfer of knowledge and technology to domestic industries, thereby stimulating industrial growth.

Commodities subject to an effectively applied custom tariff at rates of 10%, 25%, and 35% have undergone liberalization at rates of 90%, 75%, and 65%, respectively. The local sectors producing these commodities are well established and relatively competitive, capable of absorbing a certain level of competition from external firms. These goods typically fall within the categories of intermediate and finished products and could support intra-industry trade with appropriate policy incentives.

Certain commodities face effectively applied custom tariffs at rates of 50%, 60%, 75%, and 100%, indicating levels of liberalization at 50%, 40%, 35%, and 0%, respectively. Schedule 2 of the 2022 EAC CET identifies these products as sensitive, as the sectors producing them are nascent and in need of policy protection. These specific sectors include the agrifood and manufacturing sectors, encompassing products such as maize, wheat, meslin, cheese, curd, yogurt, milk, cream, cane and beet sugar, rice, and fabrics containing linen and cotton.

As Kenya transitioned to a lower-middle-income status, with projections indicating an imminent attainment of middle-income status, the country faces constraints in utilizing the GSP and the most favored nation (MFN) framework, primarily designed to benefit the least developed nations. Consequently, Kenya must engage in trade agreements that recognize reciprocity in tariff liberalization.

In the negotiation of such trade agreements, the principle of variable geometry has emerged in policy debates. Given the binding common custom union, this principle suggests that EAC member states should join negotiated trade agreements as soon as they achieve middle-income status.[2] To negotiate trade agreements under the principle of reciprocity, it is crucial to identify optimal tariff levels that achieve various policy outcomes.

---

[1]The updated common external tariff (CET) has been effective since July 2022. It introduces flexibility for EAC member states in implementing import tariffs, enabling adjustments to align with the specific trade and economic conditions prevailing in each member country. The objective is to accommodate the diverse realities of trade and economics within individual member nations.

[2]Even without a formal trade agreement, the generalized system of preference (GSP) and most favored nation (MFN) arrangements can still provide preferential market access to least developed countries.

This entails considering a broader range of custom tariffs beyond those currently outlined in the EAC CET. By examining a wider spectrum of custom liberalization levels, this research offers insights into various optimal liberalization levels that could be considered in negotiating trade agreements. An important contribution of this research is the inclusion of imports of services in policy simulations, addressing a notable gap in the community's common external tariff.

LITERATURE REVIEW

Kohler and Keuschnigg (1995) employed computable general equilibrium (CGE) modeling to simulate the effects of tariff liberalization on welfare and foreign debt using Austrian data. Their findings suggested that liberalization has positive long-term effects, leading to notable sectoral adjustments. While welfare improves, there is an observed increase in foreign debt over the long term. Similarly, Ngeleza and Muhammad (2011), using a CGE approach in a developing country context, found positive impacts of trade liberalization on welfare. Studies also indicate that full tariff liberalization reduces overall poverty, with wealthier households benefiting more (Blomqvist & McMahon, 1986; Nahar & Siriwardana, 2013). Improved welfare is associated with reduced import costs and increased access to imports following tariff liberalization. For a given level of disposable income, consumers gain access to larger quantities of imports, positively influencing welfare (Egger & Larch, 2011; Kose & Riezman, 2000).

As a policy tool, customs duties are traditionally applied to generate revenue and protect local industries. However, tariff liberalization can lead to a loss of government revenue, potentially causing fiscal deficits and necessitating increased public borrowing. CGE simulations reveal that while higher import tariffs raise government revenue, they do so at the expense of overall welfare (De Melo et al., 1989; Li et al., 2016; Vos & De Jong, 2003). Import tariffs as a policy tool are also associated with job redistribution from high-tariff to low-tariff sectors.

Chou and others (1997) applied CGE simulations to assess the impact of tariff liberalization under trade agreements on the Taiwanese economy. Their findings suggested that such liberalization within trade agreements is beneficial, leading to increased real GDP, consumption, and welfare. Household incomes and consumption benefit from lower prices of imported commodities resulting from tariff liberalization. However, their study excluded the services sector, highlighting a gap addressed by the current study. In another context, CGE simulations examining the economic effects of trade liberalization across the Taiwan Strait demonstrated positive impacts on domestic investment, external trade, and real GDP (Chen et al., 2009). A CGE application to Cameroon found that tariff liberalization raised GDP by .41% to .62% (Bakoup & Tarr, 2002). Jaswal (2023) employed CGE modeling to examine the potential impacts of tariff liberalization in the textiles and apparel sector, observing mixed findings regarding industrial and export activity.

CGE simulations also suggest that tariff liberalization under trade agreements has a positive impact on economic growth (Liyanaarachchi et al., 2016; Nguyen et al., 2021). Lowering the cost of importing commodities, reducing market prices, and improving disposable incomes contribute to GDP growth from increased spending. Targeting policies toward local agricultural sectors has been recommended to encourage domestic investments, particularly in poorer African countries that are net cereal importers (Sadoulet & de Janvry, 1992). Import tariffs on intermediate goods can impact the domestic manufacturing industry, influencing investment, GDP growth, and consumer welfare (Kreuter & Riccaboni, 2023). Liberalizing tariffs on input commodities has been shown to enhance the export duration of manufactured commodities (Zhou et al., 2019), supporting the Lerner symmetry theorem, which posits that policies encouraging imports also encourage exports (Costinot & Werning, 2019; Linde & Pescatori, 2019).

Amiti and Konings (2007) found that a 10% point fall in input tariffs translated to a 12% increase in productivity for firms importing inputs. While reducing output tariffs also increased productivity through competition, the impact of tariff liberalization on inputs was larger than that on output commodities. For developing countries like Kenya, tariff liberalization on output commodities may not significantly encourage investment and competitiveness in the domestic industry, posing challenges to structural competitiveness (Golub et al., 2017; Olofin, 2002). Liberalizing import tariffs, however, could stimulate GDP growth, driven mainly by consumption expenditure on imported output commodities. To promote GDP growth driven by investments in the domestic industry, free trade agreements could include provisions encouraging foreign direct investments and technological transfers to local firms. Antidumping protection measures may be considered to ensure fair competition and sustain productivity in local import-competing firms, recognizing their heterogeneous responses to such measures (Konings & Vandenbussche, 2008).

EMPIRICAL STRATEGY AND RESULTS

Empirical strategy

The study employs the CGE[3] policy analysis technique to investigate the impact of tariff liberalization under trade agreements on living standards, cost of living, GDP from expenditure, total investment expenditure, intermediate input demand by sector, output by sector, value added by sector, tariff revenue, revenue from sales tax, revenue from indirect taxes, revenue from direct income tax, revenue from factor income tax, and sectoral factor demand. A social accounting matrix (SAM) for Kenya for 2017 supports the policy simulations.[4] In the SAM, the columns represent payments (expenditures) while the rows represent incomes (receipts). Following the double-entry principle of accounting, every expenditure (column wise) becomes an income (row wise). The SAM used to support the policy simulations balanced at Kenya Shillings 2,206,461.50 million and had four broad categories of commodities—c_agrifood representing crops, processed food, and other agricultural commodities; c_manuf representing manufactured commodities; c_serve representing services commodities; and c_HPHC representing home production–home consumption commodities. Given this study focuses on liberalization of customs duties on imports, the home production–home consumption commodities are not considered as they are not imported. Further, the services commodities[5] are excluded from the simulations because by the time of compiling the SAM, the country was not imposing customs duties on imports of services.[6]

The agrifood category of commodities is mainly processed food, crops, wheat and barley, maize, other grains, rice, other oil seeds, fruits and nuts, other roots, sugar cane, vegetables, dairy, other meat, poultry, tea, goat, coffee, beef, beverages, bakery, and milled grains. Manufactures comprise paper and printing, machinery and other equipment, other manufacturing, leather and footwear, fertilizers, non-metallic minerals, textiles, other chemicals, and petroleum products. Tariff liberalizations are usually applied to imported products (Ntah

---

[3]Note that the specific findings can vary based on the assumptions and specifications of individual CGE models, as well as the characteristics of the economies being studied.

[4]See Emanuele and others (2020).

[5]Technically, the term "products" would be more appropriate as it represents both commodities (tangibles) and services (intangibles). The use of the term commodities after "services" is, therefore, mainly because of a desire to maintain consistency in labelling and identification of the products as in the SAM.

[6]Even in the absence of import duty on services, a shock with a positive tax on imports of services could mimic the scenario for import duty on services when real customs duties are applied on services imports.

TABLE 1 Intermediate demand by productive activities (Kenya Shilling million).

Intermediate demand	a_RHG	a_agrifood	a_manuf	a_serv
c_HPHC	191,488.86			
c_agrifood	243,071.60	369,528.44	62,352.66	227,535.38
c_manuf	95,760.26	171,739.92	682,493.13	1,031,996.44
c_serv	78,810.73	108,718.31	91,075.89	1,437,402.87
Total	609,131.45	649,986.68	835,921.68	2,696,934.70

TABLE 2 Value added by productive activities (Kenya Shilling million).

Value added	a_RHG	a_agrifood	a_manuf	a_serv
Labor	181,148.71	293,680.67	143,311.86	1,918,124.97
Land	1,400,541.54	222,328.67		
Capital	437,948.17	411,000.12	285,611.70	2,029,500.78
Total	2,019,638.42	927,009.46	428,923.56	3,947,625.75

et al., 2024). From the SAM, agrifood commodities imported into Kenya in 2017 paid import duty worth Kenya Shillings 33,905.95 million while manufactured commodities imported into the country paid import duty worth Kenya Shillings 235,166.80 million. This import duty is revenue accruing to the government. The focus of the policy simulations is on these two broad products and the aim is to reveal economic and social impacts of liberalizing customs duties on the products. Imports of these commodities have a competitive effect on domestic productive activities producing the same commodities.

The SAM also had four broad activities—a_RHG representing regional household group activities; a_agrifood representing crops, processed food, and other agricultural activities; a_manuf representing manufacturing activities; and a_serv representing services activities. The products produced by these activities are expected to face competition from tariff liberalization of agrifood and manufactured commodities due to sectoral linkages in value added and factor demand. Each of these activities makes payments to commodities and these payments constitute expenditure on intermediate demand by activities. From the SAM, the a_RHG activity had a total intermediate demand of Kenya Shillings 609,131.45 million and the largest share of the payments accrued to intermediate inputs of agrifood origin. The a_agrifood activity spent Kenya Shillings 649,986.68 million on intermediate inputs and the largest payments accrued to intermediate inputs of agrifood origin. The a_manuf activity had total payments on intermediate inputs worth Kenya Shilling 835,921.68 million and a majority of the largest expenditure on intermediate inputs was on manufacturing inputs. The a_serv activity had the highest expenditure on intermediate demand worth Kenya Shilling 2,696,934.70 million and the largest share was on services inputs (see Table 1). This reveals sectoral linkages among sectors.

Table 2 reveals value added by the productive activities that accrued to labor, land, and capital. The services activity[7] had the largest payments constituting value-added worth Kenya Shillings 3,947,625.75 million with the bulk of the value-added accruing to capital followed by labor. The regional household group activities had the second-largest contribution to total value-added worth Kenya Shillings 2,019,638.42 million with the bulk of the value-added accruing to land, followed by capital and labor. The agrifood productive activity had a total contribution to value-added worth Kenya Shillings 927,009.46 million and

[7]The term activity and sector are used interchangeably.

the bulk of it accrued to capital and labor. The manufacturing activity had the least contribution to value-added worth Kenya Shillings 428,923.56 million and the bulk of it accrued to capital followed by labor.

It is assumed that the regional household group activity does not pay indirect taxes to the government but the agrifood, manufacturing, and services activities pay. Under this assumption, the agrifood activities paid Kenya Shillings 60,969.93 million in indirect taxes, the manufacturing activities paid Kenya Shillings 18,193.21 million in indirect taxes, while the services activities paid Kenya Shillings 122,349.67 million in indirect taxes. The gross output for the regional household group activities was Kenya Shillings 2,628,769.87 million, agrifood activities had a gross output of Kenya Shillings 1,637,966.06 million, the manufacturing activities had a gross output of Kenya Shillings 1,283,038.45 million, while the services activities had a gross output of Kenya Shillings 6,766,910.12 million.

CGEs contain large sets of structural equations that link households, factor markets, productive sectors, the rest of the world, and the government. Anchoring CGEs on SAMs ensures internal consistency while allowing national accounting principles to hold (Tyler & Akinboade, 1992). Clearing of the market is attained through adjustment of prices and wages. The assumption on market clearing requires that supply of products in the economy equals demand, receipts from productive sectors are consumed in payments to factors, incomes earned by households are either expended in consumption of products, transfers to other households, tax deductions, or are saved. The policy simulation technique is built on the neoclassical theory that assumes that productive activities are undertaken to maximize profits while consumers endeavor to maximize general welfare (Karingi & Siriwardana, 2002).

When imported, the above products exert direct competition with domestic industries producing same commodities. Import tariffs are taxes applied on imported products with the sole aim being the generation of revenue for the government while protecting nascent industries. It has also been argued that overprotecting the domestic infant industries through higher import tariffs could discourage local industries from innovating to transition to maturity. A certain level of exposure to competition is, thus, deemed necessary as it encourages innovation and competitiveness in the domestic industrial sector.

To operationalize the policy simulations, the 2017 SAM for Kenya is imported into the Dynamic Equilibrium Model for Economic Development, Environment, and Agriculture (DEMETRA) CGE simulation model,[8] which runs on the general algebraic modeling system (GAMS). The GAMS software is opened and the model.gms of the DEMETRA model is opened. It is in this model.gms where the excel file containing the SAM and labeled as data_KEN_V1_small is loaded, and execution is carried out. A normal completion from the execution of the model.gms with loaded data indicates that the SAM is properly calibrated and read by the DEMETRA CGE model.[9] Next, the experiment file of the DEMETRA CGE model is opened and the Excel experiment file containing various simulation sets is loaded. This experiment file is labeled as experiment_KEN_small.

Whereas the model.gms reads the data contained in the SAM, the experiment file executes the simulations and contains the actual policy scenarios simulated and their accompanying closure rules. For a successful simulation of a policy scenario, the specific policy scenario being simulated should be initialized, the right equation stated in the assignment section, and the right closure rule adopted in the closure loop section. The closure rules in the GAMs experiment file should also reflect the simulation sets contained in the Excel version of the experiment file.

---

[8]See Emanuele and others (2020).
[9]This requirement is fully satisfied in the analysis carried out in this study.

The policy simulation on the impact of tariff liberalization is specified in Equation (1) while its accompanying closure rule is specified in Equation (2).

$$TMADJSIM(w, \text{`` }c\_manuf\text{ ''}, \text{`` }import\_tariff\text{ ''}) = .20; \tag{1}$$

$$TMADJ.\,FX(w, c) = TMADJSIM(w, c, sim1); \tag{2}$$

In Equation (1), TMADJSIM instructs the CGE model to shock import tariffs, "w" represents "world" as a trading partner, "c_manuf" represents manufactured commodities and this is adjusted to "c_agrifood" and "c_serv" for shocks on agrifood and services products, respectively. The "import_tariff" instructs the model that the implemented policy simulation pertains to import tariffs and this should also be specified in the Excel version of the experiment file. The ".20" after the equal sign instructs the model that the affectively applied tariff rate after liberalization will be 20%, and this means that the equivalent tariff liberalization is 80%. In Equation (2), "TMADJ.FX(w,c)" fixes the import tariff simulations for the trading partner "w" and imported commodity "c" while the "TMADJSIM(w,c,sim1)" instructs the model to only execute the simulation specified in the simulation set of the Excel version of the experiment file. Successful execution of the simulations reveals the impact of import tariff liberalization on various socioeconomic outcomes of interest including living standards, cost of living, GDP from expenditure, total investment expenditure, intermediate input demand by sector, output by sector, value added by sector, tariff revenue, revenue from sales tax, revenue from indirect taxes, revenue from direct income tax, revenue from factor income tax, and sectoral factor demand.

RESULTS

Evidence demonstrates that living standards as a measure of welfare rise with tariff liberalization (Table 3). The impact of tariff liberalization on living standards is also different across the sectors—agrifood and manufacturing. At each level of liberalization, welfare from imports of manufacturing commodities is higher than that from imports of agrifood commodities. This could imply that Kenya has comparative disadvantage in the manufacturing sector and comparative advantage in the agrifood sector.

Tariff liberalization affects living standards through adjustment in prevailing prices for imported commodities. With price adjustment, consumers have access to a wider range of products for the same level of disposable income. The price and income effects are, therefore, at the core of welfare adjustments emanating from reduction in import tariffs. Consumer choice improves with liberalization as consumers gain the liberty to choose between imported and locally produced products. Consumer choice is a signal to domestic producers to innovate, improve efficiency, and become more competitive.

Overall, CGE studies suggest that, on average, tariff liberalization tends to have positive effects on overall welfare. By reducing trade barriers and promoting international trade, countries can benefit from increased efficiency, specialization, and access to a wider variety of goods and services. Tariff reductions typically lead to efficiency gains in resource allocation. As resources shift toward industries where countries have a comparative advantage, production becomes more efficient, contributing to higher overall welfare. Consumers often experience benefits from tariff reductions in the form of lower prices for imported goods. This increased access to cheaper and diverse products contributes to improvements in consumer welfare. Tariff reductions may lead to income redistribution among different groups within a country. While overall welfare may increase, there may be winners and losers, and policy makers may need to address potential negative impacts on specific industries or workers.

TABLE 3 Tariff liberalization and living standards (%).

Applied tariff rate (%)	Equivalent tariff liberation (%)	c_agrifood[a]	c_manufactures[b]
99	1	.2687	1.5633
95	5	1.3486	7.8619
90	10	2.7104	15.8393
84	16	4.3623	25.5687
74	26	7.1596	42.1773
65	35	9.7255	57.5635
55	45	12.6319	75.1717
36	64	18.3212	110.218
26	74	21.4074	129.562
21	79	22.9752	139.482
16	84	24.5598	149.574
9	91	26.8071	164.000
5	95	28.1066	172.405
0	100	29.747	183.080

[a]Crops, processed food, and other agricultural commodities.
[b]Manufacture commodities.

TABLE 4 Tariff liberalization and cost of living (%).

Applied tariff rate (%)	Equivalent tariff liberation (%)	c_agrifood[a]	c_manufactures[b]
99	1	−.0029	−.0015
95	5	−.0148	−.0074
90	10	−.0297	−.0145
84	16	−.0477	−.0228
74	26	−.0779	−.0357
65	35	−.1053	−.0465
55	45	−.1362	−.0573
36	64	−.1957	−.0742
26	74	−.2275	−.0810
21	79	−.2435	−.0838
16	84	−.2596	−.0861
9	91	−.2822	−.0886
5	95	−.2952	−.0895
0	100	−.3116	−.0902

[a]Crops, processed food, and other agricultural commodities.
[b]Manufacture commodities.

The results demonstrate that tariff liberalization is associated with a reduction in cost of living as measured by consumer price index (CPI) for both imports of agrifood and manufactured commodities (see Table 4). The reduction in cost of living is highest for liberalizations of agrifood commodities compared to liberalizations of manufactured commodities. A larger share of incomes is spent on purchases of agrifood commodities, meaning price adjustments emanating from applied tariff rates are likely to have larger welfare effects as reflected in the CPI.

Liberalization of customs duties has unambiguous impact on GDP from expenditure on imported commodities. The impact is positive for imports of agrifood, and manufactured products (see Table 5). The contribution of manufactured commodities to GDP growth from expenditure is larger than that for agrifood commodities. Liberalization is known to lower cost incurred to import products and the reduction is reflected in final prices. With the same level of available income, consumers can purchase more goods. This is known to strengthen demand while encouraging spending—with the outcome being a GDP growth driven by consumption expenditure. The pitfall of such a growth is that it could be unsustainable especially if other components like investments are not vibrant.

Overall, liberalization of customs duties on agrifood and manufactured commodities has a negative impact on investment expenditure (see Table 6). Manufactured commodities exhibit the largest decline in investment expenditure with liberalization. Liberalization is known to increase competition faced by local firms from foreign competing industries. With internal and external economies of scale driving comparative disadvantage in the local industries, competition disincentivizes investment expenditure in the domestic sectors. Liberalization of tariffs is usually associated with price competition especially between imported and locally produced products. Should domestic producers have comparative disadvantage in producing the same quantity of products that can be imported, then the prices faced by consumers of domestically produced products are likely to be higher compared to those for imported products.

Assuming domestic consumers are rational, and the quality of the imported substitutes is at least the same as for those products produced domestically, a shift in demand away from the more expensive domestic products to the cheaper imports would be witnessed. The shift would be expected to disincentivize domestic investment as local industries adjust by cutting down expenditure on investments. Moreover, when tariffs are lowered, domestic industries face increased competition from imported goods. This can lead to reduced profits and market share for domestic firms, potentially discouraging them from investing in new capacity or expansion. This effect is more likely in industries that are heavily reliant on tariff protection and lack the competitiveness to thrive in a more open market. Trade liberalization can introduce uncertainty and volatility into the market, as businesses adjust to new competition and

TABLE 5 Tariff liberalization and GDP from expenditure (%).

Applied tariff rate (%)	Equivalent tariff liberation (%)	c_agrifood[a]	c_manufactures[b]
99	1	.0005	.0216
95	5	.0023	.1090
90	10	.0046	.2199
84	16	.0075	.3558
74	26	.0123	.5888
65	35	.0168	.8062
55	45	.0218	1.0567
36	64	.0319	1.5608
26	74	.0374	1.8424
21	79	.0402	1.9877
16	84	.0430	2.1362
9	91	.0471	2.3497
5	95	.0495	2.4748
0	100	.0525	2.6343

[a]Crops, processed food, and other agricultural commodities.

[b]Manufacture commodities.

TABLE 6 Tariff liberalization and total investment expenditure (%).

Applied tariff rate (%)	Equivalent tariff liberalization (%)	c_agrifood[a]	c_manufactures[b]
99	1	−.0144	−.0519
95	5	−.0729	−.2627
90	10	−.1476	−.5333
84	16	−.2397	−.8689
74	26	−.3996	−1.4558
65	35	−.5505	−2.0150
55	45	−.7263	−2.6730
36	64	−1.0855	−4.0387
26	74	−1.2887	−4.8239
21	79	−1.3942	−5.2351
16	84	−1.5024	−5.6592
9	91	−1.6584	−6.2757
5	95	−1.7501	−6.6404
0	100	−1.8673	−7.1094

[a]Crops, processed food, and other agricultural commodities.
[b]Manufacture commodities.

changing trade patterns. This uncertainty can make firms averse to taking risks and hesitant to invest in new projects. This effect is more pronounced in periods of economic instability or when the institutional framework for supporting investment is weak.

Trade liberalization can lead to a shift in investment priorities from domestic production to other sectors, such as services or export-oriented industries. This could result in a decrease in investment in the specific sectors that are directly affected by the tariff reductions. This effect depends on the structure of the economy and the availability of alternative investment opportunities outside the import-competing sectors.

Table 7 reveals that tariff liberalization on imports of manufactured commodities is associated with a positive impact on demand for intermediate inputs by the manufacturing, agrifood, services, and home production–home consumption sectors. Further, tariff liberalization on imports of agrifood commodities is associated with a shift in demand for intermediate inputs away from the manufacturing and services sectors to the agrifood and home production–home consumption sectors. The decline in intermediate demand implies a decline in sector activity while its rise indicates an increase in sector activity, revealing sectors that lose and gain in terms of demand for intermediate inputs into the production process with tariff liberalization.

Tariff liberalizations on imports of manufactured commodities are associated with positive effects on output from the manufacturing, agrifood, services, and home production–home consumption sectors (see Table 8). This corresponds with the increased demand for intermediate inputs with tariff liberalization for these sectors as observed in Table 7. For tariff liberalization on imports of agrifood commodities, there is a decline in output from the manufacturing and services sectors but a gain in output from the agrifood and home production–home consumption sectors. This reflects the results in Table 7 where intermediate input demand for manufacturing and services sectors declined with liberalization as intermediate input demand for the agrifood and the home production–home consumption sectors increased.

In terms of value added by sector, the results demonstrate that tariff liberalization on imports of manufactured commodities are associated with shift in labor and capital away from

TABLE 7 Tariff liberalization and sectoral intermediate input demand.

Equivalent tariff liberalization (%)	Tariff liberalization on manufactured commodities				Tariff liberalization on agrifood commodities			
	Intermediate demand—Manufacturing sector	Intermediate demand—Agrifood sector	Intermediate demand—Services sector	Intermediate demand—Home-production-home consumption sector	Intermediate demand—Manufacturing sector	Intermediate demand—Agrifood sector	Intermediate demand—Services sector	Intermediate demand—Home-production-home consumption sector
1	.1985	.0903	.0833	.0849	−.0103	.0393	−.0099	.0396
5	1.0027	.4558	.4191	.4281	−.0520	.1978	−.0503	.1994
10	2.0312	.9214	.8446	.8655	−.1047	.3983	−.1015	.4015
16	3.3009	1.4937	1.3636	1.4028	−.1692	.6425	−.1641	.6477
26	5.5079	2.4814	2.2502	2.3298	−.2791	1.0584	−.2716	1.0668
35	7.5985	3.4084	3.0722	3.1995	−.3810	1.4426	−.3716	1.4538
45	10.0473	4.4833	4.0137	4.2074	−.4975	1.8810	−.4866	1.8953
64	15.1094	6.6666	5.8906	6.2529	−.7289	2.7489	−.7168	2.7689
74	18.0165	7.8963	6.9285	7.4040	−.8563	3.2252	−.8446	3.2481
79	19.5400	8.5335	7.4613	8.0002	−.9215	3.4687	−.9102	3.4929
84	21.1133	9.1863	8.0038	8.6108	−.9877	3.7158	−.9770	3.7414
91	23.4045	10.1275	8.7800	9.4907	−1.0821	4.0680	−1.0727	4.0955
95	24.7628	10.6800	9.2327	10.0072	−1.1370	4.2726	−1.1285	4.3011
100	26.5137	11.3864	9.8082	10.6671	−1.2066	4.5319	−1.1994	4.5617

TABLE 8 Tariff liberalization and sectoral output.

Equivalent tariff liberalization (%)	Tariff liberalization on manufactured commodities				Tariff liberalization on agrifood commodities			
	Output—Manufacturing sector	Output—Agrifood sector	Output—Services sector	Output—Home-production-home consumption sector	Output—Manufacturing sector	Output—Agrifood sector	Output—Services sector	Output—Home-production-home consumption sector
1	.1334	.0908	.0177	.0231	−.0013	.0036	−.0024	.0030
5	.6741	.4576	.0888	.1167	−.0067	.0186	−.0124	.0155
10	1.3663	.9239	.1785	.2353	−.0136	.0378	−.0252	.0312
16	2.2218	1.4950	.2870	.3802	−.0221	.0617	−.0410	.0505
26	3.7117	2.4761	.4705	.6282	−.0366	.1033	−.0685	.0834
35	5.1260	3.3920	.6385	.8586	−.0502	.1430	−.0947	.1140
45	6.7859	4.4482	.8283	1.1230	−.0658	.1896	−.1253	.1491
64	10.2268	6.5751	1.1988	1.6514	−.0971	.2862	−.1884	.2191
74	12.2081	7.7629	1.3992	1.9442	−.1144	.3415	−.2243	.2579
79	13.2477	8.3757	1.5009	2.0946	−.1233	.3705	−.2430	.2779
84	14.3222	9.0016	1.6036	2.2478	−.1323	.4003	−.2622	.2981
91	15.8884	9.9008	1.7491	2.4672	−.1453	.4435	−.2900	.3271
95	16.8176	10.4271	1.8332	2.5951	−.1528	.4690	−.3063	.3440
100	18.0161	11.0980	1.9393	2.7578	−.1623	.5017	−.3272	.3655

TABLE 9 Tariff liberalization and sectoral value added.

Equivalent tariff liberalization (%)	Tariff liberalization on manufactured commodities				Tariff liberalization on agrifood commodities			
	Value added—Manufacturing sector	Value added—Agrifood sector	Value added—Services sector	Value added—Home-production-home consumption sector	Value added—Manufacturing sector	Value added—Agrifood sector	Value added—Services sector	Value added—Home-production-home consumption sector
1	.0352	.0899	−.0117	.0418	.0119	−.0062	.0021	−.0016
5	.1791	.4526	−.0592	.2102	.0597	−.0307	.0104	−.0081
10	.3660	.9135	−.1200	.4239	.1204	−.0614	.0208	−.0162
16	.6010	1.4779	−.1948	.6850	.1943	−.0982	.0333	−.0259
26	1.0202	2.4469	−.3248	1.1318	.3204	−.1592	.0538	−.0418
35	1.4289	3.3508	−.4474	1.5471	.4373	−.2139	.0720	−.0560
45	1.9210	4.3925	−.5905	2.0239	.5709	−.2742	.0920	−.0715
64	2.9791	6.4880	−.8834	2.9776	.8363	−.3873	.1292	−.1003
74	3.6087	7.6572	−1.0497	3.5067	.9825	−.4460	.1482	−.1150
79	3.9445	8.2601	−1.1361	3.7788	1.0574	−.4750	.1576	−.1222
84	4.2951	8.8757	−1.2249	4.0560	1.1334	−.5038	.1668	−.1293
91	4.8123	9.7598	−1.3534	4.4532	1.2420	−.5438	.1795	−.1390
95	5.1224	10.2769	−1.4290	4.6850	1.3052	−.5665	.1867	−.1445
100	5.5258	10.9361	−1.5258	4.9800	1.3853	−.5945	.1956	−.1512

the services sector to the manufacturing, agrifood, and home production–home consumption sectors (see Table 9). For tariff liberalization on imports of agrifood commodities, labor and capital are seen to shift away from the agrifood and the home production–home consumption sectors to the manufacturing and services sectors (see Table 9). Given agriculture is a mainstay sector for Kenya, liberalizing imports of agrifood commodities may trigger protective politics aimed at sustaining employment in the agrifood and the home production–home consumption sectors.

Liberalization of custom tariffs has been shown to have a negative impact on tariff revenue accruing to the government from expenditure on imports of agrifood and manufactured commodities (see Table 10). From a policy perspective, import tariffs are employed to support governments to achieve the dual objective of cushioning domestic nascent industries against excessive competition while generating much-needed revenue to support the delivery of public services. Indeed, the larger the liberalization of custom tariffs, the larger the decrease in revenue collected by the government from customs duties and the more prone to external competition domestic infant industries are. While applying liberalization of custom tariffs as a policy to protect nascent domestic industries against external competition, it should also be realized that too much protection could encourage inefficiencies, thus making the domestic industries always reliant on protection. The evidence further reveals that the largest loss in tariff revenue with liberalization is associated with manufactured commodities. This is especially so because developing countries are either de-industrializing or have lightly industrialized and this makes them have inelastic import demand for the products.

Findings demonstrate that liberalization of customs duties is associated with a decrease in revenue from sales tax especially for agrifood commodities (see Table 11). It is, however, largely associated with an increase in revenue from sales tax for manufacturers. The aim of imposing sales tax is usually to raise revenue for the government to support provision of public services. Since sales tax is usually an indirect tax applied on sales of domestically produced commodities, the decline in revenue from sales tax for agrifood commodities is reflective of the decrease in value added for the agrifood sector (Table 9) with liberalization of imports of agrifood commodities. The increase in revenue from sales tax for manufactures is reflective

TABLE 10 Tariff liberalization and tariff revenue (%).

Applied tariff rate (%)	Equivalent tariff liberation (%)	c_agrifood[a]	c_manufactures[b]
99	1	−.1063	−.6985
95	5	−.5363	−3.5216
90	10	−1.0845	−7.1180
84	16	−1.7585	−11.5355
74	26	−2.9222	−19.1549
65	35	−4.0146	−26.3010
55	45	−5.2808	−34.5813
36	64	−7.8486	−51.3822
26	74	−9.2909	−60.8363
21	79	−10.0370	−65.7338
16	84	−10.8003	−70.7503
9	91	−11.8985	−77.9813
5	95	−12.5420	−82.2265
0	100	−13.3633	−87.6533

[a]Crops, processed food, and other agricultural commodities.
[b]Manufacture commodities.

TABLE 11 Tariff liberalization and revenue from sales tax (%).

Applied tariff rate (%)	Equivalent tariff liberation (%)	c_agrifood[a]	c_manufactures[b]
99	1	−.0021	.0610
95	5	−.0105	.3075
90	10	−.0213	.6209
84	16	−.0345	1.0049
74	26	−.0573	1.6653
65	35	−.0788	2.2826
55	45	−.1037	2.9958
36	64	−.1543	4.4384
26	74	−.1826	5.2485
21	79	−.1973	5.6679
16	84	−.2123	6.0975
9	91	−.2338	6.7168
5	95	−.2464	7.0805
0	100	−.2625	7.5456

[a]Crops, processed food, and other agricultural commodities.
[b]Manufacture commodities.

TABLE 12 Tariff liberalization and revenue from indirect taxes (%).

Applied tariff rate (%)	Equivalent tariff liberation (%)	c_agrifood[a]	c_manufactures[b]
99	1	.0005	.0523
95	5	.0029	.2634
90	10	.0058	.5318
84	16	.0093	.8609
74	26	.0152	1.4268
65	35	.0205	1.9558
55	45	.0265	2.5671
36	64	.0379	3.8028
26	74	.0440	4.4961
21	79	.0471	4.8548
16	84	.0502	5.2219
9	91	.0545	5.7508
5	95	.0571	6.0611
0	100	.0602	6.4577

[a]Crops, processed food, and other agricultural commodities.
[b]Manufacture commodities.

of the increased value-added (Table 9), increased output (Table 8), and increased demand for intermediate inputs (Table 7) with tariff liberalization.

The results show that liberalization of customs duties has positive impact on indirect revenue accruing to the government from manufactured and agrifood commodities (see Table 12). Liberalization supports growth in indirect tax revenue since it is levied on commodities. Revenue from indirect taxes from manufactured commodities is larger than the revenue from

TABLE 13 Tariff liberalization and revenue from direct income tax (%).

Applied tariff rate (%)	Equivalent tariff liberation	c_agrifood[a]	c_manufactures[b]
99	1	.0004	.0152
95	5	.0018	.0763
90	10	.0037	.1539
84	16	.0060	.2491
74	26	.0100	.4122
65	35	.0138	.5642
55	45	.0182	.7393
36	64	.0272	1.0916
26	74	.0323	1.2882
21	79	.0349	1.3896
16	84	.0377	1.4931
9	91	.0416	1.6419
5	95	.0439	1.7291
0	100	.0469	1.8402

[a]Crops, processed food, and other agricultural commodities.
[b]Manufacture commodities.

agrifood commodities. For agrifood and manufactured commodities, reduction in customs duties with liberalization encourages imports of the commodities and this supports growth in import volumes of the commodities. The growth in commodity import volumes sustains growth in indirect tax revenue. Given liberalization incentivizes imports of manufactured and agrifood commodities, it could disincentivize domestic industrial activities that produce manufactured and agrifood commodities. The outcome would be a decrease in demand for imports of services should the services be highly specialized and supportive to domestic industrial activity.

Table 8 shows that liberalization of agrifood commodities was associated with a decline in domestic output from manufacturing and services sectors. The decline in output from these sectors could imply increase in imports of the commodities with liberalization. Apart from this decline, Table 8 reveals that liberalization of manufactured and agrifood commodities was associated with an increase in domestic output and this could be another source of the observed rise in revenue from indirect taxes.

Tariff liberalizations are associated with a rise in revenue from direct income taxes levied on manufactured and agrifood commodities (see Table 13). The direct income tax revenue from the manufactured commodities is larger than that from agrifood commodities. Direct income tax revenue accrues to the government from labor and corporations. This tax would be paid by labor and firms. Since direct income tax revenue is paid from earnings by firms and labor owned by workers, it means liberalization of customs duties on imports of manufactured and agrifood commodities sustains livelihoods and economic activity by corporations along the import value chain. The effect is an improvement in government revenue from direct income taxes.

Insights from the evidence indicate that liberalization of customs duties is associated with an increase in revenue from factor income taxes levied on manufactured and agrifood commodities (see Table 14). Overall, revenue from factor income taxes levied on manufactured commodities is larger than that on agrifood commodities. Improvements in factor income

TABLE 14   Tariff liberalization and revenue from factor income tax (%).

Applied tariff rate (%)	Equivalent tariff liberation (%)	c_agrifood[a]	c_manufactures[b]
99	1	.0012	.0129
95	5	.0061	.0652
90	10	.0123	.1316
84	16	.0197	.2128
74	26	.0323	.3521
65	35	.0438	.4820
55	45	.0567	.6316
36	64	.0819	.9326
26	74	.0954	1.1008
21	79	.1023	1.1875
16	84	.1092	1.2762
9	91	.1189	1.4037
5	95	.1246	1.4783
0	100	.1317	1.5736

[a]Crops, processed food, and other agricultural commodities.
[b]Manufacture commodities.

tax revenue with liberalization of customs duties on manufactured and agrifood commodities imply that job opportunities are created along the supply chain for the commodities. Workers supply labor in response to the created opportunities and end up paying direct taxes from the wages earned. This drives up revenue from factor income taxes.

Examination of the impact of tariff liberalization on demand for labor by sector indicates that liberalization of imports of manufactured commodities is associated with a shift in demand for labor away from the services sector to the manufacturing, agrifood, and the home production–home consumption sectors (see Table 15). This means that the increase in revenue from factor income tax comes from labor employed in the manufacturing, agrifood, and the home production–home consumption sectors. Furthermore, the results demonstrate that liberalization of import tariffs on imports of agrifood commodities is associated with a shift in demand for labor away from the agrifood and home production–home consumption sectors to manufacturing and services sectors (Table 15). This implies that liberalization of tariffs on imports of agrifood commodities supports employment, which in turn pays factor income taxes, in the manufacturing and services sector, though it is associated with loss of jobs in the agrifood and the home production–home consumption sectors.

The component of revenue from factor income paid by firms accrues mainly from capital accumulation by firms in various sectors. The evidence shows that tariff liberalization on imports of manufactured commodities is associated with shift in capital demand away from the services sector to the manufacturing, agrifood, and home production–home consumption sectors (Table 16). The firms paying capital factor income tax would, therefore, largely be in the manufacturing, agrifood, and home production–home consumption sectors. Tariff liberalization on imports of agrifood commodities is associated with shift in capital demand away from the agrifood and home production–home consumption sectors to the manufacturing and services sectors. Liberalization of tariffs on agrifood commodities, therefore, supports capital demand in the manufacturing and services sectors.

TABLE 15 Impact of tariff liberalization on sectoral labor factor demand.

Equivalent tariff liberalization (%)	Tariff liberalization on manufactured commodities				Tariff liberalization on agrifood commodities			
	Value added—Manufacturing sector	Value added—Agrifood sector	Value added—Services sector	Value added—Home-production-home consumption sector	Value added—Manufacturing sector	Value added—Agrifood sector	Value added—Services sector	Value added—Home-production-home consumption sector
1	.0260	.0899	−.0210	.0564	.0107	−.0082	.0009	−.0050
5	.1331	.4527	−.1062	.2838	.0540	−.0410	.0046	−.0253
10	.2731	.9135	−.2146	.5722	.1089	−.0819	.0091	−.0507
16	.4505	1.4775	−.3477	.9245	.1760	−.1310	.0145	−.0811
26	.7707	2.4449	−.5770	1.5269	.2906	−.2127	.0232	−.1316
35	1.0866	3.3464	−.7918	2.0863	.3969	−.2860	.0308	−.1770
45	1.4712	4.3840	−1.0403	2.7277	.5187	−.3670	.0388	−.2272
64	2.3106	6.4670	−1.5436	4.0080	.7615	−.5196	.0530	−.3218
74	2.8167	7.6265	−1.8263	4.7164	.8956	−.5991	.0598	−.3711
79	3.0881	8.2236	−1.9725	5.0800	.9644	−.6385	.0630	−.3956
84	3.3726	8.8328	−2.1222	5.4502	1.0344	−.6777	.0661	−.4199
91	3.7942	9.7065	−2.3378	5.9798	1.1344	−.7322	.0701	−.4538
95	4.0479	10.2171	−2.4643	6.2884	1.1927	−.7632	.0723	−.4730
100	4.3789	10.8672	−2.6258	6.6807	1.2666	−.8016	.0749	−.4969

TABLE 16 Impact of tariff liberalization on sectoral capital factor demand.

Equivalent tariff liberalization (%)	Tariff liberalization on manufactured commodities				Tariff liberalization on agrifood commodities			
	Value added—Manufacturing sector	Value added—Agrifood sector	Value added—Services sector	Value added—Home-production-home consumption sector	Value added—Manufacturing sector	Value added—Agrifood sector	Value added—Services sector	Value added—Home-production-home consumption sector
1	.0231	.0870	−.0239	.0535	.0103	−.0085	.0005	−.0054
5	.1184	.4380	−.1208	.2692	.0523	−.0427	.0028	−.0271
10	.2433	.8836	−.2442	.5424	.1054	−.0855	.0056	−.0542
16	.4019	1.4284	−.3959	.8756	.1702	−.1367	.0088	−.0868
26	.6889	2.3618	−.6577	1.4445	.2810	−.2222	.0137	−.1411
35	.9729	3.2301	−.9034	1.9714	.3838	−.2990	.0177	−.1900
45	1.3195	4.2279	−1.1883	2.5742	.5014	−.3841	.0216	−.2443
64	2.0787	6.2257	−1.7669	3.7722	.7357	−.5451	.0274	−.3473
74	2.5376	7.3344	−2.0927	4.4322	.8651	−.6292	.0294	−.4013
79	2.7841	7.9045	−2.2616	4.7702	.9313	−.6711	.0302	−.4282
84	3.0427	8.4854	−2.4346	5.1137	.9988	−.7128	.0308	−.4551
91	3.4261	9.3175	−2.6841	5.6040	1.0951	−.7709	.0312	−.4925
95	3.6571	9.8031	−2.8306	5.8892	1.1512	−.8039	.0313	−.5139
100	3.9585	10.4207	−3.0179	6.2511	1.2223	−.8450	.0312	−.5404

CONCLUSION

The study endeavored to examine the impact of import tariff liberalization on living standards, cost of living, GDP from expenditure, total investment expenditure, intermediate input demand by sector, output by sector, value added by sector, tariff revenue, revenue from sales tax, revenue from indirect taxes, revenue from direct income tax, revenue from factor income tax, and sectoral factor demand.

The findings revealed that tariff liberalization on agrifood and manufactured commodities is associated with overall improvement in living standards as a measure of welfare. The welfare gains from liberalization of imports of manufactured commodities were larger than those from liberalization of agrifood commodities. Liberalization of customs duties on imports of agrifood and manufactured commodities was further associated with a decline in the cost of living as measured by the consumer price index. The decrease in cost of living was largest with liberalization for agrifood commodities compared to manufactured commodities.

Reduction of customs duties on agrifood and manufactured commodities was associated with an increment in GDP from expenditure. The growth is largest for liberalization of manufactured commodities compared to agrifood commodities. Liberalization of tariffs on agrifood and manufactured commodities is, however, associated with a decline in total investment expenditure. The decline in investment expenditure with liberalization is largest for manufactured commodities compared to agrifood commodities. The decline in investment expenditure is reflected in the decline in intermediate input demand for the manufacturing and services sectors with liberalization of import tariffs on agrifood commodities. The manufacturing and services sectors also reveal a decline in output with liberalization of imports of agrifood commodities. Liberalization of imports of manufactured commodities is associated with a decline in value added for the services sector while liberalization of imports of agrifood commodities is associated with a decline in value added for the agrifood and home production–home consumption sectors.

Moreover, the findings reveal that liberalization of tariffs on imports of agrifood and manufactured commodities is associated with a decline in revenue from customs duties. Liberalization is associated with a decline in revenue from sales tax for agrifood commodities but is associated with a rise in revenue from sales tax from liberalization of manufactured commodities. Liberalization of tariffs on agrifood and manufactured commodities is further associated with a rise in revenue from indirect and direct taxes. An example of a direct tax is the factor income tax that reveals an improvement in revenue with liberalization. For liberalization of manufactured commodities, much of the revenue from factor income tax is likely to come from enhanced employment in manufacturing, agrifood, and the home production–home consumption sectors. For liberalization of agrifood commodities, much of the revenue from factor income tax is likely to come from enhanced employment in the manufacturing and services sectors.

Policy implications

Tariff liberalizations which are integral in trade agreements should be embraced because they are associated with welfare gains, reduction in cost of living, and GDP growth from expenditure. Targeted policy incentives could be directed to specific domestic sectors since tariff liberalization has a downside on investment expenditure in certain domestic sectors. Specifically, policy incentives targeting intermediate input demand should be directed to the manufacturing and services sectors if imports of agrifood commodities are liberalized. To support output with liberalization of agrifood commodities, targeted policy incentives should be directed to the manufacturing and services sectors which experience a decline in output. Policy incentives

to encourage value addition when manufactured commodities are liberalized should be directed to the services sector while value-added policy incentives should be directed to the agrifood and the home production–home consumption sectors if agrifood commodities are liberalized.

For tariff liberalization on imports of manufactured commodities, targeted policy incentives should be directed to the services sector, which sheds jobs. For liberalization of tariff on imports of agrifood commodities, targeted policy incentives should be directed to the agrifood and the home production–home consumption sectors, which register job losses. Such targeted policy incentives could support industrial activity, thus supporting the government to compensate for the loss of revenue from customs duties and sale tax that occurs with liberalization.

CONFLICT OF INTEREST STATEMENT
There are no financial and non-financial interests affecting this work.

DATA AVAILABILITY STATEMENT
Social Accounting Matrix (SAM) available.

ETHICS STATEMENT
The work has conformed and complied with research ethics and it is approved for consideration.

INFORMED CONSENT
The work is submitted to the journal for consideration with informed consent.

ORCID
Shadrack Muthami Mwatu https://orcid.org/0000-0002-6137-129X

REFERENCES
Africa Research Bulletin. 2015. "Kenya: Upgrade to Middle-Income Status." *Africa Research Bulletin* 52(6): 20881–0882. https://doi.org/10.1111/j.1467-6346.2015.06505.x.

Akinboade, Oludele Akinloy. 1993. "Technical Efficiency Change in Kenyan Agriculture and the Poor: A Computable General Equilibrium Analysis." *African Development Review* 5(2): 1–19. https://doi.org/10.1111/j.1467-8268.1993.tb00114.x.

Akinboade, Oludele Akinloy. 2008. "Kenya, Agricultural Policy Options and the Poor: A Computable General Equilibrium Analysis." *Development Southern Africa* 13(5): 663–80. https://doi.org/10.1080/03768359608439924.

Amiti, Mary, and Jozef Konings. 2007. "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia." *American Economic Review* 97(5): 1611–38. https://doi.org/10.1257/aer.97.5.1611.

Bakoup, Ferdinand, and David Tarr. 2002. "The Economic Effects of Integration in the Central African Economic and Monetary Community: Some General Equilibrium Estimates for Cameroon." *African Development Review* 12(2): 161–90. https://doi.org/10.1111/1467-8268.00021.

Blomqvist, Ake, and Gary McMahon. 1986. "Simulating Commercial Policy in a Small, Open Dual Economy with Urban Unemployment: A General Equilibrium Approach." *The Journal of Development Studies* 22(2): 443–57. https://doi.org/10.1080/00220388608421989.

Chen, Kun-Ming, Meng-Chia Tsai, Chia-Ching Lin, and Chaw-Hsia Tu. 2009. "Impact of Cross-Strait Trade Liberalization: A Computable General Equilibrium Analysis." *China & World Economy* 17(6): 106–22.

Chou, Ji, Yun-Peng Chu, and Shiu-Tung Wang. 1997. "Effects of Trade Liberalization on Taiwan: A Computable General Equilibrium (CGE) Analysis." *Asian Economic Journal* 11(2): 169–86. https://doi.org/10.1111/1467-8381.00030.

Costinot, Arnaud, and Iván Werning. 2019. "Lerner Symmetry: A Modern Treatment." *American Economic Review* 1(1): 13–26. https://doi.org/10.1257/aeri.20170006.

Davies, Elwyn, and Lars Nilsson. 2019. "A Comparative Analysis of EU and US Trade Policies towards Least Developed Countries and the African Growth and Opportunity Act Beneficiaries." *Development and Policy Review* 38(5): 613–29. https://doi.org/10.1111/dpr.12434.

De Melo, Jaime, Julie Stanton, and David Tarr. 1989. "Revenue-Raising Taxes: General Equilibrium Evaluation of Alternative Taxation in U.S Petroleum Industries." *Journal of Policy Modelling* 11(3): 425–49. https://doi.org/10.1016/0161-8938(89)90012-4.

East African Community. 2022. *EAC Common External Tariff.* https://www.eac.int/documents/category/eac-common-external-tariff.

Egger, Peter, and Mario Larch. 2011. "An Assessment of the Europe Agreements' Effects on Bilateral Trade, GDP, and Welfare." *European Economic Review* 55: 263–79. https://doi.org/10.1016/j.euroecorev.2010.05.002.

Emanuele, Ferrari, Mainar Alfredo, and Jiménez Sofia. 2020. *SAM-Kenya-2017.* Seville, Spain: European Commission, Joint Research Centre.

Golub, Stephen S., Janet Ceglowski, Ahmadou Aly Mbaye, and Varun Prasad. 2017. "Can Africa Compete with China in Manufacturing? The Role of Relative Unit Labour Costs." *The World Economy* 41(6): 1508–28.

Jaswal, Isha. 2023. "Can Regional Comprehensive Economic Partnership Alter the Direction of Global Textiles and Clothing Trade? A Computable General Equilibrium Analysis." *The Journal of Business Perspective.* https://doi.org/10.1177/09722629231195478.

Karingi, Stephen, and Mahinda Siriwardana. 2002. "Structural Adjustment Policies and the Kenyan Economy: A Computable General Equilibrium Model Analysis." *African Development Review* 13(1): 24–45. https://doi.org/10.1111/1467-8268.00029.

Kohler, Wilhelm, and Christian Keuschnigg. 1995. "Dynamic Effects of Tariff Liberalization: An Intertemporal CGE Approach." *Review of International Economics* 3(1): 20–35. https://doi.org/10.1111/j.1467-9396.1995.tb00049.x.

Konings, Jozef, and Hylke Vandenbussche. 2008. "Heterogeneous Responses of Firms to Trade Protection." *Journal of International Economics* 76(2): 371–83. https://doi.org/10.1016/j.jinteco.2008.08.002.

Kose, M. Ayhan, and Raymond Riezman. 2000. "Understanding the Welfare Implications of Preferential Trade Agreements." *Review of International Economics* 8(4): 619–33. https://doi.org/10.1111/1467-9396.00246.

Kreuter, Helena, and Massimo Riccaboni. 2023. "The Impact of Import Tariffs on GDP and Consumer Welfare: A Production Network Approach." *Economic Modelling* 126: 106374. https://doi.org/10.1016/j.econmod.2023.106374.

Li, Chunding, Jing Wang, and John Whalley. 2016. "Impact of Mega Trade Deals on China: A Computational General Equilibrium Analysis." *Economic Modelling* 57: 13–25.

Linde, Jesper, and Andrea Pescatori. 2019. "The Macroeconomic Effects of Trade Tariffs: Revisiting the Lerner Symmetry Result." *Journal of International Money and Finance* 95: 52–69. https://doi.org/10.1016/j.jimonfin.2019.01.019.

Liyanaarachchi, Tilak S., Athula Naranpanawa, and Jayatilleke S. Bandara. 2016. "Impact of Trade Liberalization on Labour Market and Poverty in Sri Lanka: An Integrated Macro-Micro Modelling Approach." *Economic Modelling* 59: 102–15.

Muhammad, Andrew. 2009. "Would African Countries Benefit from the Termination of Kenya's Economic Partnership Agreement (EPA) with the EU? An Analysis of EU Demand for Imported Roses." *Journal of Agricultural Economics* 60(1): 220–38. https://doi.org/10.1111/j.1477-9552.2008.00169.x.

Muhammad, Andrew, William A. Amponsah, and Jennifer H. Dennis. 2010. "The Impact of Preferential Trade Agreements on EU Imports from Developing Countries: The Case of Fresh Cut Flowers." *Applied Economic Perspectives and Policy* 32(2): 254–74. https://doi.org/10.1093/aepp/ppp008.

Nahar, Bodrun, and Mahinda Siriwardana. 2013. "Trade Opening, Fiscal Reforms, Poverty, and Inequality: A CGE Analysis for Bangladesh." *The Developing Economies* 51(2): 145–85. https://doi.org/10.1111/deve.12009.

Ngeleza, Guyslain, and Andrew Muhammad. 2011. "Preferential Trade Agreements between the Monetary Community of Central Africa and the European Union: Stumbling or Building Blocks? A General Equilibrium Approach." *Journal of International Development* 27(2): 251–72. https://doi.org/10.1002/jid.1838.

Nguyen, Manh Toan, Tung Lan Dang, and Thi Hong Han Huynh. 2021. "Trade Liberalization and Income Distribution in Vietnam: A Dynamic CGE Approach." *Asian Economic Journal* 34(4): 404–29. https://doi.org/10.1111/asej.12224.

Ntah, Marcellin Ndong, Victor Nechifor, Emanuele Ferrari, Martin Wafula Nandelenga, and Amsalu Woldie Yalew. 2024. "The Impacts of Russia's Invasion of Ukraine on the Kenyan Economy: Evidence from an Economy-Wide Model." *African Development Review.* https://doi.org/10.1111/1467-8268.12728

Olarreaga, Marcelo, and Caglar Ozden. 2005. "AGOA and Apparel: Who Captures the Tariff Rent in the Presence of Preferential Market Access?" *The World Economy* 28(1): 63–77. https://doi.org/10.1111/j.1467-9701.2005.00642.x.

Olofin, Samuel. 2002. "Trade and Competitiveness of African Economies in the 21st Century." *African Development Review* 14(2): 298–321. https://doi.org/10.1111/1467-8268.00056.

Sadoulet, Elizabeth, and Alain de Janvry. 1992. "Agricultural Trade Liberalization and Low-Income Countries: A General Equilibrium-Multimarket Approach." *American Journal of Agricultural Economics* 74(2): 268–80. https://doi.org/10.2307/1242481.

Sorgho, Zakaria, and Joe Tharakan. 2019. "Assessing the Impact of Unilateral Trade Policies EBA and AGOA on African Beneficiaries' Exports Using Matching Econometrics." *The World Economy* 42(10): 3086–3118. https://doi.org/10.1111/twec.12842.

Thurlow, James. 2011. "Consequences of Avian Flu for Growth and Poverty: A CGE Analysis for Kenya." *African Development Review* 23(3): 276–88. https://doi.org/10.1111/j.1467-8268.2011.00286.x.

Tyler, Godfrey, and Oludele Akinboade. 1992. "Structural Adjustment and Poverty: A Computable General Equilibrium Model of the Kenyan Economy." *Oxford Agrarian Studies* 20(1): 51–61. https://doi.org/10.1080/13600819208424047.

Vos, Rob, and Niek De Jong. 2003. "Trade Liberalization and Poverty in Ecuador: A CGE Macro-Microsimulation Analysis." *Economic Systems Research* 15(2): 211–32. https://doi.org/10.1080/0953531032000091180.

World Bank. 2022. *Kenya: Country Partnership Framework for the Period FY23-FY28.* https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099421512052241562/secbos01bdb49b00208e1f0d132ef1fbe94.

Zhou, Dinggen, Jing-Jing Yang, and Ming-Yong Lai. 2019. "Input Trade Liberalization and the Export Duration of Products: Evidence from China." *China & World Economy* 27(6): 1–25. https://doi.org/10.1111/cwe.12305.

AUTHOR BIOGRAPHIES

Shadrack Muthami Mwatu (MSC Economics, BSC Economics & Statistics, CPA) is a Research and Policy Analyst at the Kenya Institute for Public Policy Research and Analysis (KIPPRA). His research interests include macroeconomics, microeconomics, econometrics, research methods, economic policy analysis and planning, managerial economics, public finance, monetary economics, labor economics, institutional economics, corporate finance, welfare economics, and development economics.

Nancy Nelima Nafula is a Social Sector Principal Policy Analyst and Head of the Capacity Building Department at the Kenya Institute for Public Policy Research and Analysis. She holds a Ph.D. (Economics), M.A (Economics), and B.A. (Economics major) from the University of Nairobi. Most of Dr. Nafula's work so far has focused on the topics of gender, poverty, health, social protection, education, and labor markets.

John Gakuu Karanja is a Research and Policy Analyst at the Kenya Institute for Public Policy Research and Analysis (KIPPRA). He has a Bachelor of Business Administration (BBA) degree from the Kenya Methodist University, Kenya, a Master of Business Administration (MBA) degree in Finance from Meru University of Science & Technology, Kenya, and he is a Certified Public Accountant. He is a Senior Prison Officer in the rank of Inspector of Prisons—Kenya Prisons Service, an Associate Member of the Institute of Human Resource Management of Kenya, as well as an Associate Member of Kenya Institute of Management. He is also engaged as a lecturer of financial and cost accounting, human resource management, business law, and research methods. His research interests are on financial innovations, financial management practices, human resource management, corporate governance, and performance.