



TRADE DIAGNOSTIC

Uganda

An assessment of Uganda's trade structure, competitiveness and AfCFTA integration opportunities using multi-region input-output accounting and CGE simulation.

AICTEM TRADE DIAGNOSTIC

Lead Author: John-Mary Matovu

Models: FE-PPML gravity, corridor network, calibrated Armington sourcing, MRIO value-chain analytics, Caliendo–Parro CGE

Key datasets: GTAP Africa V3 (GTAP 11b, 2017; 62 regions, 65 commodities), World Bank WDI and LPI, AICTEM corridor and port network

Scenarios: 2017 benchmark; AfCFTA facilitation and trade-cost counterfactuals

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Executive Summary

Uganda is a landlocked, fast-growing East African economy — GDP of about US\$62 bn — whose trade is constrained less by tariffs than by the **cost and reliability of moving goods to market** and by **shallow regional value chains**: a diagnosis consistent with the broader evidence that trade costs, not tariffs, are the binding constraint on African integration (Maliszewska and Ruta, 2020; UNECA, 2021; Limão and Venables, 2001). This assessment quantifies those constraints using an integrated spatial-gravity-MRIO-network-CGE pipeline and reaches the following headline findings. *(Full citations, including online sources, are listed in the References at the end of this report.)*

- **Uganda realises only about a tenth of its intra-African export potential.** A fixed-effects gravity model estimates Uganda's frictionless intra-African export potential at roughly **US\$15.2 bn** against actual (MRIO-gross) intra-African exports of about **US\$1.5 bn**, leaving a **missing-trade gap of ~US\$13.6 bn** (a fill ratio of **0.10**). This is not a country that has half-built its regional trade: outside a handful of EAC neighbours it has barely begun, and the arithmetic below concerns a gap roughly nine times the size of realised trade. The gap is wider than earlier rounds of this assessment reported, because pricing port dwell time at the value of time raised modelled delivered costs across the continent and therefore raised the frictionless benchmark against which realised trade is measured.
- **Uganda's natural markets are its neighbours, and it serves only the nearest of them.** The largest African markets in the model are **Kenya (~US\$506 m)**, **South Sudan (~US\$336 m)**, **Rwanda (~US\$204 m)**, **the Democratic Republic of Congo (~US\$120 m)**, **Sudan (~US\$85 m)**, **Tanzania and Burundi**. Realisation across them varies more than their size: Uganda fills **61%** of its gravity potential in Kenya and **64%** in Rwanda — the two cheapest markets it can reach — but only **6%** in South Sudan, whose **US\$5.4 bn** shortfall is on its own about two-fifths of the national gap and the largest single unrealised market on the list.
- **The binding constraint is logistics and non-tariff friction, not tariffs.** Uganda's average delivered transport cost to African markets is about **18.6% of cargo value**, with an average of **1.7 border crossings** and **~355 hours** of transit. Removing tariffs alone moves Uganda's intra-African trade by **+0.4%**, whereas **harmonising non-tariff barriers and standards raises it +47.7%**, port efficiency **+11.7%**, one-stop border posts **+6.8%**, corridor upgrading **+3.6%** and regional rail **+1.0%**; a **combined facilitation package would raise Uganda's intra-African exports by +54.6%**. Two cautions belong with that list. The tariff figure is a genuine estimate rather than a structural zero — earlier rounds reported exactly zero because the tariff variable was collinear with the common-REC dummy and the estimator discarded it — but it is imprecise enough to be consistent with a substantially larger gain, so it is weak evidence rather than a demonstration that tariffs do not bind. And of the facilitation levers, non-tariff and standards reform and port efficiency are the two that are larger than tariff removal at conventional confidence; the corridor, rail and border levers are larger in expectation but statistically inseparable from it. Even

the full package closes under a fifth of the measured gap, which is the honest measure of how far Uganda is from its frictionless benchmark.

- **Uganda is integrated into the world more than into African value chains.** Backward GVC participation (foreign value added in exports) is only ~**11.5%** and forward participation ~**9.5%**; the economy is **upstream** (index ~2.1). Just **3.2%** of Uganda's intermediate inputs are bought from other African economies against **16.7%** from outside the continent, and the leakage is concentrated in construction inputs (~US\$851 m), food and beverage processing (~US\$616 m), transport services (~US\$343 m) and agriculture (~US\$321 m) — sectors in which regional suppliers demonstrably exist.
- **Strategic value chains with the clearest regional upside** are agro-processing (coffee, tea, dairy, fish, maize, sugar), construction materials (cement, steel), petrochemicals and fertilisers, pharmaceuticals, and transport/ICT-enabled services — each combining real Ugandan capacity, large regional demand (Kenya and Rwanda today, South Sudan and the DRC as the unrealised prize), and currently high extra-African import leakage.
- **Economy-wide gains from regional integration are positive and progressive.** A general-equilibrium (Caliendo–Parro) model finds that cutting intra-African trade costs raises Ugandan welfare by **+0.58% at a –10% cost cut and +1.68% at –20%**, delivered mainly through higher real wages (**+0.72%** and **+2.00%** respectively). The gains are convex in the depth of the cut but middling in continental terms: Uganda ranks ninth of the twenty-five economies the CGE solves, almost exactly at the sample mean.
- **Uganda is both transit-dependent and a regional gateway.** It depends on the **Northern Corridor** (Mombasa) and, secondarily, the **Central Corridor** (Dar es Salaam) for its own overseas trade, while simultaneously acting as the **gateway for South Sudan, eastern DRC, Rwanda and Burundi** — a dual role that makes corridor reliability and border efficiency doubly important and exposes Uganda to single-points-of-failure (one primary corridor, one main gateway port).

What is specific to Uganda in this sample is the size of the non-tariff-barrier lever relative to everything else it can control: harmonising SPS and technical standards alone (+47.7%) is worth at least four times any single infrastructure investment, precisely because Uganda's comparative advantage sits in agricultural and dairy exports that standards gaps and periodic regional import bans most directly threaten — making standards diplomacy, not corridor construction, the fastest lever available to policymakers.

Recommended reforms, in priority order: (1) attack non-tariff barriers and harmonise standards/SPS (the single largest lever); (2) cut dwell time at the gateway ports the transit corridors depend on, Mombasa and Dar es Salaam; (3) complete one-stop border posts and digital customs at Malaba, Elegu, Mpondwe, Katuna and Mutukula; (4) upgrade and climate-proof the Northern and Central

corridors and revive cross-border rail; (5) lower energy costs and build processing capacity in the priority value chains; (6) implement AfCFTA tariff liberalisation as the enabling legal foundation.

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1. Introduction

Uganda sits at the geographic heart of the Great Lakes region, landlocked but bordered by six countries — Kenya, Tanzania, Rwanda, Burundi (via the EAC), South Sudan and the Democratic Republic of the Congo — that together form a large and fast-growing regional market. Its trade position is defined by a paradox the rest of this report quantifies: Uganda is **simultaneously transit-dependent and a regional supplier hub**. It must move its own imports and exports more than a thousand kilometres overland to the Indian Ocean ports of Mombasa and Dar es Salaam, yet it is itself the nearest industrial and agricultural supplier for the conflict-affected, infrastructure-poor markets of South Sudan and eastern DRC. How well Uganda exploits that position depends on the very frictions — corridor cost, border delay, non-tariff barriers and missing value chains — that this assessment measures.

Uganda's regional-integration agenda is dense and overlapping. It is a founding member of the **East African Community (EAC)**, a member of the **Common Market for Eastern and Southern Africa (COMESA)** and of the **Intergovernmental Authority on Development (IGAD)**, and a signatory of the **African Continental Free Trade Area (AfCFTA)**. The EAC customs union has already removed most intra-EAC tariffs, which is precisely why this assessment finds tariffs to be second-order: the binding constraints lie in the *non-tariff* and *physical* domains that the AfCFTA's facilitation agenda — its NTB-elimination mechanism, rules-of-origin simplification, and the Pan-African Payment and Settlement System (PAPSS) — is designed to address (Maliszewska and Ruta, 2020; UNECA, 2021; UNCTAD, 2021). With first oil production approaching from the Lake Albert fields (Tilenga and Kingfisher) and the East African Crude Oil Pipeline (EACOP) to Tanga, Uganda's trade and connectivity profile is also on the cusp of structural change, raising the stakes for getting corridor and value-chain policy right.

The purpose of this assessment is to provide a single, model-based diagnosis of **why Uganda under-trades, with whom, through which corridors, in which sectors, and what to do about it**. It applies the same integrated pipeline used at continental level — spatial accessibility → gravity → multi-region input–output → network → scenario → CGE — but focused on Uganda, so that every finding is traceable to data and reproducible from the accompanying Julia packages. The report follows the standard structure of a country bottleneck assessment, from economic structure (Section 2) and trade profile (Section 3) through connectivity (Section 4), gravity and value-chain analysis (Sections 5–7), network position and bottlenecks (Sections 8–9), scenario and economic-impact analysis (Sections 10–11), and policy prioritisation and roadmap (Sections 12–13), to conclusions (Section 14) and technical annexes.

A note on data and units. The quantitative core is the GTAP multi-region input–output database, which records *gross* flows (including services, informal and re-exported trade) and therefore yields trade magnitudes larger than official merchandise-trade statistics; where this matters the report says

so. Macroeconomic figures in Section 2 are drawn from external sources (Bank of Uganda, Uganda Bureau of Statistics, IMF and World Bank) and are approximate; all model-derived figures (Sections 3–11) are exact outputs of the pipeline and are reproduced in the annex tables.

2. Country Economic Structure

2.1 Macroeconomic Profile

Uganda is a low-income but rapidly growing economy. Approximate recent indicators (external sources; figures rounded):

Table 1: Uganda: Macroeconomic profile

Indicator	Approximate value	Source / note
GDP (nominal)	~US\$62 bn	World Bank / IMF; the model panel uses US\$62.0 bn
Population	~51 million	model uses 51.4 m
GDP per capita	~US\$1,206	among the lower-middle/low-income range
Real GDP growth	~5–6%	among the faster-growing African economies
Inflation	~3–4% (recent)	Bank of Uganda has kept inflation relatively contained
Exchange rate	~UGX 3,700–3,800 / US\$	managed float
Fiscal balance	deficit ~4–5% of GDP	elevated by infrastructure and (recently) oil spending
Public debt	~50% of GDP	rising but moderate by regional standards
Logistics Performance Index	2.6 / 5	World Bank LPI; below the African median, and the friction the tra

Notes: GDP, population, per-capita and Logistics Performance Index figures are external estimates (World Bank WDI and LPI, IMF and population and the LPI enter the gravity and spatial models as country covariates.

Two structural facts frame everything that follows. First, Uganda is **landlocked**, and the delivered cost of moving Ugandan goods to African markets — **18.6% of cargo value on this model’s own accounting** (Section 4), against a Logistics Performance Index of 2.6 out of 5 — makes logistics quality a first-order constraint, not a footnote (Arvis et al., 2023; Limão & Venables, 2001; macroeconomic indicators from World Bank WDI, IMF Article IV and Bank of Uganda). Second, the economy is on the verge of an **oil era**: first production from the Lake Albert fields and the EACOP pipeline will add a large extractive export, shift the balance of payments, and intensify demand on the western corridors — making the connectivity and value-chain questions of this report more, not less, urgent.

2.2 Sectoral Structure

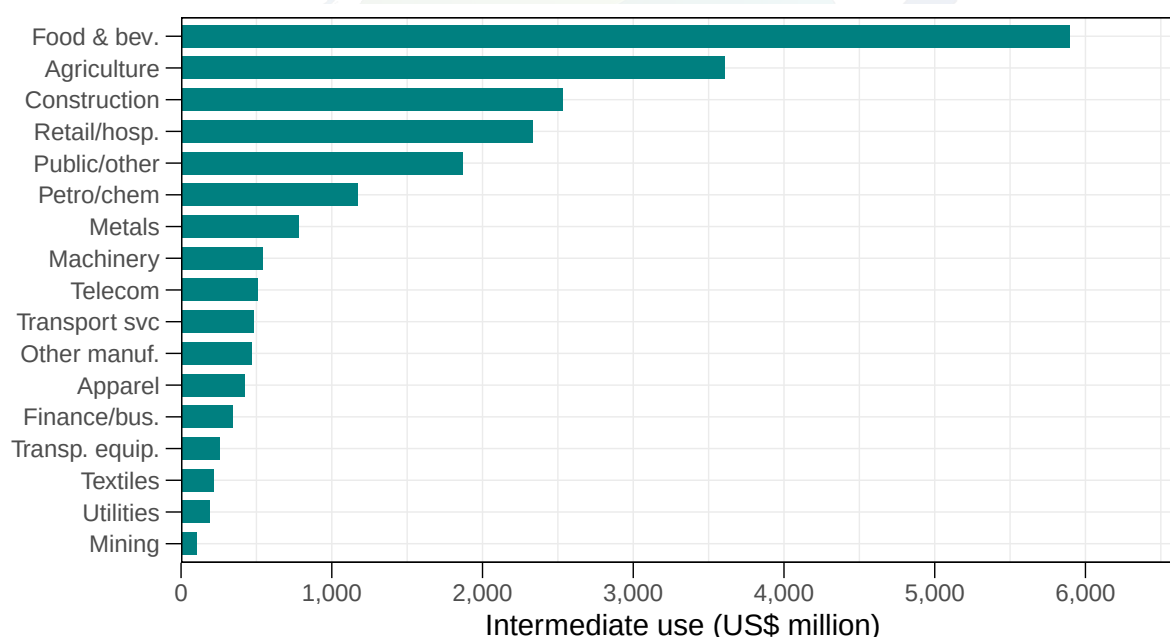
Uganda’s output is broadly balanced across agriculture, industry and services, with agriculture still employing the majority of the workforce:

- **Agriculture, forestry and fishing (AFF)** — the largest employer and the backbone of exports: coffee (Uganda is among Africa’s largest coffee exporters), tea, fish, maize, sugar, dairy, livestock, cocoa, horticulture and flowers. The MRIO shows agriculture with a high domestic and intra-African orientation.

- **Mining and extraction (MIN)** — currently modest (gold — much of it re-exported, cobalt, tin, limestone), about to be transformed by oil.
- **Manufacturing** — light and processing-oriented: food and beverages (FBE), cement and construction materials, steel re-rolling (MPR), textiles and apparel (cotton-based), plastics and basic chemicals (PCM), and a nascent pharmaceuticals industry (ELM/PCM).
- **Construction (CON) and utilities (EGW)** — buoyed by infrastructure and (hydro)power investment; Uganda is a regional electricity exporter via its Nile hydropower.
- **Services** — trade and hospitality (SMH), transport and logistics (TRA), telecommunications and a growing ICT/business-process sector (PTE, FIB), and public administration (PAO).

Figure 1 ranks Uganda's sectors by intermediate input use, a proxy for activity scale that — unlike value added — is directly observed in the MRIO.

Figure 1: Uganda: sectors ranked by intermediate input use



Notes: US\$ million. Intermediate input use is a proxy for activity scale. The 65 GTAP commodities are aggregated into 17 broad groups, weighted by the underlying levels; no commodity is dropped.

The ranking is agro-industrial from top to bottom. **Food and beverages (~US\$5.9 bn)** buys more intermediate input than any other group, followed by **primary agriculture (~US\$3.6 bn)**, **construction (~US\$2.5 bn)**, **retail and hospitality (SMH, ~US\$2.3 bn)**, **public and other services (PAO, ~US\$1.9 bn)** and **petrochemicals and non-metallic minerals (PCM, ~US\$1.2 bn)**. Metals, machinery, telecoms and transport services follow an order of magnitude lower, and **utilities (~US\$186 m)** and **mining (~US\$103 m)** are the smallest groups on the chart — a reminder that Uganda's hydropower and mineral sectors are strategically important but, as buyers of intermediates, very small. The two

facts that matter for what follows are that the economy's purchasing power is concentrated in food processing, agriculture and construction, and that these are exactly the chains in which regional supply exists; today most of that purchasing leaks outside Africa rather than reaching African suppliers (Section 6.4), which is why they are the natural focus of a regional-sourcing strategy.

2.3 Production Geography

Uganda's economic geography is organised around a central industrial-and-commercial core and a set of agricultural belts and border gateways:

- **Greater Kampala–Jinja–Entebbe corridor** — the industrial, commercial and logistics heartland, containing the bulk of manufacturing, the main industrial parks (Namanve and others), the international airport (Entebbe) and the inland container depots that anchor the Northern Corridor.
- **Agricultural belts** — the coffee and banana zones of the central and western highlands; the tea estates of the west and south-west; the dairy and livestock "cattle corridor" of the south-west and centre; the fisheries of Lake Victoria, Albert and Kyoga; the cotton, maize and oilseed zones of the east and north; and sugar in the centre and east.
- **Mining and oil zones** — the **Albertine Graben** in the west (oil, with the Kabaale industrial park and refinery site) and scattered gold and mineral workings.
- **Border gateways** — **Malaba and Busia** (to Kenya and the Northern Corridor), **Mutukula** (to Tanzania and the Central Corridor), **Katuna/Gatuna and Mirama Hills** (to Rwanda), **Elegu/Nimule** (to South Sudan, a major export gateway), and **Mpondwe and Bunagana** (to eastern DRC, another major export gateway). These border towns are the physical points at which Uganda's regional trade succeeds or stalls.

This geography — a central production core feeding agricultural and processed goods outward through a ring of border towns to interior neighbours, while drawing imports inward along the Northern Corridor — is the spatial structure the rest of the report analyses.

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3. Trade Profile

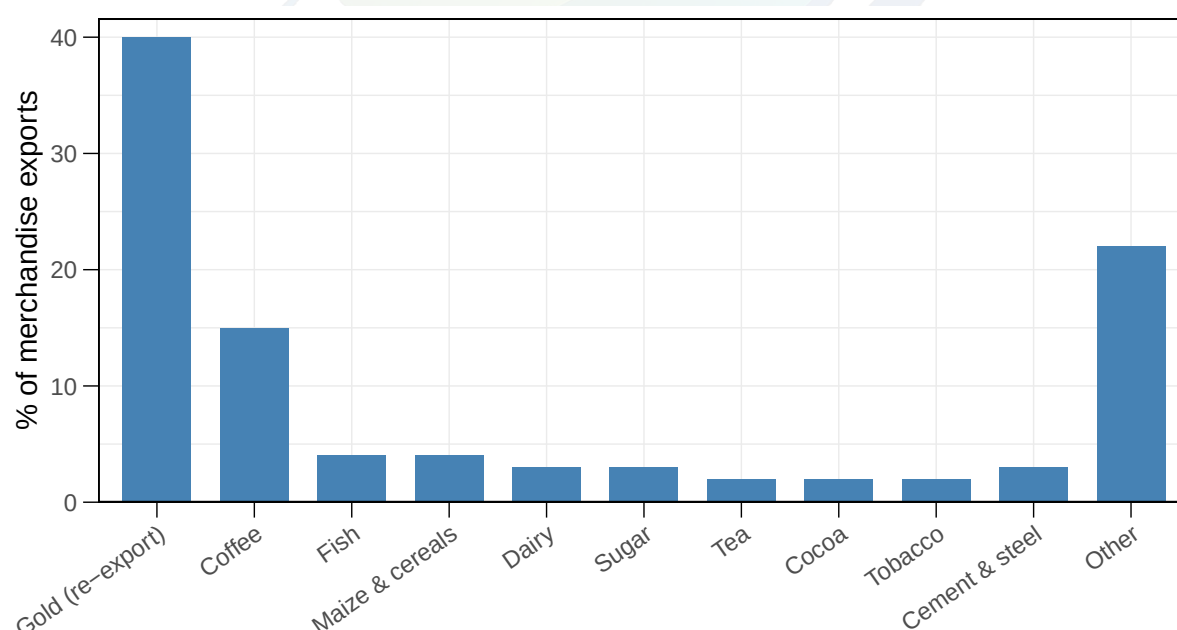
Built with TradeAnalytics (GTAP value-added and bilateral-trade accounts) and TradeFuture.

3.1 Export Structure

Uganda's exports combine a few high-value primary commodities with a growing range of regional manufactures and processed goods. In **official merchandise statistics**, the largest single export is **gold** (much of it imported and re-exported, destined for the United Arab Emirates), followed by **coffee** (Uganda's signature agricultural export, to the EU, Sudan, Italy and increasingly regional roasters), **fish and fish products, tea, sugar, maize, dairy, cocoa, tobacco, cement and steel**. This split — a dominant re-exported mineral plus a coffee-anchored agricultural base plus regional manufactures — means Uganda's *measured* export concentration (gold) overstates its *productive* export concentration (which is agriculture- and processing-led).

In the **MRIO gross accounts** used here, Uganda's total exports are on the order of **US\$3.4 bn** (including services, informal and re-exported trade), of which the regional and global split is analysed in Sections 3.3–3.4. The productive heart of Uganda's exports — and the part with the clearest regional growth potential — is **agro-processing and light manufacturing**, the focus of the value-chain analysis in Section 7. Figure 2 sets out the indicative export composition by product.

Figure 2: Uganda: indicative export structure by product



Uganda's *measured* export basket is dominated by **gold (~40%, almost entirely imported and re-exported to the Gulf)**, followed by its genuine productive flagship **coffee (~15%)** and a spread of agricultural and processed goods — fish, maize and cereals, dairy, sugar, tea, cocoa, tobacco — plus cement and steel. Stripping out re-exported gold, Uganda's *productive* exports are **agriculture- and agro-processing-led**, exactly the goods best suited to the nearby regional market that Sections 4–5 analyse. The chart makes the strategic point visually: the headline export (gold) is a re-export sold outside Africa and contributes little domestic value, whereas the development-relevant exports (coffee,

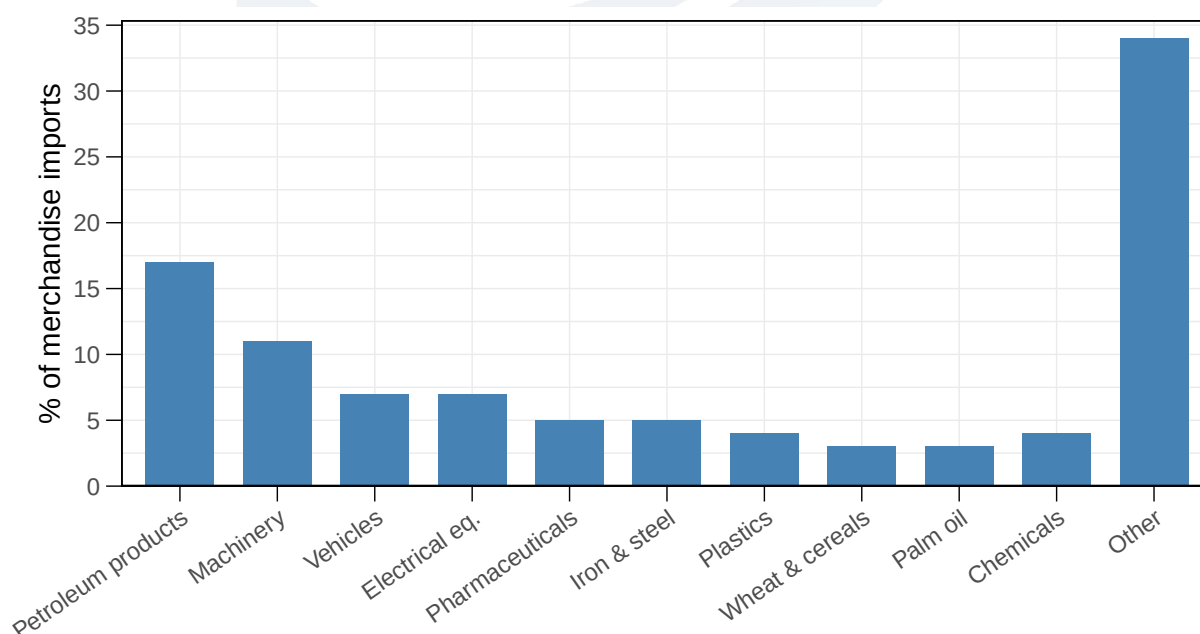
food, materials) are smaller in the measured basket but are where Uganda's comparative advantage (Section 7) and regional opportunity lie.

3.2 Import Structure

Uganda's imports are dominated by goods it does not yet produce at scale: **refined petroleum products** (its single largest import by value, sourced via Kenya from the Gulf), **machinery and electrical equipment, vehicles and transport equipment, pharmaceuticals, chemicals and fertilisers, iron and steel, plastics, wheat and palm oil**. By origin, Uganda's imports come overwhelmingly from **outside Africa — China, India, the Gulf (UAE, Saudi Arabia) and Japan — plus Kenya and Tanzania** within the region (the latter largely as transit re-exports). This import structure is the source of the **import-leakage** that the MRIO analysis (Section 6.4) identifies as a regional-sourcing opportunity: many of these inputs — petroleum products excepted — have potential African suppliers.

The **strategic dependence** that matters most is on **refined fuel** (a landlocked economy's classic vulnerability, exposed to corridor disruption) and on **imported industrial inputs and capital goods**, which tie Uganda's investment and manufacturing costs to extra-African supply chains and shipping costs. Figure 3 sets out the indicative import composition by product.

Figure 3: Uganda: indicative import structure by product



Uganda's imports are led by **refined petroleum products (~17%)** — the classic landlocked-economy dependence, exposed to corridor disruption — followed by **machinery, vehicles and electrical equipment (together ~25%), pharmaceuticals, iron and steel, plastics, chemicals, and wheat and palm oil**. The basket is dominated by goods Uganda does not yet produce at scale and sourced

overwhelmingly from **outside Africa (China, India, the Gulf, Japan)**. Two implications follow: fuel dependence is a **resilience** vulnerability, addressed by the refinery and energy agenda of Sections 7 and 9, while the **machinery, steel, chemicals and pharmaceuticals** imports are partly **regionally substitutable** and constitute the import-leakage opportunity quantified in Section 6.4.

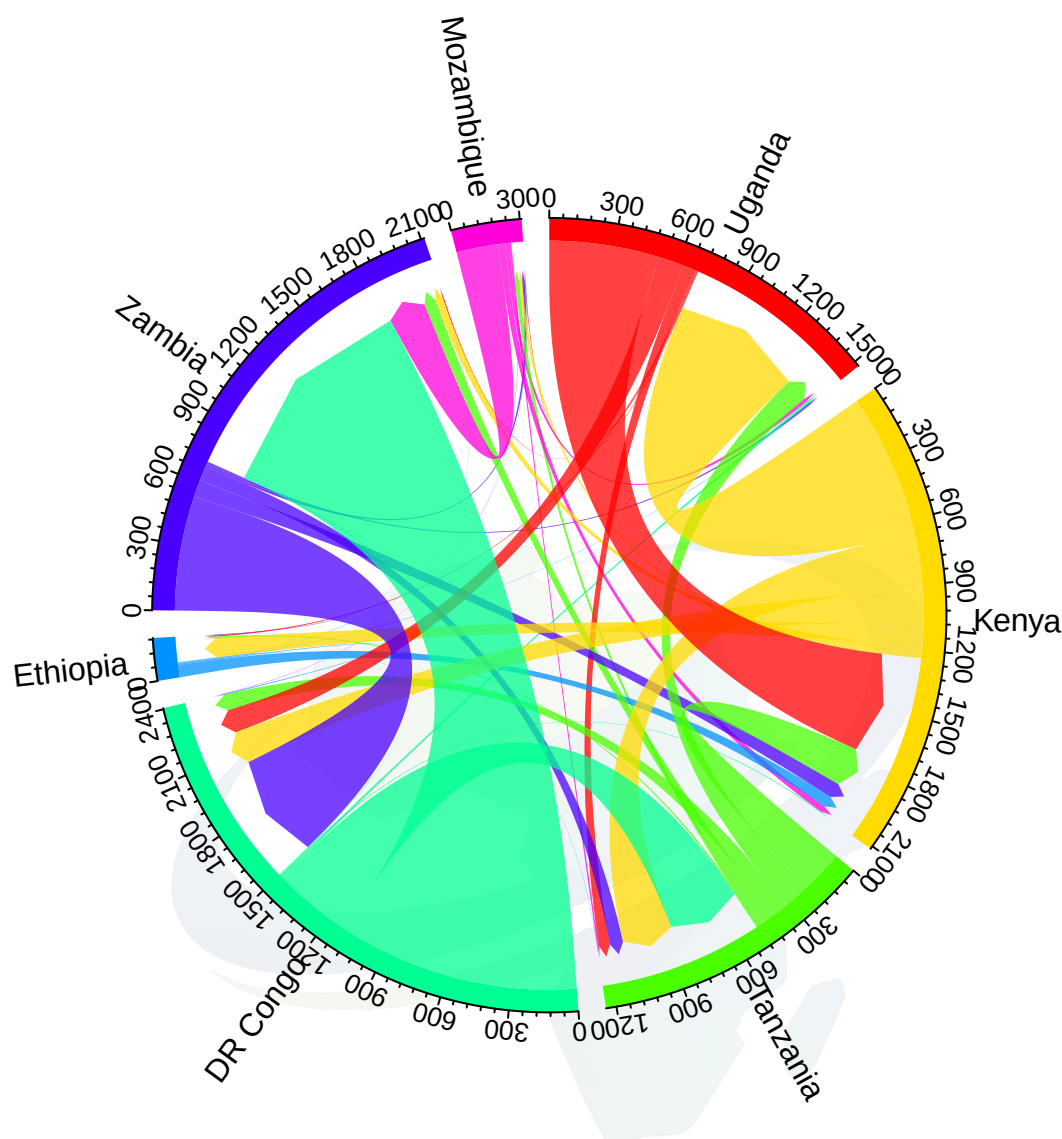
3.3 Intra-African Trade

Uganda's neighbours are its natural market, but it realises only a small part of that regional potential — about US\$1.5 bn of exports against a frictionless benchmark of US\$15.2 bn. Figure 5 below and Annex Table 3 rank Uganda's intra-African export partners by value, actual exports against that gravity potential. The structure is **hub-and-neighbour**: a small number of near markets carry almost all of the realised trade.

- **Kenya** is Uganda's single largest African market (~**US\$506 m**, a third of all its intra-African exports), its EAC partner and transit neighbour, with two-way trade in agricultural and manufactured goods across Malaba and Busia.
- **South Sudan** (~**US\$336 m**) is the second, reflecting Uganda's role as the principal supplier of food, beverages, construction materials and consumer goods to that market — much of it via the Elegu/Nimule gateway, and much of it informal. It is also, by a wide margin, the most under-served: realised trade is 6% of potential.
- **Rwanda** (~**US\$204 m**) is the third, reached across Katuna and Mirama Hills at the lowest delivered transport cost of any African destination.
- **The Democratic Republic of Congo** (~**US\$120 m**) follows, supplied through the Mpondwe and Bunagana gateways into the conflict-affected but populous eastern provinces, then **Sudan** (~**US\$85 m**), **Tanzania** (~**US\$56 m**) and **Burundi** (~**US\$45 m**).

These seven markets take about 88% of Uganda's intra-African exports, and the ranking is essentially a map of transport cost: the four cheapest destinations on the continent for Ugandan cargo — Rwanda, Kenya, Burundi and Tanzania — are also the four in which Uganda comes closest to its potential. Where distance and friction rise, realisation collapses, which is why the *missing* trade of Section 5 sits in a quite different set of partners from the realised trade above.

Figure 4 shows the structure of regional trade as a chord diagram of the East and Central African neighbourhood.

Figure 4: Uganda: regional trade web

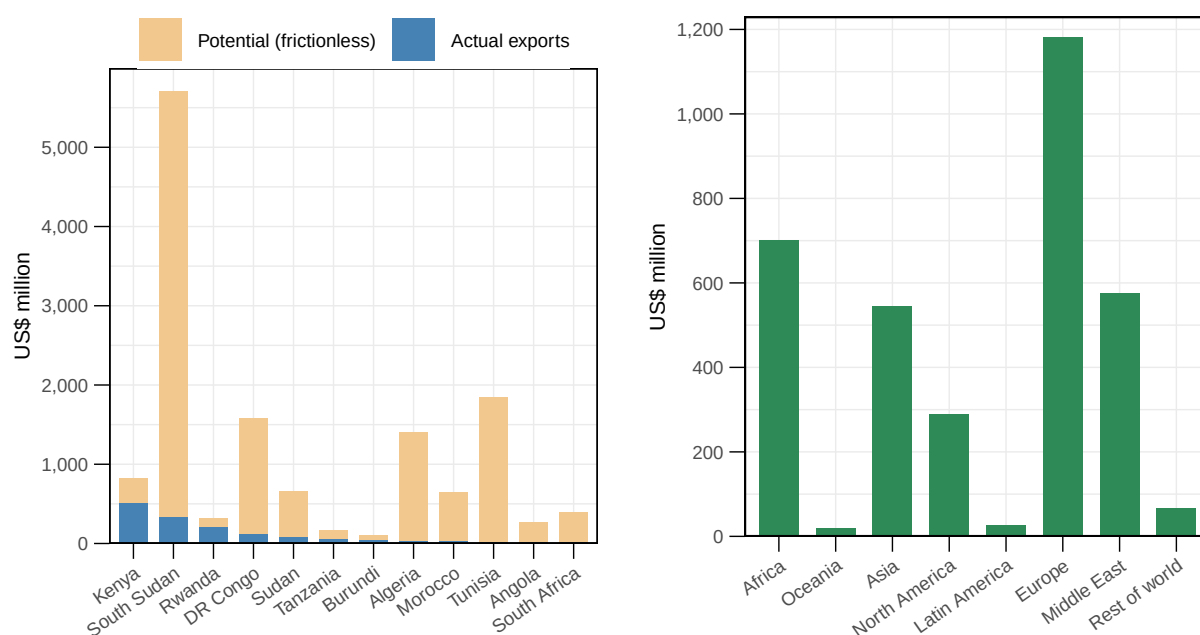
Notes: Chord width is proportional to bilateral gross flow among the seven economies the diagram resolves. Uganda's South Sudan, Rwanda and Burundi markets fall outside this subset and are not shown here — see Figure 5.

Uganda's thickest ribbon by far runs to **Kenya** (~US\$506 m out, ~US\$664 m back, making Kenya simultaneously Uganda's largest African market and its largest African supplier), followed by a much thinner link to the **DR Congo** (~US\$120 m) and a thinner one still to **Tanzania** (~US\$56 m) — visual confirmation that Uganda's regional trade is concentrated in a single neighbouring relationship. Elsewhere the web shows the expected regional structure: a heavy **Zambia–DR Congo** Copperbelt link that dwarfs anything Uganda participates in, and thinner cross-cluster threads. The chord makes Uganda's position legible at a glance: it is **tied tightly to one neighbour and only loosely to the wider continent**. Thickening the thin ribbons — and adding the off-diagram South Sudan, Rwanda and Burundi links — is precisely the integration opportunity that the gravity analysis (Section 5) quantifies.

3.4 Extra-African Dependence

Figure 5 places Uganda's intra-African export partners alongside the world-region decomposition of its gross exports from the MRIO bilateral accounts.

Figure 5: Export markets: African partners and world regions



Notes: Left: largest intra-African export partners, actual (blue) against frictionless gravity potential (orange), US\$ million. Right: gross exports by world region, US\$ million. Source: GTAP MRIO gross flows.

The left panel is the chart behind the partner ranking above; the right panel decomposes the same gross exports by world region: **Europe is the single largest destination (~US\$1.18 bn)**, followed by the **Middle East (~US\$577 m)**, **Asia (~US\$545 m)** and **North America (~US\$290 m)**, with Latin America and Oceania negligible (~US\$26 m and ~US\$20 m). Two cautions matter for reading it. First, the bar labelled **Africa (~US\$702 m)** is the *residual* African aggregate: the African economies the MRIO resolves individually — Kenya, the DR Congo, Tanzania, South Africa and the rest — are separate columns in the underlying table and are not plotted here, so Uganda's **total** African exports are about **US\$1.5 bn**, the figure used throughout Section 5, not the US\$702 m the bar shows. Second, these are **gross MRIO flows**, and Uganda's largest single merchandise export — gold — is overwhelmingly *imported and re-exported* to the Gulf (counted here within the Middle East) and to refiners in Europe, which inflates those bars above Uganda's genuine *productive* exports to those regions (UBOS, 2023; UNCTAD, 2021). Corrected for both, Africa at ~US\$1.5 bn is close to the largest genuinely productive destination Uganda has, and is certainly the most development-relevant.

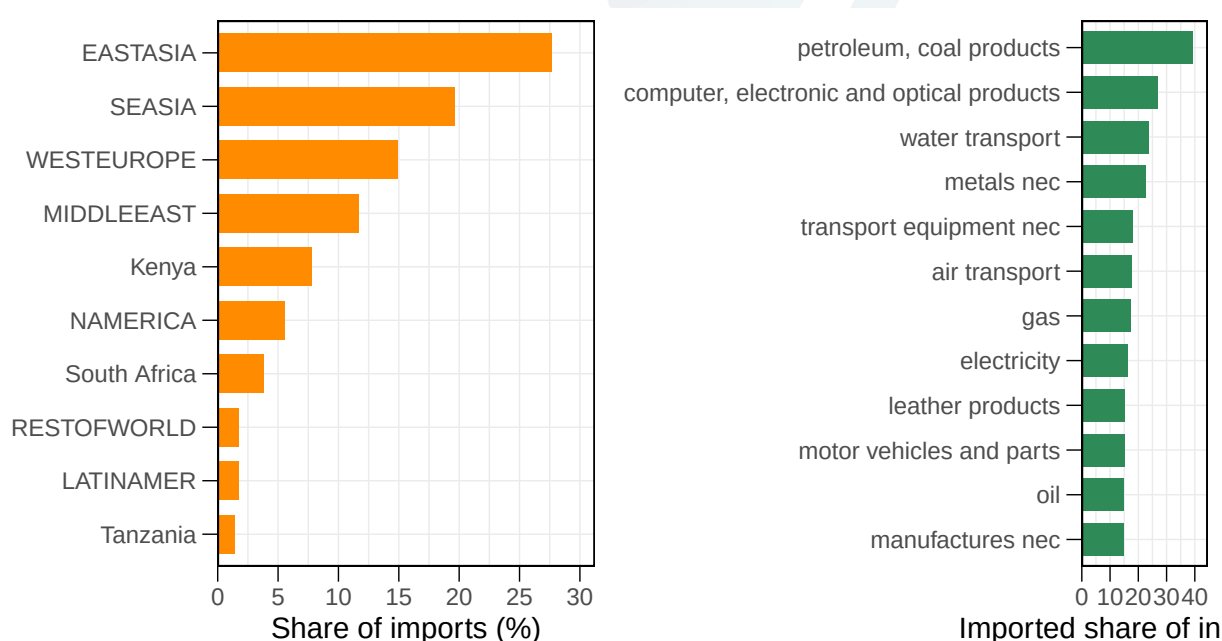
The chart makes Uganda's strategic trade question concrete: its *measured* export basket is dominated by a re-exported mineral sold outside the continent, while its *productive* export base — agriculture and light manufacturing — is most naturally sold *within* the continent, to the very neighbours it currently under-serves (Section 5). The policy implication is that deepening intra-African trade is not about redirecting gold but about scaling Uganda's regional agro-processing and manufacturing exports,

where both the capacity and the nearby demand exist. The heavy extra-African dependence on the *import* side (petroleum, machinery, chemicals from China, India and the Gulf — Section 3.2) is the complementary vulnerability: it ties Uganda's input costs to long, shipping-exposed supply chains and is the source of the regional-sourcing opportunity quantified in Section 6.

3.5 Trade Dependency Analysis

Trade dependence measures how exposed Uganda's economy is to events beyond its borders, and how concentrated that exposure is. The left panel of Figure 6 ranks Uganda's import sources. Four of the top five are *extra-continental world aggregates* — **East Asia (27.6%)**, **South-East Asia (19.6%)**, **Western Europe (14.9%)** and **the Middle East (11.7%)** — which between them supply almost three-quarters of Uganda's imports. **Kenya, at 7.8%, is the largest single-country source and the largest African one**, ahead of South Africa (3.8%) and Tanzania (1.4%); the ten sources shown cover about 96% of the total, and the import-source Herfindahl index is 0.16. Concentration on that scale is a resilience risk: a shock to East Asian output, shipping or trade policy passes almost undamped into Uganda's production costs (Hummels et al., 2001). Within Uganda's own input structure, dependence is deepest in **transport services** (71% of inputs bought outside Africa), **utilities** (41%) and **construction** (34%) — the last of these being, in absolute terms, Uganda's single largest extra-African input bill (Section 6.4). Taken together, imported inputs equal about **14%** of Uganda's total intermediate-input absorption, so the trade-facilitation and regional-sourcing reforms discussed later in this report are also a resilience agenda, not only a growth one.

Figure 6: Uganda: import dependence by partner and by sector



Notes: Left: the ten largest import-source partners as a share of Uganda's total imports. Right: commodities ranked by the imported share of their intermediate inputs, computed across all African economies rather than for Uganda alone.

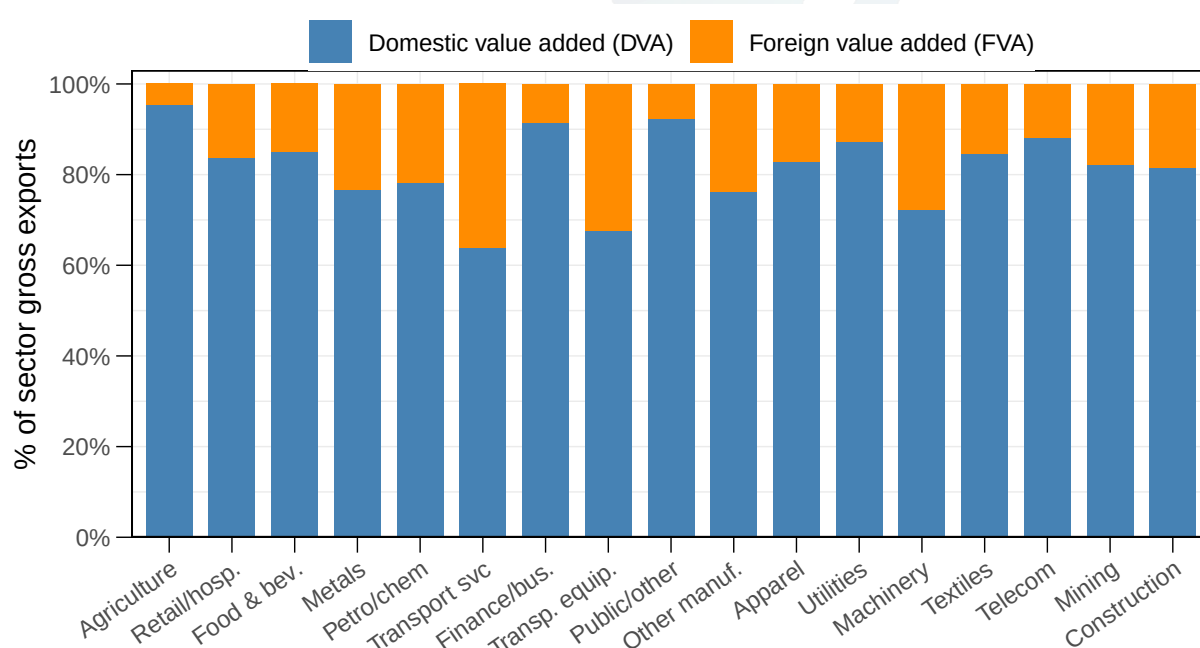
The right panel is a *continental* benchmark rather than a Ugandan one — it ranks the 65 GTAP

commodities by their imported input share across all African economies, and is identical in every country report in this series. It is worth reading because it says which chains are structurally import-exposed anywhere in Africa: **petroleum and coal products (39%)**, **computers and electronics (27%)**, **water transport (24%)**, **metals nec (22%)** and **transport equipment (18%)**. Uganda buys into all five, and three of them — fuels, metals and transport equipment — are exactly the chains Section 6.4 identifies as the hardest to regionalise.

3.6 Value-Added Decomposition of Exports

Gross exports overstate the income a country actually earns from trade, because part of their value is imported content merely passing through. Decomposing exports in the Koopman–Wang–Wei (2014) tradition, about **86%** of Uganda's gross exports is **domestic value added** — income retained at home — and **14%** is **foreign value added**, the imported inputs embodied in exports. For Uganda, a high domestic share is typical of resource- and primary-based exports that undergo little imported processing before they leave the country. The sectoral pattern in Figure 7 is informative: **agriculture (95% domestic)**, **public and other services (92%)** and **financial and business services (92%)** retain the most domestic value, while **transport services (36% foreign)**, **transport equipment (32%)** and **machinery (28%)** carry the most foreign content, reflecting their reliance on imported fuel, vehicles, machinery and intermediate goods. The policy implication is that raising the domestic gains from trade depends less on exporting more volume and more on substituting competitive domestic or regional inputs into the high-foreign-content chains.

Figure 7: Uganda: domestic and foreign value added in gross exports



Notes: Domestic value added (DVA, blue) and foreign value added (FVA, orange) by broad sector. The foreign share is the sector's backward GVC-participation rate.

4. Spatial Connectivity and Market Access

Built with TradeFuture (spatial, least-cost routing) and TradeAnalytics.

4.1 Domestic Transport Network

Uganda's domestic network radiates from the Kampala–Jinja–Entebbe core. **Roads** carry the overwhelming majority of freight; the paved trunk network links Kampala to each border gateway (Malaba/Busia east, Mutukula south, Katuna/Mirama Hills south-west, Elegu north, Mpondwe/Bunagana west) but secondary and feeder roads — the links that connect farms to markets — are thinner and weather-exposed. **Rail** is limited: the colonial-era metre-gauge line from Mombasa via Malaba to Kampala operates only partially, and the planned Standard Gauge Railway (SGR) has been repeatedly delayed, so rail's modal share of Uganda's trade is small. **Inland water transport** on Lake Victoria (the Port Bell–Mwanza/Kisumu links) offers a secondary route to Tanzania and Kenya but is under-utilised. **Air freight** through Entebbe handles high-value, time-sensitive exports (fish, flowers, some horticulture). **Logistics hubs** — inland container depots and the Namanve industrial area near Kampala — concentrate the consolidation and customs functions that make or break corridor performance.

4.2 Regional Corridors

Uganda's external trade moves on two principal corridors, with a strong primary dependence:

- **The Northern Corridor** — from the port of **Mombasa** through Kenya (via the Malaba/Busia borders) to Kampala and onward to Rwanda, Burundi, eastern DRC and South Sudan. This is Uganda's **primary lifeline**, carrying the majority of its overseas imports (notably petroleum) and a large share of its exports. The corridor has a dedicated coordination authority and has seen real dwell-time improvements, but its modelled reliability (~0.60) reflects continuing congestion, road condition and border friction.
- **The Central Corridor** — from **Dar es Salaam** through Tanzania (via the Mutukula border) to Kampala. This is Uganda's **redundancy route**, lower-reliability (~0.55) and longer, but strategically vital as an alternative when the Northern Corridor is disrupted.

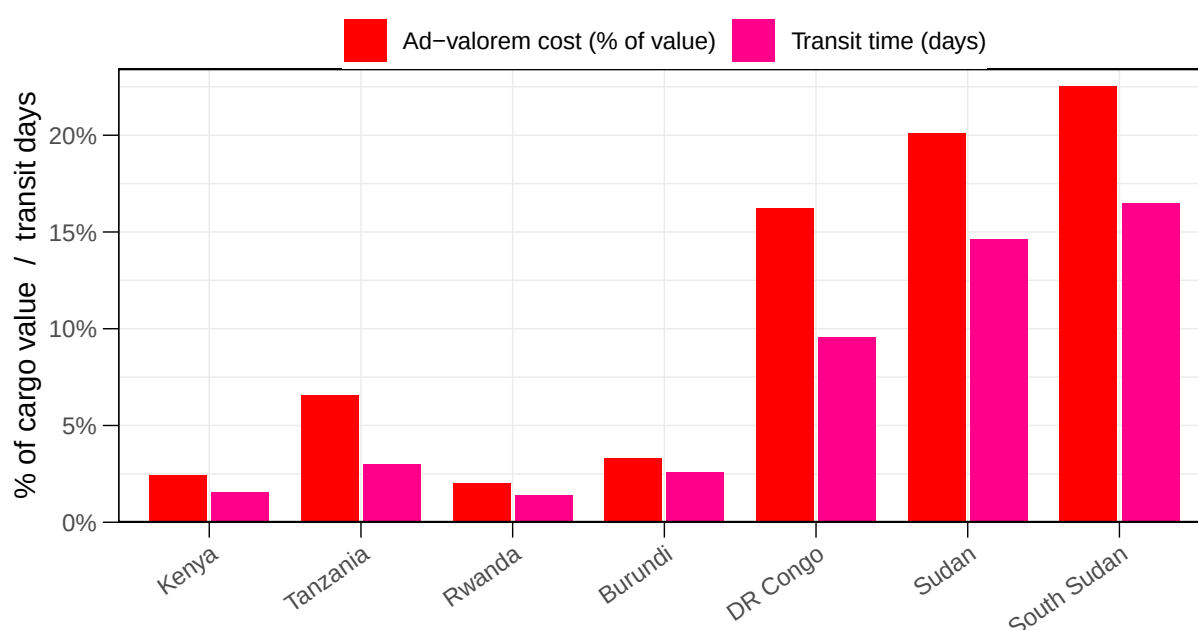
Uganda is also the **upstream node** of the corridors that serve its interior neighbours: goods bound for Rwanda, Burundi, eastern DRC and South Sudan pass *through* Uganda, making Uganda's own internal corridor and the Elegu, Mpondwe, Katuna and Mirama Hills gateways regionally significant transit points.

4.3 Travel Time and Logistics Costs

The spatial model computes, for Uganda, an **average delivered transport cost of ~18.6% of cargo value**, an **average transit time of ~355 hours**, and an **average of ~1.7 border crossings** to reach

an African destination, at an average **cost of ~US\$371 per tonne**. The cost figure now includes port dwell time priced at the value of time on any maritime leg, as border waiting already was on the land legs, which is why it sits above the figure earlier rounds reported. These continental averages, however, conceal an enormous range that is the key to Uganda's market access: trade with immediate neighbours is cheap and fast, while trade with distant African markets is expensive and slow, as Figure 8 shows.

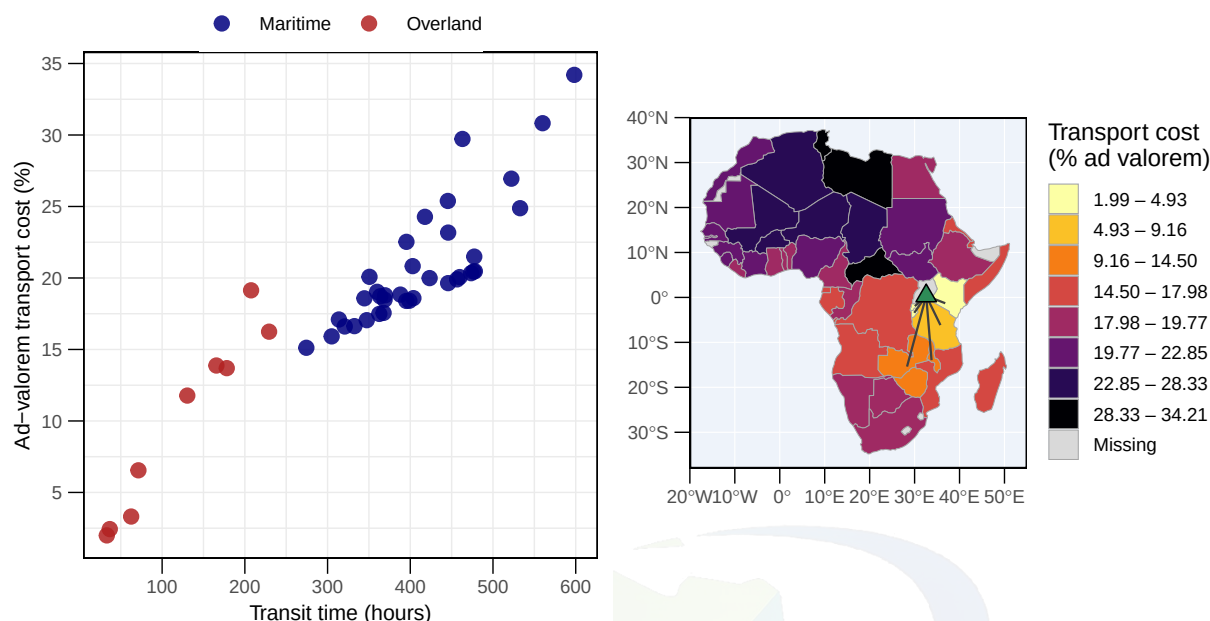
Figure 8: Uganda: delivered cost and time on the key corridors



Cost and time rise together and track the corridor used. The **EAC neighbours reached overland** — Rwanda (2.0% of cargo value, 1.4 days), Kenya (2.4%, 1.5 days), Burundi (3.3%, 2.6 days) and Tanzania (6.5%, 3.0 days) — are cheap and fast, while the conflict-affected interior links cost eight to eleven times as much and take three to five times as long: the **DR Congo at 16.2% and 9.6 days, Sudan at 20.1% and 14.6 days, and South Sudan at 22.5% and 16.5 days**, the most expensive destination of the seven. The figure operationalises Uganda's two-corridor dependence: the Northern Corridor to Mombasa is the efficient primary route for the eastern EAC, the Central Corridor to Dar es Salaam is the redundancy, and the internal gateways to South Sudan and the DRC — Uganda's largest *unrealised* markets — carry the highest frictions, which is exactly where border and corridor reform (Section 10) would pay off most.

4.4 Market Access Index

Figure 9 plots Uganda's delivered transport cost against transit time for every African destination, distinguishing overland from maritime routings, and maps the same cost surface geographically — the country-level market-access picture.

Figure 9: Transport cost and market access to African destinations

Notes: Left: delivered transport cost against transit time to each African market, overland and maritime routing. Right: the same delivered cost drawn spatially. Cost is ad-valorem, as a share of cargo value.

The figure separates into two sharply distinct regimes. A **tight low-cost cluster** of immediate neighbours, reached overland, sits at the bottom-left: **Rwanda** (2.0% of value, ~33 h, one border), **Kenya** (2.4%, ~37 h, one border), **Burundi** (3.3%, ~63 h) and **Tanzania** (6.5%, ~71 h) — for these markets Uganda's access is excellent, comparable to a coastal economy's. A **long high-cost tail** of distant markets, reached by maritime routing around the continent, stretches to the upper-right: **Libya** (26%, ~500 h, four crossings), **Tunisia** (23%), the **Central African Republic** (22%), **Algeria** (19%) and the rest of North and West Africa, where the transport wedge is two-to-four times the value of the tariffs the AfCFTA removes. Between them lie the medium-distance Southern and Horn-of-Africa markets at 8–12%. This market-access reading follows the economic-geography tradition in which infrastructure affects income through access to markets and suppliers (Limão and Venables, 2001; Donaldson and Hornbeck, 2016), and the evidence that African road-freight prices and trade costs are among the world's highest (Teravaninthorn & Raballand, 2009; Arvis et al., 2023; Atkin & Donaldson, 2015).

Uganda's market access is **excellent for its four overland neighbours and poor for everywhere else**, and this is decisive for strategy. Nine destinations are now routed overland in the model, but only **Rwanda, Kenya, Burundi and Tanzania** sit in single digits; the **eastern DRC (16.2%)** is reached overland and still costs eight times what Rwanda does across four borders, while **South Sudan (22.5%)** carries the cost of a long, partly maritime detour even though both share a land border with Uganda, which is a statement about the state of those routes rather than about distance. The realistic regional market for Uganda's bulky, lower-value agro-processed and construction-materials exports is therefore the **Great Lakes and East African interior**, with the overland four already cheap and the DRC and South Sudan links the ones worth making cheap. Distant African markets, reachable only

by an expensive sea leg, are not a realistic frontier for those goods; they matter only for high-value, low-bulk exports (coffee, gold, niche products) where transport is a small share of value. The policy lever that most improves Uganda's market access is therefore **not** trying to reach North Africa, but **deepening the cheap overland links to neighbours** — reducing the border crossings and corridor frictions on the very pairs where access is already best, so that the latent regional demand identified in Section 5 is realised.

5. Gravity Model Analysis

Built with TradeFuture (gravity_panel, estimate_gravity, missing_trade_summary) and TradeAnalytics.

The gravity model estimates how much Uganda *should* trade with each African partner given economic size and frictions, and compares that potential to actual trade. It is estimated by fixed-effects Poisson pseudo-maximum-likelihood (FE-PPML) on the bilateral panel — the best-practice specification (Santos Silva & Tenreyro 2006; Head & Mayer 2014) that absorbs size and multilateral resistance and identifies the friction effects from bilateral variation (full method in Annex G).

5.1 Actual vs Potential Trade

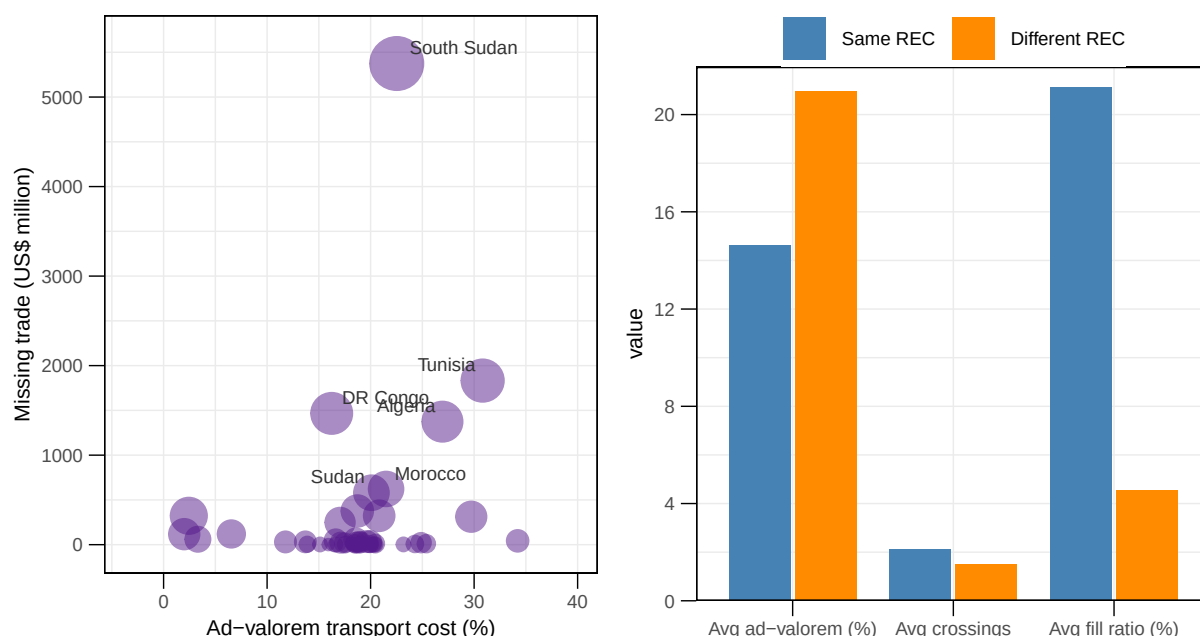
Figure 5 (Section 3.4) and Annex Table 3 rank Uganda's African export markets by value, actual exports against the frictionless gravity potential. The chart is dominated by the **distance between the two bars**, not by the height of either. **Kenya** is the largest realised market (~US\$506 m against a potential of ~US\$829 m) and the fullest of the large ones, at **61%** of potential — what Uganda's regional trade looks like when EAC membership and the Northern Corridor hold friction to 2.4% of cargo value. **Rwanda** is fuller still at **64%**. Everything else is a fraction: **South Sudan** realises ~US\$336 m of a ~US\$5.71 bn potential (**6%**), **the DRC** ~US\$120 m of ~US\$1.59 bn (**8%**), **Sudan** ~US\$85 m of ~US\$665 m (**13%**), and the North African markets — **Tunisia** at 1% and **Algeria** at 2% of their multi-billion-dollar potentials — are effectively unserved.

The ranking localises Uganda's trade opportunity with precision, and it is not the same list as the realised-trade ranking. Where Uganda *does* trade it trades close to potential; where the potential is large it barely trades at all. **South Sudan is both the second-largest realised market and the largest unrealised one**, combining high latent demand (Uganda is its natural supplier) with the highest delivered friction of any neighbour. The Kenya and Rwanda bars, by contrast, are nearly full, which bounds what facilitation can achieve on those two pairs and points the effort at the South Sudan, DRC and Sudan links instead. Closing the gap is therefore a friction-reduction problem on a small number of identifiable corridors and borders — but on markets Uganda has hardly entered, not on markets it is half-way into.

5.2 Missing Trade

Aggregated across partners, Uganda's **actual intra-African exports of ~US\$1.53 bn fall short of a frictionless potential of ~US\$15.2 bn, a missing-trade gap of ~US\$13.6 bn and a fill ratio of 0.10.** Uganda realises about a tenth of its estimated regional export potential, and the gap is roughly nine times the trade it actually does. That ratio, rather than any single partner, is the headline result of this assessment, and it changes the character of the policy question: this is not a matter of completing a half-built regional trade but of building most of it.

The gap is **extremely concentrated: South Sudan alone accounts for 39%** of it (US\$5.37 bn), and **Tunisia (US\$1.83 bn) and the DRC (US\$1.47 bn) for a further 24%** — three partners, nearly two-thirds of the total. Adding Algeria (US\$1.37 bn), Morocco (US\$622 m) and Sudan (US\$580 m) brings six partners to 83%. That composition deserves care rather than celebration. Roughly **59% of the gap sits in Uganda's own neighbourhood** (South Sudan, the DRC, Sudan, Kenya, Tanzania, Rwanda, Burundi and Ethiopia) and is genuinely addressable by the corridor, border and standards levers this report costs. But roughly **29% sits in North Africa**, where the frictionless benchmark assumes away a transport wedge of 19–34% of cargo value that is itself the main reason the trade does not exist; no facilitation programme available to Kampala converts a Tunisian potential into Ugandan exports. The actionable gap is therefore closer to **US\$8.1 bn** than to the headline US\$13.6 bn — still more than five times Uganda's entire realised intra-African trade. On this basis no partner shows actual exports above potential: the fullest pairs are Rwanda (0.64) and Kenya (0.61), followed by Burundi (0.43) and Tanzania (0.32), and then a long way down to Somalia (0.20), Djibouti (0.18) and Eritrea (0.17), where old commercial and informal ties still lift realisation above what friction alone would predict. Figure 10 plots Uganda's missing trade against the transport friction to each partner, and decomposes trade costs by REC membership.

Figure 10: Missing trade and the frictions behind it

Notes: Left: missing trade by partner (US\$ million) against the transport friction to that partner; bubble area is gravity potential. Right: average transport cost, border crossings and fill ratio for partners inside and outside the same Regional Economic Community.

The largest missing-trade bubbles sit at **moderate-to-high friction**: **South Sudan** (22.5% ad-valorem), **Tunisia** (30.8%), the **DR Congo** (16.2%), **Algeria** (26.9%), **Morocco** (21.5%) and **Sudan** (20.1%) are the six labelled points, and all but the DR Congo combine large gravity potential with a delivered transport cost above Uganda's 18.6% average. Low-friction neighbours such as **Kenya and Rwanda** sit at the bottom-left with small residual gaps: their trade is largely realised. The tilt is positive but loose (the correlation between a partner's friction and its missing trade is about 0.20), because potential — bubble size — does at least as much work as friction. Uganda's missing trade is not random: it is concentrated where **high latent demand meets high friction**, which is the configuration most responsive to facilitation where the friction is fixable and least responsive where it is a 5,000-kilometre sea leg.

The right panel adds an important qualification to the familiar bloc story. Partners that share a Regional Economic Community (EAC/COMESA/IGAD) with Uganda do face lower transport cost (**14.6% against 21.0%**) and, decisively, realise far more of their potential (**a 21% average fill ratio against 5%**). But they do *not* cross fewer borders: REC partners average **2.12** crossings against **1.50** for non-REC partners, because Uganda's bloc partners are mostly interior neighbours reached overland through one or two posts while its non-REC partners are reached by sea, which the model counts as a single crossing. The bloc effect here is a cost-and-realisation effect, not a border-count effect — and since South Sudan, Sudan and the DRC are already inside a shared bloc with Uganda in this model, their gaps cannot be closed by adding them to one. What they need is the physical and security-related friction removed from links that already enjoy formal preference.

5.3 Drivers of Under-Trade

Decomposing the gap against the model's friction terms identifies the binding constraints on Uganda's regional trade, in order of importance:

- Logistics and transport cost** — the largest single driver, and effectively the whole story. The estimated semi-elasticity on the ad-valorem wedge is **−0.089 per percentage point** ($p = 0.006$), so removing Uganda's 18.6% average wedge multiplies predicted trade by about **five**. That one mechanism carries most of the aggregate result of Section 5.2. Logistics *quality* does **not** enter separately: average LPI is a function of exporter and importer identity alone, so the exporter and importer fixed effects span it exactly and it is not identified in this specification. Earlier rounds of this assessment reported a very large positive LPI coefficient, but that was whichever column survived the estimator's pivot rather than an estimate of anything, and it has been removed. Uganda's 2.6/5 LPI score (Section 2.1) remains descriptively relevant; this model simply cannot price it.
- Non-tariff barriers and standards** — divergent SPS and technical standards (acute for Uganda's agricultural and dairy exports, which have faced periodic regional bans), restrictive rules of origin and licensing; the model assigns the **largest single policy uplift** to removing these (+47.7%, Section 10), and it is one of only two levers — with port efficiency — that are larger than tariff removal at conventional confidence.
- Border dwell and procedures** — an average of 1.7 crossings per shipment, with the South Sudan and DRC borders adding dwell, documentation and informal costs. Note that the *count* of crossings is not the border effect: most of what a border costs Uganda is already inside the ad-valorem wedge, which prices border waiting at the value of time and carries roughly 60% of the standalone border effect. What the count measures is the residual, and it now estimates −0.276, correctly signed and, for the first time, significant on its own ($p = 0.035$). Tested jointly, cost and crossings are significant (Wald $p = 0.013$). Earlier rounds reported this coefficient as marginally *positive*; that wrong sign traced to port dwell being left out of delivered cost, which understated the cost of the low-crossing maritime routes, and pricing both port calls has since pulled the two terms apart — their correlation falls from 0.71 to 0.51 — far enough for the count to be separately identified. The practical reading is unchanged: one-stop border posts pay (+6.8%) by cutting delay and cost, not by cutting the number of posts.
- Tariffs** — already low within the EAC and falling under AfCFTA. The tariff coefficient is now **identified and estimated at −0.0035** ($p = 0.79$), from bilateral applied duties taken out of GTAP's own duty-paid-against-CIF accounting rather than from a proxy. Earlier rounds reported it as exactly zero, but that was an artefact: the proxy was a constant multiple of one minus the common-REC dummy, so it was perfectly collinear with a regressor beside it and the estimator dropped it. The +0.4% tariff-removal scenario is now a real, if weak, estimate — its confidence

interval is wide enough to include a substantially larger gain — rather than the mechanical consequence of a discarded variable.

- **Institutions, currency and language** — currency fragmentation and customs-coordination gaps add friction; shared language (+0.66) and shared bloc membership (+0.91) *reduce* it, and are the two largest positive terms in the estimated model — and, with delivered cost and the border-crossing count, make up the four terms of six that are statistically distinguishable from zero.

This is the empirical fingerprint of the gravity model's strong positive common-REC effect: shared bloc membership bundles together lower friction (proximity, mutual recognition, simpler procedures) and translates into more realised trade — consistent with the gravity literature on regional trade agreements (Tinbergen, 1962; Anderson and van Wincoop, 2003; Carrère, 2006; Baier and Bergstrand, 2007; Head and Mayer, 2014) and best-practice PPML estimation (Santos Silva and Tenreyro, 2006). For Uganda, though, the corollary is sobering rather than encouraging: its three largest neighbourhood gaps — South Sudan, Sudan and the DRC — are **already** inside a shared bloc, and still realise 11–18% of their potential. Bloc membership is necessary and manifestly not sufficient. Uganda's missing trade is a **logistics-and-NTB problem** to be addressed by facilitation, standards work and physical investment on links that already have their legal preferences in place, not by tariff cuts or new accessions.

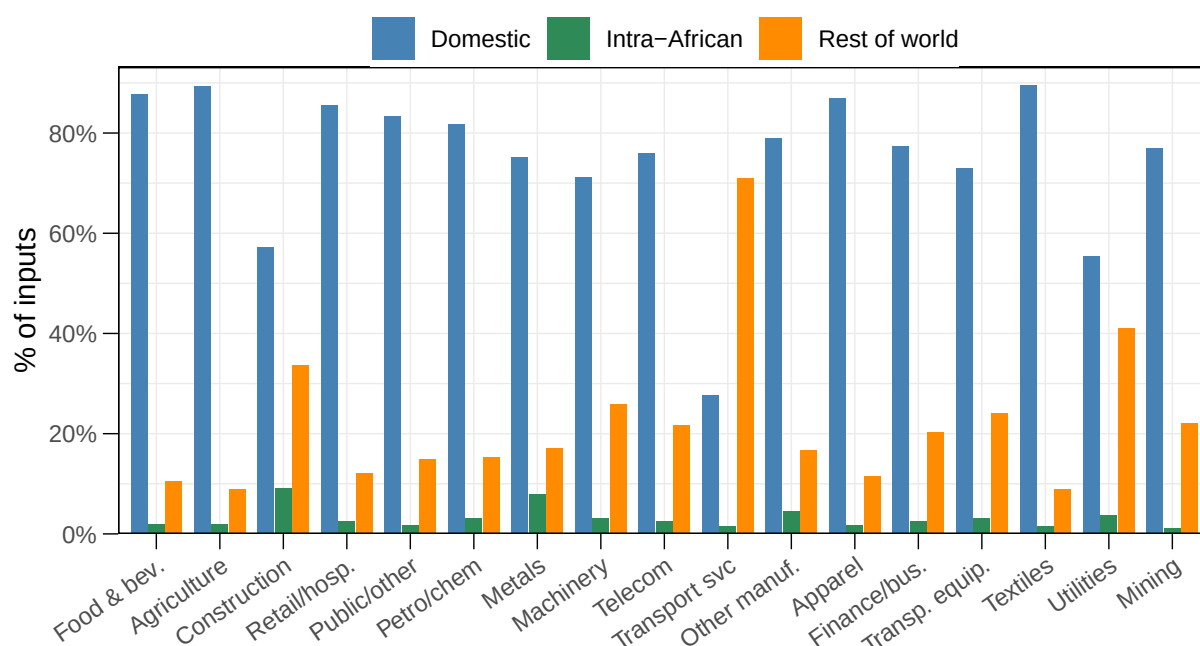
6. MRIO Value Chain Analysis

Built with TradeAnalytics (GTAP Leontief accounts) and TradeFuture (mrio, spatial_mrio).

The multi-region input–output analysis traces how Uganda's industries buy from and sell to each other and to the world, identifying where regional value chains are thin and where imported inputs could be regionally sourced.

6.1 Domestic Inter-Industry Linkages

Uganda's production structure is **domestically oriented and shallow**: domestic value added is about **57% of output**, imported inputs about **8.4%**, and the economy's inter-industry linkages are concentrated in agriculture→food-processing, construction→materials, and services→all sectors. Figure 11 breaks each sector's intermediate input use down by source — domestic, intra-African and rest-of-world.

Figure 11: Uganda: input sourcing by sector

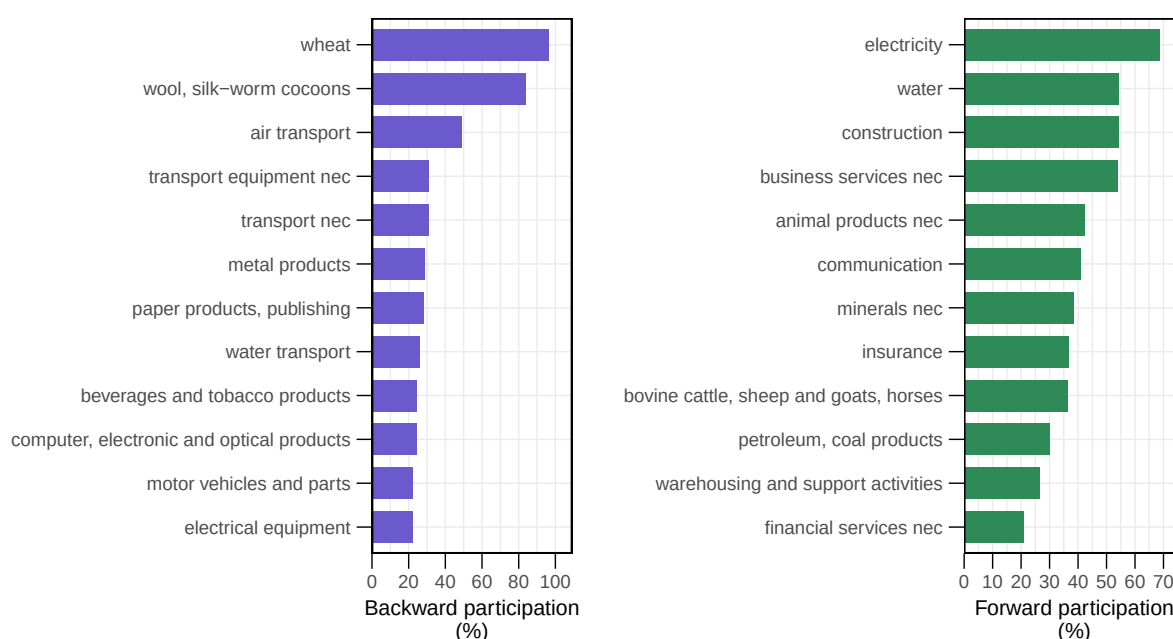
Notes: Domestic (blue), intra-African (green) and rest-of-world (orange) shares of intermediate input use.

The dominant feature is the **height of the domestic (blue) bars**: economy-wide, **80.1%** of Uganda's intermediate inputs are bought at home, a sign of a shallow, domestically-linked economy rather than one plugged into regional or global value chains. Where domestic sourcing is *lower*, the gap is filled overwhelmingly by **rest-of-world imports (orange)** rather than African ones — most starkly in transport services (TRA), where 71% of inputs come from outside Africa, then utilities (EGW, 41%), construction (CON, 34%), machinery (ELM, 26%) and transport equipment (TEQ, 24%). The **intra-African (green) bars are small everywhere**, the single most important message of the chart: across the whole economy only **3.2%** of inputs are bought from other African countries, against **16.7%** from the rest of the world. Even the best cases are modest — construction reaches 9.1% and metals 7.8%, and no broad sector exceeds ten per cent. There is no conspicuous exception to point at, which is itself the finding.

Uganda's value chains run *domestic-then-global*, skipping the regional layer entirely — the micro-level counterpart of the thin regional GVC integration Section 6.2 documents next. This is both a diagnosis and an opportunity: the orange in Figure 11 is the **import leakage** that Section 6.4 quantifies sector by sector, and converting some of it to green is what "building regional value chains" concretely means for Uganda.

6.2 Backward Linkages

Backward linkages measure how strongly a sector pulls on its suppliers when it expands — the sectors with the highest backward linkage are those whose growth most stimulates the rest of the economy. Figure 12 pairs Uganda's backward GVC participation (the foreign value-added share of output) with the mirror-image forward participation measure.

Figure 12: Backward and forward participation in global value chains

Notes: Left: backward participation, the foreign value-added share of output by sector. Right: forward participation, domestic value re-exported as inputs by sector.

Two of the twelve bars need reading with care before the rest can be believed. **Wheat (96.5%)** and **wool and silk-worm cocoons (83.6%)** top the ranking not because Uganda has built sophisticated processing in them but because it barely produces them: what leaves the country under those headings is almost entirely imported content passing through, and the ratio measures that faithfully. Setting them aside, backward participation is highest in **air transport (48.7%)**, **transport equipment nec (30.8%)**, **transport services nec (30.7%)**, **metal products (28.8%)**, **paper products and publishing (28.2%)** and **water transport (26.0%)**, followed by beverages and tobacco, computers and electronics, motor vehicles and electrical equipment, all near 22–24% — the import-intensive, assembly-and-processing activities that depend on foreign fuel, vehicles, machinery, steel and chemicals. At the broad-sector level it is lowest in **agriculture (4.6%)**, **public and other services (7.5%)** and **financial and business services (8.4%)** — the primary and labour-intensive sectors built on domestic value added. These high-backward sectors are Uganda's **double-edged opportunity**: because they pull hard on suppliers, growing them stimulates the most upstream activity — but today that stimulus flows to *foreign* suppliers. If the inputs behind construction, metals, machinery and utilities could be sourced regionally (Section 6.4), their growth would stimulate *African* suppliers instead, building the regional value chains the continent lacks — the backward-and-forward-linkage logic of input–output analysis (Leontief, 1936; Hummels et al., 2001; Koopman et al., 2014) applied to Africa's missing regional value chains (Foster-McGregor et al., 2015; World Bank, 2020). This is the analytical case for pairing Uganda's infrastructure-and-industrial growth with a deliberate regional-sourcing strategy.

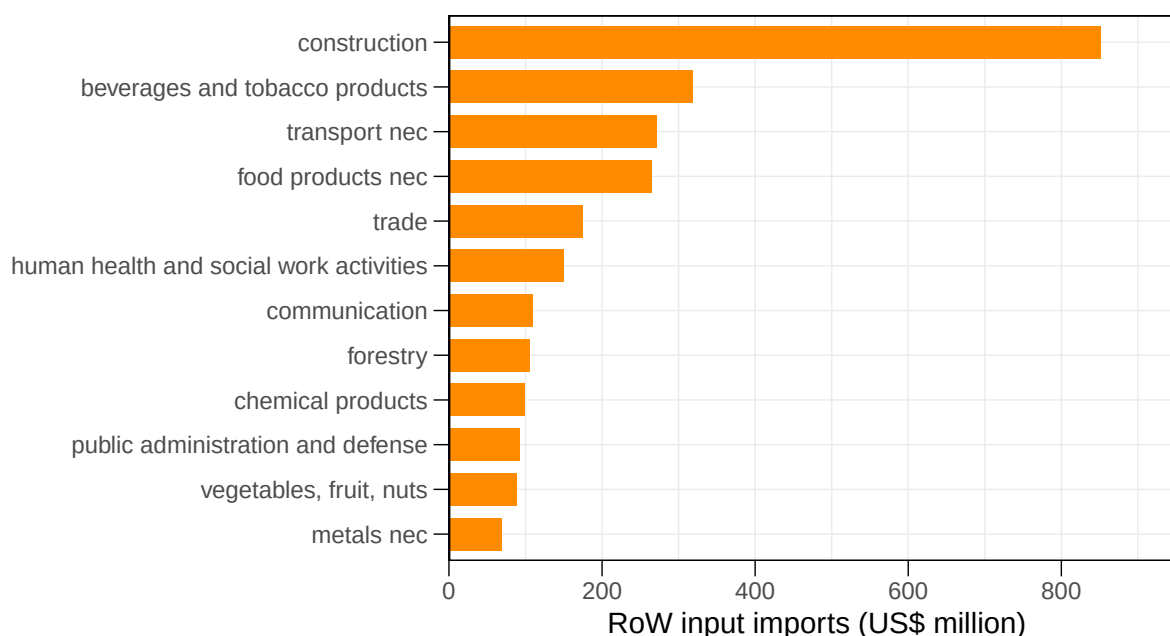
6.3 Forward Linkages

Forward linkages measure how much a sector supplies inputs to others — high-forward sectors are the upstream base of the economy. In Uganda, **agriculture, mining, utilities (power) and basic processing** are the high-forward sectors: agriculture feeds food-and-beverage processing; power and water feed all of industry; and Uganda's **electricity** in particular is a forward-linked regional export (Uganda sells Nile hydropower to Kenya, Tanzania, Rwanda and the DRC). Uganda's forward GVC participation (VS1) is **~9.5%** and its upstreamness index **~2.1** — clearly upstream, the profile of an economy that supplies raw and lightly processed inputs and imports the stages that follow. The right panel of Figure 12 above sets out forward participation commodity by commodity: **electricity leads at 68.6%**, followed by **water (54.3%)**, **construction (54.3%)**, **business services nec (53.8%)**, **animal products nec (42.4%)**, **communication (40.9%)** and **minerals nec (38.4%)**, with insurance, live cattle, and petroleum and coal products close behind (forward participation measured in the Daudin et al., 2011, and Borin–Mancini, 2019, sense; upstreamness following Antràs et al., 2012). Power is the standout, reflecting Uganda's role as a regional electricity exporter (Nile hydropower to Kenya, Tanzania, Rwanda and the DRC); the utility and business-service entries below it are the enabling inputs every other sector buys. Nine commodities are excluded from the chart because the ratio, normalised by each commodity's own gross exports, exceeds 100% for commodities that barely export — a normalisation artefact rather than a share, and not a finding (see Annex C).

These high-forward sectors are Uganda's natural springboards into regional value chains: they already supply inputs, so the strategic task is to capture more of the downstream processing at home and to route the forward linkages to *African* rather than extra-African processors — the mirror image of the import-leakage opportunity that Section 6.4 quantifies next.

6.4 Import Leakage

Figure 13 ranks Uganda's sectors by the value of inputs imported from outside Africa — the "leakage" that regional suppliers could potentially capture.

Figure 13: Uganda: extra-African input imports by sector

Notes: US\$ million. This is the addressable regional-sourcing opportunity: demand currently met from outside Africa that a regional supplier could in principle capture.

Uganda's total extra-African input bill is about **US\$3.6 bn**, and one commodity carries almost a quarter of it: **construction (~US\$851 m)**, the imported cement, steel, fittings and equipment that go into Uganda's building boom. Behind it come **beverages and tobacco products (~US\$318 m)**, **transport services nec (~US\$271 m)**, **food products nec (~US\$265 m)**, **trade (~US\$175 m)** and **human health services (~US\$150 m)**. In *share* terms the picture is different again: the most import-dependent activities are **transport services nec (74.5% of inputs bought outside Africa)** and **air transport (71.2%)**, where the inputs are largely fuel, aircraft and foreign carriage, followed by electricity (58.7%) and construction (33.6%).

Not all of this leakage is equally addressable. **Transport and air-transport inputs** are the hardest: bunker fuel and foreign carriage have no African substitute Uganda can buy into in the near term, and they are the price of a landlocked geography. But the largest lines — **construction materials, beverage and food-processing inputs, chemicals and metals** — *do* have potential African suppliers (Kenya, Tanzania, Egypt, South Africa and regional cement, steel and packaging producers), and the data already show what happens when those suppliers are reachable: metal products source **15%** of their inputs intra-African and construction **9%**, the two highest regional shares in the economy. These are the sectors where a regional-sourcing strategy (Section 10's +47.7% NTB/standards lever) could convert import leakage into intra-African trade — simultaneously deepening regional value chains and improving Uganda's resilience to extra-continental supply shocks.

6.5 Export Value-Added

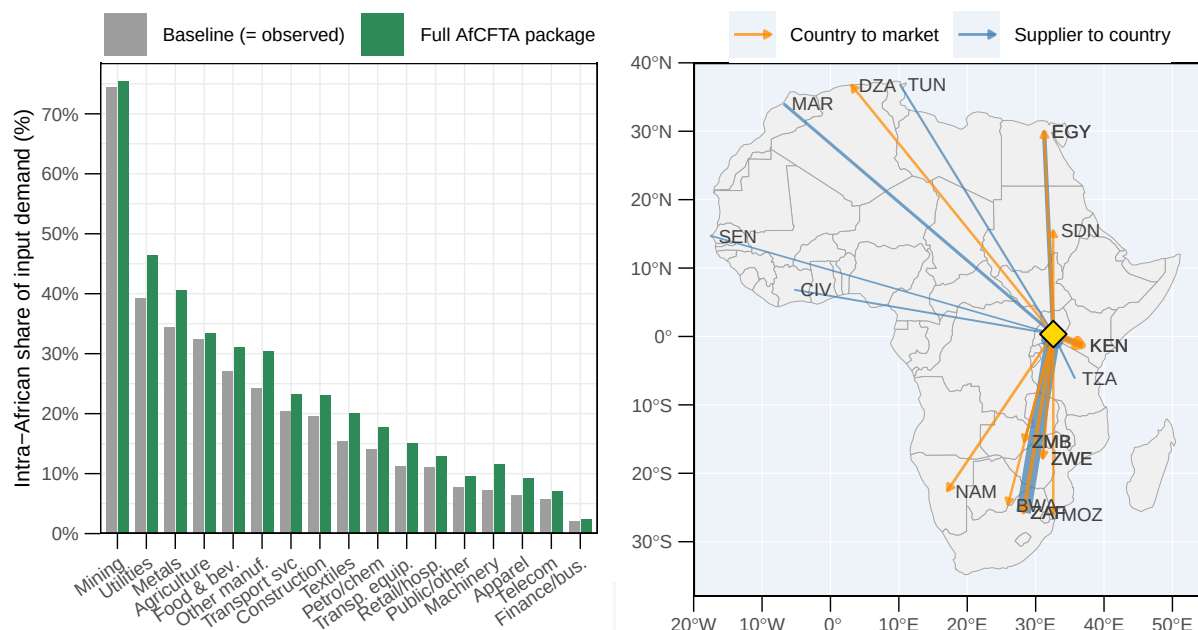
Uganda's exports embody a **high domestic value-added share** — the decomposition of Section 3.6 puts ~86% of the value of Uganda's gross exports in domestic hands and ~14% in imported inputs,

and the narrower Hummels–Ishii–Yi vertical-specialisation index gives a consistent ~11.5%. This is characteristic of a commodity-and-agriculture exporter: coffee, tea, fish and gold carry little imported content. The flip side is **shallow value chains** — high domestic content reflects not sophisticated domestic sourcing but the *absence* of processing depth: Uganda exports the raw or lightly processed good rather than a complex manufacture assembled from many suppliers. The sectoral pattern says the same: domestic value added dominates everywhere, highest in agriculture (95%), public services (92%) and business services (92%), and lowest in transport services (64%), transport equipment (68%) and machinery (72%) — and the commodity-level panel of Figure 12 (Section 6.2) shows the same ordering in finer grain. The development goal is to *deepen* value chains (add processing stages, ideally sourcing inputs regionally) while *retaining* high domestic value added — converting upstream commodity exports into downstream processed exports, growing the domestic base in the high-RCA processing sectors (food, materials) without ceding it to imports, which is the purpose of the priority-value-chain agenda in Section 7.

6.6 Regional sourcing and its response to facilitation

The import-leakage of Section 6.4 raises a question about sourcing: *how much of the input demand Uganda currently meets from outside Africa would move to African suppliers if regional frictions fell, and from whom?* The TradeFuture sourcing layer (`optimize.jl`) answers it with an **Armington CES expenditure share**: for each of the 65 commodities it splits every African country's input demand between **African suppliers** — priced at the corridor friction the spatial model computes (Section 4), with a scarcity markup where capacity binds — and a **rest-of-world backstop**, at GTAP's own import-source substitution elasticity for that commodity. The backstop is priced per destination from GTAP's observed international transport margin plus dwell time at the gateway and the inland haul from the port of entry to the capital, so for a landlocked economy like Uganda it responds to the same corridor and port levers as the regional option does — which the flat constant used in earlier rounds could not.

This replaces a least-cost linear programme, and the change matters for how the figure is read. Both the destination and the supplier margins are now calibrated cell by cell to the observed 2017 pattern, which means **the model's baseline equals Uganda's observed sourcing by construction**. There is consequently no “optimal versus actual” gap to report, and the earlier rounds' headline — a cost-minimising share far above the observed one — was never identified: it moved with an Armington distribution weight that nobody had chosen. What the model does produce, and what Figure 14 now plots, is the *response*: how far Uganda's regional sourcing share moves when frictions fall.

Figure 14: Uganda's regional input sourcing and its response to the AfCFTA package

Notes: Left: Uganda's intra-African sourcing share by sector, calibrated baseline (grey, equal to observed by construction) against the full AfCFTA package (green). Right: the supplier and market links the same allocation implies. Sourcing is an Armington CES on GTAP's own import-source substitution elasticities; its friction matrix is transport cost only and carries no tariff channel, so tariff removal produces no response here.

How to read the left panel. Nothing in the allocation corners any more: where the linear programme put **38 of Uganda's 65 commodity rows** at exactly 0% or 100%, **none** now sits at a bound, and every supplier the CES gives a finite weight keeps a positive share. The bars are therefore an interior allocation rather than a boundary artefact, and the grey bar is a description of what Uganda actually does rather than a foil.

The response is substantial by the standards of this model, and uneven across sectors. Economy-wide, Uganda's intra-African share of imported input demand rises from **15.98% to 19.62%** under the full AfCFTA package — **+3.64 percentage points, +22.8% in relative terms**, against a continental average of +1.70 pp and +16.5%. Uganda is thus among the economies the package helps most, which is what the continental pattern predicts: the largest gains go to the landlocked and interior economies, because the backstop they are substituting away from carries an inland haul that the coastal economies do not pay. At the broad-sector level the response is largest for **utilities (39.2% to 46.4%, +7.2 pp)**, **mineral products (34.5% to 40.6%, +6.1 pp)** and **other manufacturing (24.3% to 30.4%, +6.1 pp)**, then **textiles (+4.6 pp)**, **electrical machinery (+4.3 pp)** and **food and beverages (27.1% to 31.0%, +4.0 pp)**. It is smallest where either African supply is already dominant — **mining**, at a 74.4% base, moves only +1.1 pp because there is little left to win — or where the regional share is so thin that a proportional shift moves little in absolute terms, as in **petroleum and coal products (+0.1 pp)** and **business services (+0.4 pp)**. The pattern is the useful result: the sectors that respond are those where African supply exists and friction, rather than the absence of a supplier, is what currently sends the order overseas, which is the same reading the leakage analysis of Section 6.4 supports.

One thing this panel cannot show. The sourcing model's friction matrix is built from delivered

transport cost alone; tariffs enter the gravity model next door and have no channel here at all. AfCFTA tariff removal therefore registers no movement in this figure, and that zero is a structural blind spot in the sourcing model, not evidence that tariffs are irrelevant to where Uganda buys its inputs. The same was true of the linear programme it replaces.

The right panel now tells a different story from earlier rounds, and the difference is instructive.

Under the linear programme Uganda's sourcing collapsed onto **Kenya**, with Rwanda a distant second and Tanzania absent altogether — and that locality was read as a finding about Uganda's realistic frontier. It was in fact an artefact of cornering: a programme that picks the single cheapest delivered supplier on each row and nothing else will always look local, because proximity is what makes a supplier cheapest. With curvature in the allocation, Uganda's modelled sourcing is **continental, not local**: **South Africa** supplies about **40%** of it, ahead of **Egypt (9%)**, **Kenya (8%)**, **Morocco (6%)**, **Tunisia (4%)** and **Tanzania (3%)**, which is what one would expect of an economy importing manufactures, chemicals and metals that only the continent's large industrial producers make. Supplier totals now reproduce the GTAP benchmark exactly, so these shares can be read as levels rather than as a normalisation artefact.

The *outbound* side remains firmly East African, and that asymmetry is the real result. **Kenya** takes about **14%** of Uganda's modelled regional supply links, ahead of South Africa (7%), Namibia (5%), Zimbabwe (4%), Algeria (4%) and Egypt (4%). Uganda sells into its neighbourhood and buys from the continent's industrial core. The policy reading changes accordingly: EAC deepening remains the right frame for Uganda's *exports* — buying its neighbours' markets for its food, agricultural and processed output — but its regional-*sourcing* opportunity runs to South Africa, Egypt and the Maghreb, and is therefore a question of long-haul corridor, port and standards reform rather than of border posts with Kenya and Rwanda alone. Both agendas are in the package; they are not the same agenda.

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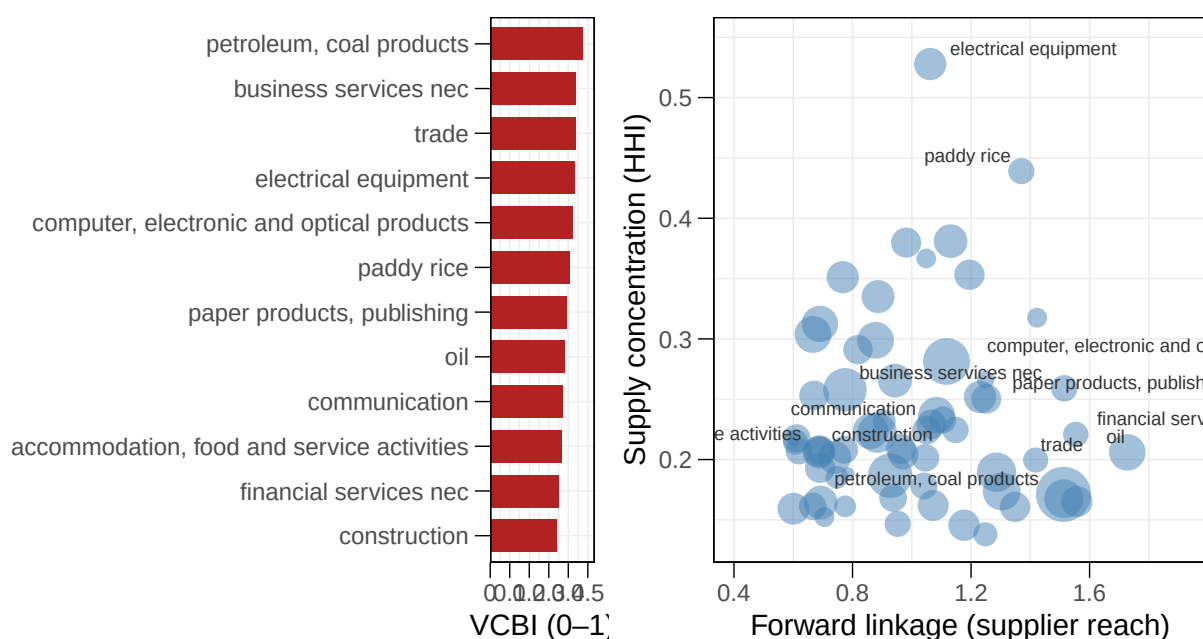
6.7 Value-Chain Bottleneck Index

The **Value-Chain Bottleneck Index (VCBI)** scores each sector on how much it constrains the wider production network, combining four equally-weighted, 0–1-normalised dimensions: *forward linkage* (how widely the sector feeds others as a supplier, from the Ghosh inverse), *network betweenness* (how often it sits on the shortest supply path between other industries), *supply concentration* (the Herfindahl index of which countries supply it), and *import dependence* (the cross-border share of its inputs). A high score flags a critical, concentrated, import-exposed pivot whose disruption would fragment the most chains (Freeman, 1977; Antràs et al., 2012). For Uganda, the binding bottleneck is **transport equipment** (VCBI 0.56), followed by petroleum, chemicals & non-metallic minerals and financial & business services. The driver panel explains why: transport equipment combines a wide supplier reach (above-average forward linkage), so a disruption propagates across many downstream industries; a moderately concentrated supplier base (HHI 0.15); heavy import dependence (36% of its inputs sourced abroad). These are precisely the sectors where targeted resilience measures — supplier diversification, strategic stockholding, or regional capacity-building — would yield the largest

system-wide payoff, and they should anchor the value-chain priorities in Section 7.

Figure 15 ranks Uganda's commodities by the Value-Chain Bottleneck Index, which combines forward linkage, network betweenness, supplier concentration and import dependence into one score. **Petroleum and coal products** leads at 0.473, followed by business services (0.437), trade (0.437) and electrical equipment (0.431). Three of the four are the logistics-and-services functions a landlocked economy depends on, and the right-hand panel shows why the fourth is there: electrical equipment has a supplier HHI of 0.53, the most concentrated supply base in the table. Fuel and power sit at the top of the list for a country whose every import arrives by road from Mombasa.

Figure 15: Uganda: the Value-Chain Bottleneck Index



Notes: Left: broad sectors ranked by the Value-Chain Bottleneck Index (VCBI). Right: the underlying drivers — forward linkage (supplier reach) against supply concentration (HHI), with bubble area proportional to import dependence.

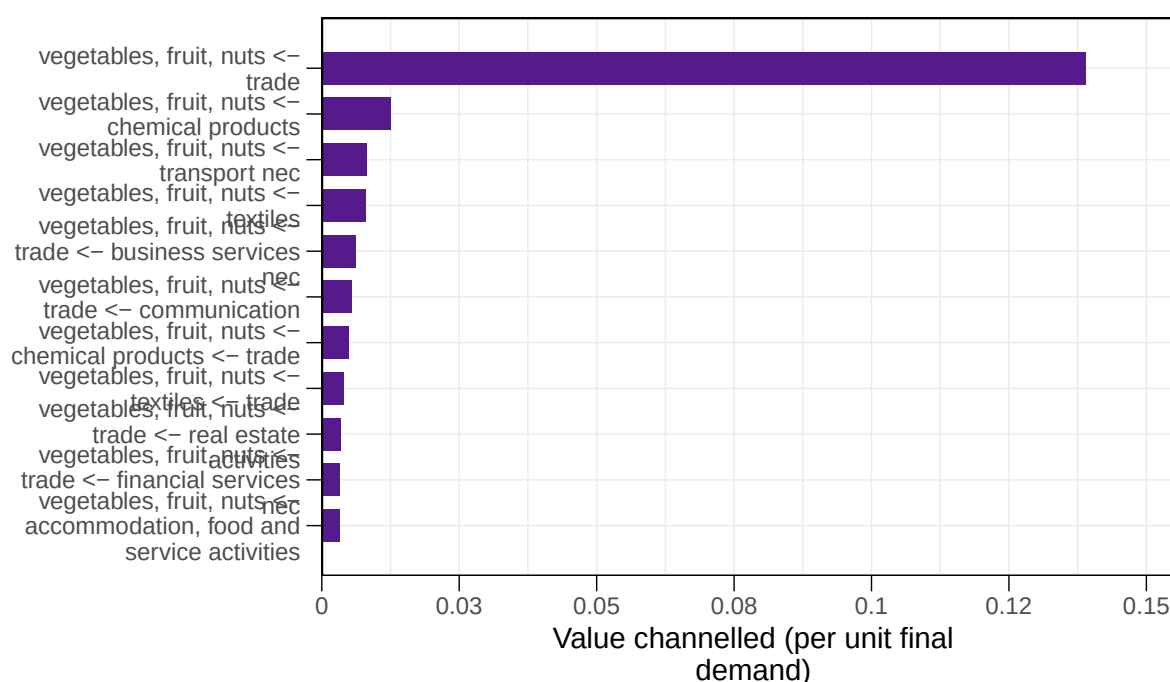
6.8 Structural Path Analysis

Structural path analysis (SPA) opens up the Leontief inverse to reveal the *specific chains* behind a sector's production, rather than only its total input requirement (Defourny and Thorbecke, 1984). Tracing upstream from one unit of petroleum, chemicals & non-metallic minerals final demand, the strongest single path is **petroleum, chemicals & non-metallic minerals** ← **maintenance, retail & hospitality**, which channels about 27% of all traced input value; the next most important are petroleum, chemicals & non-metallic minerals ← mining & extraction and petroleum, chemicals & non-metallic minerals ← petroleum, chemicals & non-metallic minerals. Direct (first-order) supplier links account for roughly 86% of the traced value, with the leading direct input coming from maintenance, retail & hospitality; the remaining second- and third-order links capture the indirect rounds in which suppliers themselves draw on other industries. Reading these chains shows policymakers exactly where an upstream constraint — a costly or unreliable maintenance, retail & hospitality input, for instance — would propagate into petroleum, chemicals & non-metallic minerals, and therefore which supporting

sectors must be strengthened alongside the headline industry rather than in isolation.

Structural path analysis traces what feeds Uganda's leading agricultural chain, vegetables, fruit and nuts, and Figure 16 ranks the paths. The result is the most concentrated in this series: $\leftarrow$ **trade** alone channels 0.139 per unit of final demand and **70.2%** of all traced input value, with chemical products (0.013), transport (0.008) and textiles (0.008) far behind. Seven-tenths of what Ugandan horticulture buys is distribution margin, which makes market infrastructure, aggregation and cold chain the operative value-chain intervention rather than input supply.

Figure 16: Uganda: structural path analysis of the leading sector



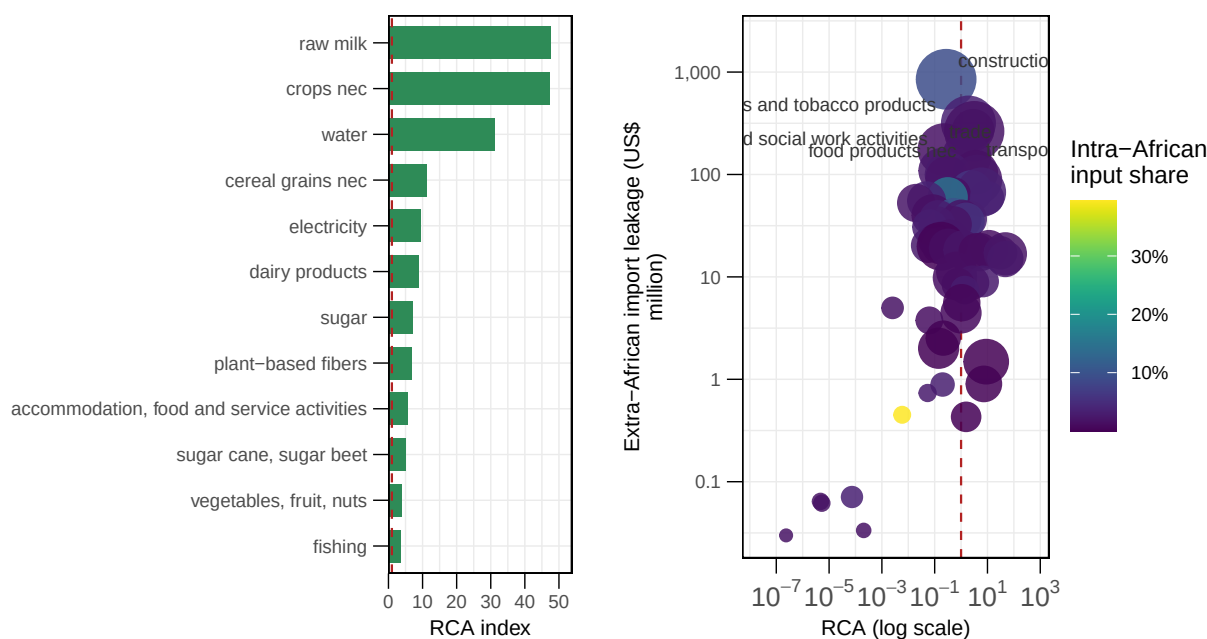
Notes: The dominant supply paths delivering inputs into the sector, ranked by the value each channels per unit of final demand. Each step “A $\leftarrow$ B” reads “A draws inputs from B”.

7. Priority Value Chains

Built with TradeAnalytics (RCA, value-added) and TradeFuture (sourcing, friction).

Uganda's revealed comparative advantage (RCA) identifies where its competitive strengths lie and thus which value chains to prioritise. Figure 17 ranks sectors by RCA and combines it with import leakage and scale into a single opportunity map.

Figure 17: Comparative advantage and the value-chain opportunity map



Notes: Left: revealed comparative advantage by sector; RCA above 1 indicates advantage. Right: RCA (horizontal) against extra-African import leakage (vertical), with bubble area proportional to sector scale.

Uganda's comparative advantage is concentrated, and tells a clear story. **Agriculture (RCA 6.6), food and beverages (5.5), construction materials (5.4), textiles (4.2) and other manufacturing (4.1)** are its strongest sectors, with mining (2.0), public/other services (2.1), apparel (1.8), machinery (1.5) and retail (1.2) also above unity. Its comparative **disadvantages** are exactly the import-dependent sectors of Figure 13: **petrochemicals (0.76), metals (0.46), transport equipment (0.25), utilities (0.24), transport services (0.52) and telecoms (0.59)**. Uganda is, in short, **strong in agro-processing, food, textiles and construction materials, and weak in heavy and sophisticated manufacturing** — a profile that maps directly onto its priority value chains below. This RCA reading uses the Balassa (1965) index and the value-added refinement of Koopman et al. (2014), and the upgrading logic follows the global-value-chains development agenda (World Bank, 2020; Balié et al., 2019; UNECA, 2021).

The right panel sorts Uganda's sectors into strategic quadrants. **High-RCA, low-leakage sectors on the lower-right** — agriculture, food and beverages, construction materials, textiles — are Uganda's export strengths, ready to scale into the regional market. **High-leakage, low-RCA sectors on the upper-left** — utilities/energy, petrochemicals, finance, metals — are import-dependence problems: Uganda buys these from outside Africa and is not yet competitive in them. The sectors of greatest *regional-value-chain* interest are those with both meaningful RCA and meaningful leakage (food processing, retail, public services) and the strategically critical high-leakage inputs (PCM, metals, machinery) where regional sourcing could substitute for extra-African imports. The map operationalises the priority-setting: grow the lower-right strengths into the regional market, and attack the upper-left leakage through regional sourcing and selective industrial policy.

Combining the RCA map (where Uganda is competitive), the regional-demand picture (Section 5: South Sudan, DRC, EAC), the import-leakage map (Section 6.4: where inputs are bought abroad) and

the accessibility map (Section 4: cheap to neighbours), the following **priority value chains** emerge for Uganda:

- **Agro-processing — coffee, tea, cocoa.** Highest RCA, Uganda's signature export; the upgrade opportunity is *processing depth* (roasting, branding, instant coffee) and regional retail penetration. Strong domestic value added; main constraints are standards, finance and energy cost.
- **Dairy and livestock.** Uganda is a regional dairy surplus producer (to Kenya, regional markets); the binding constraint is **SPS standards and periodic regional import bans** — precisely the NTB lever. High regional demand in the EAC and South Sudan.
- **Fish and aquaculture.** High-value (air-freighted to EU and regional), constrained by sustainability, cold-chain and standards; a quality-and-logistics value chain.
- **Maize, grains and packaged foods.** Uganda is the regional breadbasket for South Sudan, eastern DRC, Kenya and the refugee economy; constraints are SPS (aflatoxin standards), storage and border delay — a quick-win facilitation target given the perishability and the informal-trade prevalence.
- **Sugar and agro-industrial products.** Established capacity with regional surplus; constrained by regional protectionism and NTBs.
- **Construction materials — cement and steel.** High RCA (construction) and large regional demand (South Sudan, DRC reconstruction); Uganda has cement and steel-rerolling capacity. The opportunity is to **regionally source** the inputs (currently imported, Figure 13) and supply finished materials to neighbours.
- **Fertilisers and basic chemicals (PCM).** A comparative *disadvantage* today and a large import leak, but strategically critical for Uganda's agriculture; the regional-sourcing and industrial-policy opportunity is to substitute African (Egyptian, North African, regional) supply for extra-African imports and, longer-term, build domestic capacity around the oil/gas feedstock.
- **Pharmaceuticals.** A nascent, policy-supported sector (regional and local demand, import substitution); needs standards, skills and scale.
- **Energy and power trade.** Uganda's hydropower surplus is a genuine forward-linked regional export (to Kenya, Tanzania, Rwanda, DRC); the constraint is transmission interconnection, and the upside is large as the region's demand grows. Oil adds a major new extractive chain.
- **Transport, logistics and ICT-enabled services.** Enabling sectors where Uganda's central position and English-language workforce give it gateway and business-process potential; constrained by the same logistics and regulatory frictions analysed throughout.

For each chain the binding constraints recur in the same pattern — **standards/SPS, border and corridor friction, energy cost, finance and scale** — which is why the cross-cutting reforms of Sections 10 and 12 benefit the whole portfolio rather than any single chain.

8. Trade Network Position

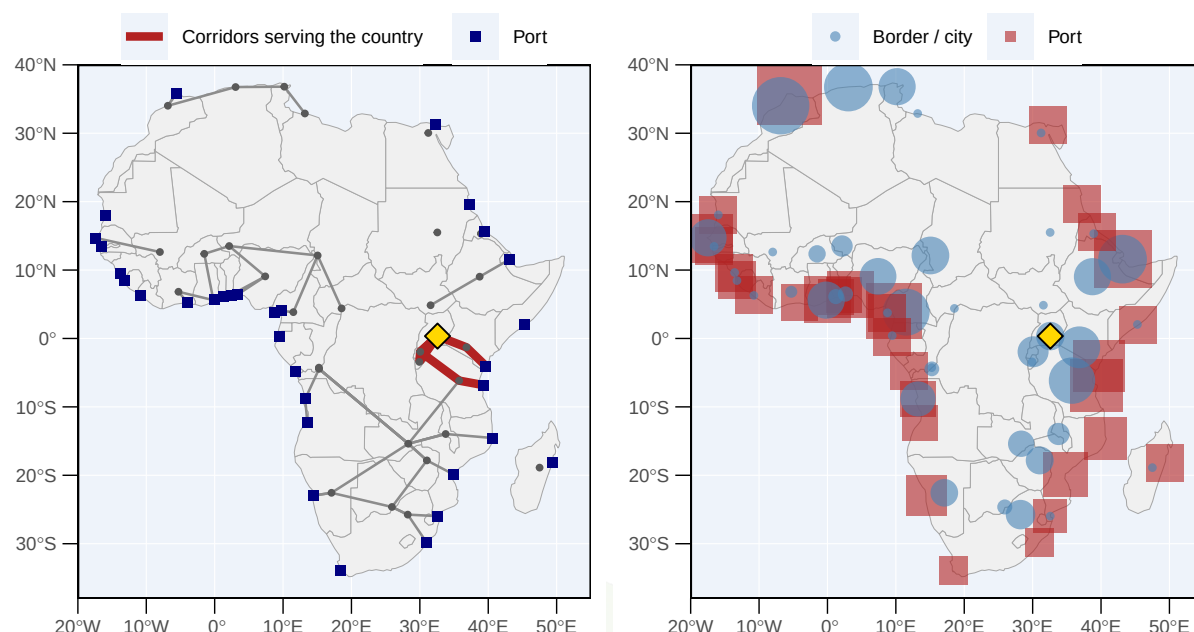
*Built with TradeFuture: the corridor-plus-maritime network is assembled by `build_network` and the country-to-country reach is computed by the **spatial-access** function *accessibility* (least-cost Dijkstra routing); network position is assessed with *betweenness centrality* (Freeman, 1977) on the same network. The corridor and gateway data draw on the Northern Corridor Transit and Transport Coordination Authority's transport observatory and the AU's PIDA corridor programme (NCTTCA, 2023; AUDA-NEPAD/PIDA).*

The modelled network comprises **69 nodes** (46 African capitals and 23 gateway ports) joined by **660 weighted edges** — road and rail corridor segments, inter-port maritime links, and port–hinterland drayage — each carrying a delivered cost, transit time and border/port delay. Maps 8.1–8.3 render this network, Uganda's least-cost reach across it, and its centrality structure.

8.1 Country as Trade Node

Uganda occupies a **dual network position** that is unusual and strategically important. On the one hand it is a **transit-dependent landlocked economy**, reliant on foreign corridors and ports (Mombasa, Dar es Salaam) over which it has no direct control — the classic vulnerability of the interior. On the other hand it is a **regional gateway and hub** for the Great Lakes interior: Uganda is the nearest industrial-and-agricultural supplier, and a major transit point, for **South Sudan, eastern DRC, Rwanda and Burundi**. Goods flow *into* Uganda along the Northern Corridor and *out* again through the Elegu, Mpondwe/Bunagana, Katuna and Mirama Hills gateways to these interior markets. Uganda is therefore best characterised as a **secondary hub / gateway economy** — peripheral to the global network but central to its own sub-region. This duality means that corridor reliability and border efficiency matter to Uganda twice over: once for its own trade, and once for the transit trade that underpins its regional supplier role.

Figure 18 maps the modelled trade-corridor network and Uganda's place within it, alongside the betweenness centrality of its nodes.

Figure 18: Position in the African trade-corridor network

Notes: Left: the corridor network drawn geographically, with this country's corridors highlighted and its capital starred. Right: betweenness centrality of ports and border gateways; marker area is proportional to betweenness.

The left panel makes Uganda's landlocked, transit-dependent position visible at a glance: Kampala sits in the deep interior of the Great Lakes, more than a thousand kilometres from the nearest sea, and its connection to world markets runs entirely through **two corridors that cross foreign territory** — the Northern Corridor east to Mombasa (through Kenya) and the Central Corridor south-east to Dar es Salaam (through Tanzania). The wider network shows the same radial, port-oriented pattern across the continent: corridors run from coastal gateways *inward* to capitals, with very few links running *between* interiors. Uganda's external trade has **no domestic outlet** and only one real alternative to its primary route, so corridor reliability and the efficiency of the Kenyan and Tanzanian borders are, geographically, the binding determinants of its trade costs — the structural fact behind every result in Sections 4–7. The right panel shows betweenness concentrating at the **gateway ports** — Tanger Med, Djibouti, Mombasa, Dar es Salaam, Durban and the West African gateways — because the maritime–overland interface is where landlocked trade must funnel. **Mombasa and Dar es Salaam**, the two largest nodes near Uganda, are the pivots on which Uganda's entire external trade depends, and rank among the highest-betweenness nodes on the continent: efficiency gains there propagate to every route that uses them, and disruption there fragments those same routes. For Uganda, this localises the systemic risk precisely: its trade is hostage to two high-betweenness foreign ports and the corridors that feed them, which is the network-analytic case for the redundancy and resilience measures discussed in Section 8.3.

The same delivered-cost surface that Figure 9 (Section 4.4) mapped confirms this geographically: accessibility falls away sharply with distance and border count, with a **dark-blue inner ring** — Kenya, Rwanda, Burundi, Tanzania and the eastern DRC — reachable overland at single-digit ad-valorem cost, and a **bright outer tier** — the Central African Republic and the Maghreb, Libya at ~26% —

reachable only by an expensive sea leg, at two-to-four times the value of the tariffs the AfCFTA removes. Uganda's realistic market is its immediate neighbourhood, which is why deepening trade with the dark-blue neighbours, not chasing distant markets, is the efficient strategy.

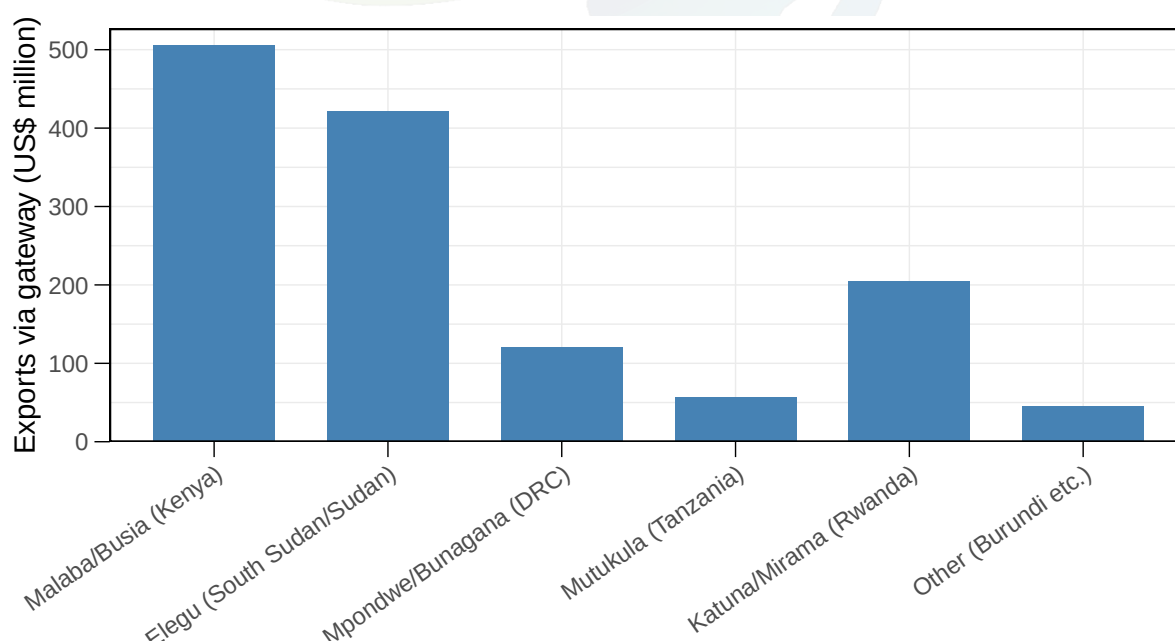
8.2 Critical Corridors and Borders

Ranked by importance to Uganda's trade:

- **Corridors:** (1) the **Northern Corridor** (Mombasa–Malaba–Kampala) — the primary artery, carrying the majority of Uganda's overseas trade and most of the transit trade to the interior; (2) the **Central Corridor** (Dar es Salaam–Mutukula–Kampala) — the essential redundancy route; (3) the **internal corridors** onward to South Sudan (Kampala–Elegu–Juba), the DRC (Kampala–Mpondwe), Rwanda (Kampala–Katuna/Mirama Hills) and Burundi.
- **Border posts, by trade importance:** **Malaba and Busia** (Kenya — the gateway for overseas imports and EAC trade), **Elegu/Nimule** (South Sudan — Uganda's single largest export gateway by destination value), **Mpondwe and Bunagana** (DRC — the second-largest export gateway), **Mutukula** (Tanzania — the Central Corridor and redundancy), and **Katuna/Gatuna and Mirama Hills** (Rwanda). These borders are where Uganda's regional trade is physically realised or lost; their dwell times and procedures are the operational frontier of the facilitation agenda.

Figure 19 ranks Uganda's border gateways by the export value that flows through them.

Figure 19: Uganda: export value by border gateway



Notes: US\$ million.

The **Elegu gateway to South Sudan/Sudan** carries the largest export value, followed by the **Mpondwe/Bunagana gateway to the DR Congo** and the **Malaba/Busia gateway to Kenya** (and

overseas transit), with the Tanzania (Mutukula) and Rwanda (Katuna/Mirama) gateways smaller. Uganda's export economy is **physically concentrated on a few border posts**, and — tellingly — its two highest-value gateways (Elegu and Mpondwe) serve the **conflict-affected, infrastructure-poor markets of South Sudan and eastern DRC**, where border informality and insecurity are greatest. These gateways are therefore both the **most valuable and the most fragile** points in Uganda's trade network, making one-stop-border-post and customs investment there (Section 12) especially high-return.

8.3 Vulnerability Analysis

Uganda's network exhibits two acute vulnerabilities. First, **single-points-of-failure**: its overseas trade depends predominantly on **one primary corridor (Northern) and one gateway port (Mombasa)**, so a disruption to either — congestion, accident, political closure, or a washout — forces costly diversion to the longer, lower-reliability Central Corridor. The Central Corridor is the only meaningful redundancy, and its quality therefore has strategic, system-level value. Second, **climate and security exposure**: the Northern Corridor and Uganda's internal routes are exposed to **flooding and landslides** (the western and eastern highlands, Lake Victoria basin) and to **insecurity** on the South Sudan and eastern-DRC links, both of which raise effective friction and can sever Uganda's largest export markets. The scenario analysis (Section 10) quantifies the upside of corridor and border investment; the same machinery implies that a climate or security shock to these corridors would cut Uganda's regional trade materially — a resilience cost that argues for **redundancy (a reliable Central Corridor, Lake Victoria water transport, rail) and climate-proofing** as explicit objectives, not afterthoughts — a resilience imperative underscored by the trade-cost and infrastructure literatures (Limão and Venables, 2001; Teravaninthorn and Raballand, 2009) and by the climate exposure of African corridors (Maliszewska and Ruta, 2020).

9. Bottleneck Diagnostics

This section consolidates the constraints identified across the models into four categories.

9.1 Physical Bottlenecks

- **Road condition and feeder-road gaps** — trunk roads are adequate but congested; feeder roads that

connect farms to markets are thin and weather-exposed, raising first-mile costs for the agro-processing value chains.

- **Rail deficit** — the metre-gauge line is only partly operational and the SGR is delayed, so Uganda

cannot shift heavy, bulky trade (cement, steel, bulk agriculture, fuel) to lower-cost rail; rail investment

scores only +1.0% in the scenario model (Section 10), the smallest of the facilitation levers.

- **Border infrastructure** — congestion and limited facilities at Malaba, Elegu and Mpondwe; one-stop

border posts are partly implemented but not complete.

- **Port dependence** — reliance on Mombasa (and Dar es Salaam) with limited inland-depot and Lake-Victoria alternatives.

9.2 Policy Bottlenecks

- **Non-tariff barriers and standards** — the single largest constraint in the model: divergent SPS and

technical standards, periodic regional bans on Ugandan agricultural and dairy exports, restrictive rules of origin, and licensing. Removing/harmonising these is the **+47.7%** lever. The dominance of NTBs over tariffs echoes the trade-restrictiveness literature (Kee et al., 2009; UNCTAD, 2021) and the WTO Trade Facilitation Agreement evidence (WTO, 2022); much of Uganda's regional trade also flows informally to escape these very barriers (Afrika & Ajumbo, 2012).

- **Tariffs** — already low within the EAC and falling under AfCFTA; a small measured effect (+0.4%), estimated too imprecisely to call binding or irrelevant.
- **Customs procedures and documentation** — duplicated inspections, paper processes and informal

payments add dwell and cost, especially at the South Sudan and DRC borders.

- **Export bans and trade-policy unpredictability** — periodic regional trade disputes (e.g. milk, sugar, maize, poultry) undermine the predictability that regional value chains need.

9.3 Productive Capacity Bottlenecks

- **Energy cost and reliability** — despite a hydropower surplus, delivered electricity cost and reliability constrain manufacturing competitiveness; energy-cost reduction is a distinct lever.

- **Skills, finance and firm scale** — limited access to affordable finance, a shallow skills base in technical manufacturing, and small firm size cap the ability to meet regional demand and standards.

- **Input availability** — dependence on imported chemicals, machinery and intermediate inputs (Section 6.4) raises costs and exposes producers to supply shocks.

9.4 Institutional Bottlenecks

- **Agency coordination** — multiple border agencies with overlapping mandates; incomplete single-window

and one-stop-border-post coverage.

- **Digital systems** — partial electronic customs and cargo-tracking; scope to extend digital trade and

payments (PAPSS).

- **Standards bodies** — the capacity of the Uganda National Bureau of Standards and mutual-recognition

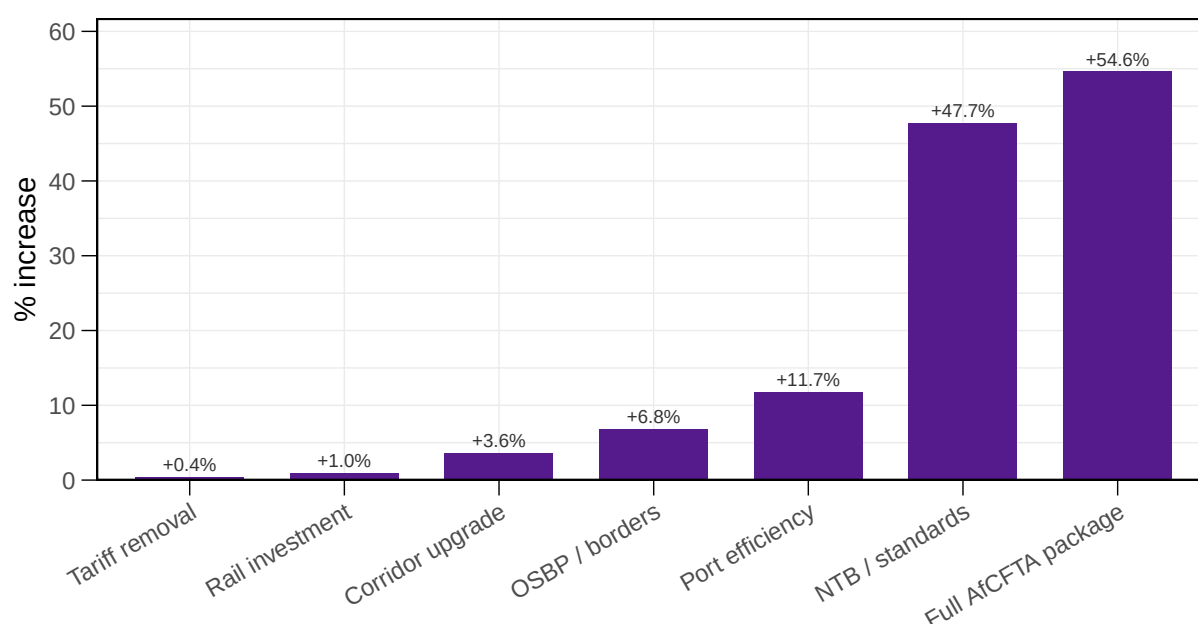
arrangements with partner bodies is central to unlocking the agro-processing chains.

- **Governance and corruption risks** at borders and in procurement, which raise effective trade costs.

10. Scenario Analysis

Built with TradeFuture (scenario engine, fixed-coefficient gravity counterfactuals).

The scenario engine re-predicts Uganda's intra-African trade under alternative policy settings, holding the estimated gravity coefficients fixed (method in Annex G). Figure 20 ranks the scenarios by their effect on Uganda's intra-African exports.

Figure 20: Uganda: projected uplift in intra-African exports by policy scenario

Notes: Percentage increase against the calibrated baseline. Each scenario is a counterfactual on the estimated gravity frictions, holding economic structure fixed.

The ordering is the core policy result for Uganda and mirrors the continental finding that facilitation, not tariffs, is the lever:

- **AfCFTA tariff removal: +0.4%** — intra-EAC tariffs are already low, so on Uganda's own trade there is little to remove. Note this is now a measured effect: earlier rounds reported exactly zero because the tariff variable was collinear with the common-REC dummy and was discarded by the estimator. The estimate is imprecise, and its interval is consistent with a materially larger gain.
- **Regional rail investment: +1.0%** — shifting heavy/bulk trade to rail.
- **Corridor upgrading: +3.6%** — improving the Northern and Central corridors.
- **One-stop border posts: +6.8%** — completing OSBPs and digital customs at Uganda's borders.
- **Port efficiency: +11.7%** — cutting dwell time at the gateway ports Uganda's transit corridors depend on, principally Mombasa and Dar es Salaam. Earlier rounds reported this as zero, but that was structural: the lever moved travel time, which the gravity model does not estimate. Dwell is now priced at the value of time, as border waiting already was, and for a landlocked economy that pays for the delay twice — once at the quay and again on the inland haul — it is the largest single lever after standards reform.
- **NTB / standards harmonisation: +47.7%** — the single largest lever, removing the non-tariff and standards barriers that most constrain Uganda's agro-processing and manufactured exports.

- **Full AfCFTA package (combined facilitation): +54.6%** — the integrated programme, which still exceeds the largest single lever, showing the reforms are complementary.

For Uganda the prize is in non-tariff and standards reform (+47.7%) and in the port, border, corridor and rail levers (+1.0% to +11.7% each), which together (+54.6%) could raise Uganda's intra-African exports by more than half. The dominance of the NTB/standards lever is especially telling given Uganda's agro-processing and dairy export profile, where SPS standards and regional bans are the recurring obstacle (Section 7); and it is the larger of the two levers this model can say are bigger than tariff liberalisation at conventional confidence, the other being port efficiency. The remaining three infrastructure and border levers are larger than tariff removal in expectation, but their confidence bands overlap it, so the ordering among them should not be read as established — and the tariff figure itself is a weak estimate rather than a demonstration of irrelevance. That the combined package still exceeds the single largest lever confirms that Uganda should pursue facilitation, infrastructure and standards reform *together*, not sequentially. The broad direction of this result — that facilitation and NTM reduction carry more of the gains than tariff removal — is consistent with the AfCFTA impact assessments, though this pipeline can now put a confidence band on the comparison where earlier rounds could only report a tariff effect the estimator had discarded (Maliszewska and Ruta, 2020; UNECA, 2021; UNCTAD, 2021).

Additional scenarios. Two further scenarios complete the picture. A **regional-sourcing / export-diversification strategy** — converting part of the import leakage of Figure 13 into regional trade and broadening Uganda's export base beyond gold and coffee — operates through the same NTB and sourcing channels and reinforces the +47.7% lever. An **industrial-park-plus-energy-cost** scenario — lowering delivered power cost and providing serviced industrial land (Namanve and successors) — raises productive capacity in the priority chains, complementing the trade-facilitation levers on the supply side. Finally, a **climate-shock scenario** — flooding or landslides disrupting the Northern Corridor — would, by the same model logic that values corridor upgrading at +3.6%, *cut* Uganda's regional trade by a margin at least as large (the continental climate scenario implies $\approx -12\%$), underscoring the resilience case for corridor redundancy and climate-proofing.

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11. Economic Impact Assessment

Built with KITEAnalytics (Caliendo–Parro general-equilibrium model).

The CGE model closes the analysis by translating trade-cost reductions into economy-wide outcomes. It is a multi-sector general-equilibrium model in the modern quantitative-trade tradition, solved by exact hat algebra (Eaton & Kortum, 2002; Dekle, Eaton & Kortum, 2008; Caliendo & Parro, 2015), whose welfare results can be read through the gains-from-trade formula of Costinot and Rodríguez-Clare (2014). Figure 21 shows Uganda's welfare and real-wage gains across successive intra-African trade-cost cuts.

Figure 21: Uganda: general-equilibrium welfare and real-wage gains

Notes: Welfare (teal) and real wage (gold) by depth of intra-African trade-cost cut, Caliendo–Parro CGE.

Uganda's gains **rise steeply, and more than proportionally, with the depth of the cost cut**: welfare increases by about +0.25% at a –5% cut, +0.58% at –10%, and +1.68% at –20%, with real-wage gains running a little ahead of welfare at each step (+0.33%, +0.72% and +2.00%). The near-equality of the welfare and real-wage bars shows that the gains accrue to Ugandans principally through higher real wages — cheaper imported inputs and better market access raise real incomes — rather than through terms-of-trade effects alone. The convex shape (the –20% bar is far more than four times the –5% bar) means deep facilitation pays disproportionately. Uganda is among the **larger proportional beneficiaries** of intra-African cost reduction precisely because it starts from high frictions (landlocked, weak logistics performance) — the same feature that depresses its current trade makes the gains from removing those frictions large, the progressive incidence that the AfCFTA welfare assessments also find for smaller and more isolated economies (Maliszewska and Ruta, 2020; Costinot and Rodríguez-Clare, 2014).

The welfare and real-wage results imply, through the model's structure and the trade responses of Section 10, the following directional impacts of a serious facilitation programme:

- **Exports** — intra-African exports up by up to ~55% under the combined package (Section 10), led by agro-processing, food, construction materials and manufactures to South Sudan, the DRC and the EAC.
- **Imports** — cheaper and more reliable imported and regionally-sourced inputs, improving manufacturing competitiveness.
- **GDP and sectoral output** — output gains concentrated in the high-RCA tradable sectors (agriculture, food and beverages, textiles, construction materials) and in transport/logistics services.

- **Employment and household income** — the real-wage channel above implies broad-based income gains; agro-processing and logistics are labour-intensive, so the employment incidence is favourable and reaches rural and small-trader households (including the women who dominate informal cross-border trade).
- **Government revenue** — a shift from tariff revenue (small, declining) toward a larger trade and output base; net revenue effects are positive if the base effect dominates.
- **Poverty** — the progressive, real-wage-led incidence is poverty-reducing, especially through agriculture and informal trade.
- **Emissions** — modal shift to rail and corridor efficiency reduce freight emissions intensity; oil production is a countervailing factor requiring its own mitigation.
- **Regional value-chain participation** — the central structural gain: converting import leakage into regional sourcing (Section 6.4) deepens Uganda's position in East and Central African value chains.

The CGE thus confirms that Uganda's trade-facilitation agenda is not only trade-expanding but **welfare-improving, broad-based and progressive** — and, by symmetry, that a corridor or climate shock that *raised* trade costs would impose correspondingly regressive losses.

12. Policy Prioritisation

Ranking the reforms by the framework **Priority Score = Trade Impact × Feasibility × Cost Efficiency × Time to Results**, using the scenario impacts (Section 10) and the qualitative diagnostics (Section 9):

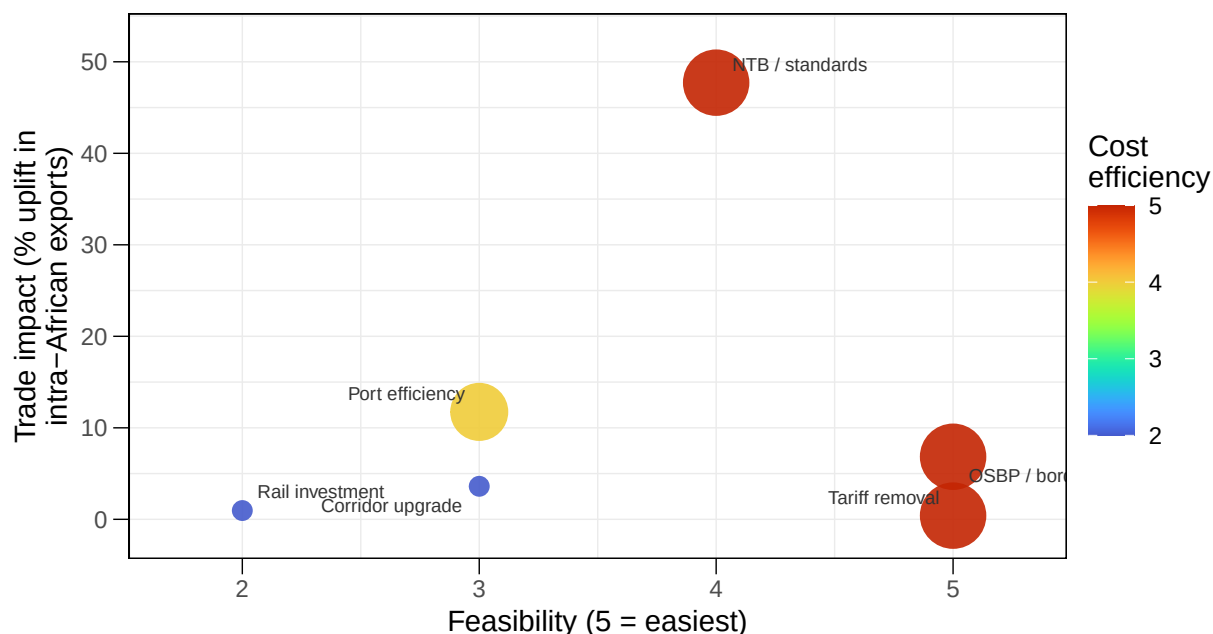
Table 2: Uganda: policy priority scoring

Reform	Trade impact	Feasibility
NTB removal & standards/SPS harmonisation	Very high (+47.7%)	High
One-stop border posts & digital customs (Malaba, Elegu, Mpondwe, Katuna, Mutukula)	Moderate (+6.8%)	High
Regional-sourcing & export-diversification strategy	High	Medium
Corridor upgrading (Northern, Central) + climate-proofing	Modest (+3.6%)	Medium
Regional rail (revive metre-gauge / SGR)	Low (+1.0%)	Low
Gateway port dwell-time reduction (Mombasa, Dar es Salaam)	High (+11.7%)	Medium
Energy-cost reduction & industrial parks	Supply-side	Medium
Value-chain capacity (agro-processing, pharma, materials)	Structural	Medium
AfCFTA tariff liberalisation	Low alone (+0.4%, imprecise)	High
EAC/COMESA regulatory coordination & PAPSS	Cross-cutting	Medium

Notes: Model output; see the data note in the annex.

Figure 22 maps the same reforms by trade impact, feasibility and cost efficiency.

Figure 22: Uganda: policy priority map



Notes: Impact against feasibility; bubble area is cost-efficiency.

NTB/standards harmonisation sits at the top (highest impact, +47.7%) and well to the right (high feasibility and cost efficiency) — the unambiguous first priority. **One-stop border posts** are the most feasible and cost-efficient quick win at moderate impact, and **gateway port dwell-time reduction** now leads them: it is an operational reform before it is a capital one, and for a landlocked economy paying for quay delay twice it is worth +11.7%, the largest lever after standards reform. **Corridor upgrading and rail** now sit lower on impact as well as lower on feasibility and cost efficiency — the strategic, capital-heavy, longer-horizon investments. **Tariff removal** is highly feasible but near-zero impact (bottom-right). The map yields a clear sequence: start in the upper-right (NTBs/standards, port dwell, OSBPs) for fast, cheap, high-impact gains; schedule the upper-left, lower-feasibility infrastructure (corridors, rail) as funded strategic projects; and treat tariff liberalisation as the enabling legal floor. This is the prioritisation the categories below formalise — and which aligns with the sequencing recommended in the AfCFTA and regional-integration assessments (World Bank, 2020b; UNECA, 2021; tralac, 2023) and with Uganda's own development-planning priorities (Republic of Uganda / NPA, 2020).

- **Quick wins (0–2 years):** NTB/standards harmonisation, one-stop border posts and digital customs — highest impact per dollar, institutional rather than capital-intensive.
- **Medium-term institutional reforms (2–5 years):** regional-sourcing strategy, standards-body and customs modernisation, trade-finance and payments integration (PAPSS), services and digital-trade liberalisation.
- **Strategic infrastructure (5–15 years):** Northern and Central corridor upgrading and climate-proofing, cross-border rail, Lake Victoria water transport, and inland-depot/port redundancy.

- **Industrial-policy priorities:** energy-cost reduction, serviced industrial parks, and capacity-building in the priority value chains (agro-processing, construction materials, fertilisers/chemicals, pharmaceuticals).
- **Regional-coordination priorities:** EAC/COMESA/AfCFTA harmonisation, mutual recognition of standards, and resolution of the recurring trade disputes that undermine predictability.

13. Implementation Roadmap

Sequencing follows the tiers established in Section 12: **quick wins** (NTB/standards harmonisation, one-stop border posts) in years 0–2, **medium-term institutional reforms** (regional-sourcing strategy, standards-body and customs modernisation, PAPSS integration) in years 2–5, and **strategic infrastructure** (Northern and Central corridor upgrading, cross-border rail, Lake Victoria water transport) over a 5–15 year horizon, with industrial-policy and regional-coordination priorities running throughout. This sequencing is designed to align with the AfCFTA and EAC facilitation agendas and with Uganda's Third National Development Plan (Republic of Uganda / NPA, 2020), the national planning framework against which these reforms should ultimately be costed and scheduled.

14. Conclusions and Recommendations

Uganda trades below its potential with its own region for reasons this assessment has measured and ranked. Its **binding constraints** are, in order: **non-tariff barriers and divergent standards** (the single largest lever, +47.7%); **transport and border frictions** on the corridors and gateways that connect it to its neighbours (ports +11.7%, OSBPs +6.8%, corridor +3.6%, rail +1.0%); **shallow regional value chains and high extra-African import leakage** in chemicals, metals, machinery and utility inputs; and **productive-capacity gaps** (energy cost, finance, skills, scale). **Tariffs are not the binding constraint the facilitation levers are** — removing them moves Uganda's trade by about +0.4%, a measured but imprecise effect rather than the structural zero earlier rounds reported — and **geography, while real (landlocked, weak logistics), is most damaging where it compounds with poor infrastructure and thick borders**, which are fixable.

Uganda's **best trade opportunities** lie in deepening trade with its **natural neighbouring markets** — **South Sudan, the DRC, Kenya, Rwanda, Burundi and Tanzania** — where it under-serves a latent demand of several billion dollars (a fill ratio of only 0.10), and in scaling its **competitive value chains** — **agro-processing (coffee, tea, dairy, fish, maize, sugar), construction materials, and selected manufactures and services** — into that regional market. Its **priority corridor investments** are the Northern and Central corridors (upgraded, climate-proofed and rail-supported) and the border gateways to South Sudan and the DRC. Its **priority reforms**, in sequence, are: (1) **dismantle non-tariff barriers and harmonise standards/SPS** with EAC and COMESA partners; (2) **cut dwell time at**

the gateway ports, Mombasa and Dar es Salaam; (3) **complete one-stop border posts and digital customs**; (4) **upgrade and de-risk the corridors and revive cross-border rail**; (5) **lower energy costs and build value-chain capacity** through industrial parks and finance; and (6) **implement AfCFTA tariff liberalisation** as the enabling legal foundation. Done together, these reforms could raise Uganda's intra-African exports by roughly **half** and deliver **broad-based, progressive welfare gains** — provided the corridors on which they depend are built **resiliently**, because the same fragile logistics that constrain Uganda's trade today could, under a climate or security shock, surrender those gains in a single season.

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A. Annexes

A.1 Annex A — Data and Reproducibility

- **GTAP** (multi-region input–output core): 164 regions $\times$ 120 sectors, supply–use tables at basic prices, transformed to inter-country input–output form. Source of the MRIO, value-added, GVC, RCA and bilateral-trade results.
- **World Bank** — World Development Indicators (GDP, population, GDP per capita) and trade-cost data. The Logistics Performance Index is not available in the current data extract (Section 2.1).
- **Bank of Uganda, Uganda Bureau of Statistics (UBOS), Uganda Revenue Authority (URA)** — macroeconomic indicators (Section 2.1) and official trade statistics.
- **IMF** — macro-fiscal and balance-of-payments context.
- **Corridor and border data** — Northern Corridor Transit and Transport Coordination Authority, Central Corridor data, and the calibrated corridor/port/border network in TradeFuture/data/ (corridors.csv, ports.csv).
- **AfCFTA / EAC / COMESA** — tariff schedules, the NTB-reporting mechanism, and rules-of-origin and standards frameworks.

Macroeconomic figures in Section 2.1 are approximate and drawn from the above external sources; all model-derived results in Sections 3–11 are exact outputs of the accompanying packages and are reproduced in Annexes B–D. Three Julia packages produce every model result in this report and share the GTAP cache and the corridor network: TradeAnalytics computes GVC, RCA and regional-integration diagnostics from the GTAP supply–use tables via the Leontief inverse; TradeFuture is the spatial, gravity, MRIO, network and scenario engine, computing least-cost routing, FE-PPML gravity and missing trade, the MRIO sourcing accounts, network centrality and the policy scenarios; and KITEAnalytics is the Caliendo–Parro general-equilibrium model used for the welfare and real-wage impacts of Section 11, validated by a no-change scenario and a US–China benchmark. The Uganda figures and annex tables are generated by TradeFuture/scripts/uganda_build.jl and uganda_charts2.jl; every figure is regenerable from that script and every model result is also written as a CSV under the relevant output/ directory. Gravity flows are in US dollars; the MRIO sourcing accounts and GTAP bilateral-trade tables are in thousands of US dollars; the report converts all monetary values to US\$ million, and the GTAP gross-trade convention means these magnitudes exceed official merchandise-trade statistics.

A.2 Annex B — Uganda’s top intra-African trade partners

Directed gravity flows with Uganda as origin and as destination, ranked by actual trade and shown against the frictionless gravity potential. Values in US\$ million.

Table 3: Uganda: top 15 intra-African export and import partners

Partner	Actual	Potential	Missing	Ad-val %	Crossings	Same REC
<i>Largest export partners</i>						
Kenya	506.3	828.8	322.5	2.4	1	Yes
South Sudan	336.1	5710.7	5374.6	22.5	3	Yes
Rwanda	204.4	321.6	117.2	2.0	1	Yes
DR Congo	120.2	1586.5	1466.3	16.2	4	Yes
Sudan	85.0	665.0	580.0	20.1	1	Yes
Tanzania	56.3	176.0	119.7	6.5	2	Yes
Burundi	45.0	105.6	60.6	3.3	2	Yes
Algeria	29.6	1403.7	1374.1	26.9	2	
Morocco	29.6	651.8	622.3	21.5	1	
Tunisia	21.1	1853.9	1832.8	30.8	3	
Angola	17.8	266.3	248.4	17.0	1	
South Africa	17.2	393.3	376.1	18.7	2	
Nigeria	16.1	338.5	322.4	20.8	1	
Ethiopia	6.6	60.7	54.1	18.6	2	Yes
Zambia	5.6	36.1	30.6	11.8	3	Yes
<i>Largest import partners (origin)</i>						
Kenya	664.3	1086.9	422.7	2.4	1	Yes
South Africa	323.9	7621.8	7297.8	18.7	2	
Tanzania	118.4	368.3	249.9	6.5	2	Yes
Egypt	112.0	784.9	672.9	18.8	1	Yes
Rwanda	47.4	74.7	27.3	2.0	1	Yes
Mozambique	18.2	266.3	248.1	16.6	1	
DR Congo	13.4	177.1	163.7	16.2	4	Yes
South Sudan	9.1	155.6	146.5	22.5	3	Yes
Zambia	9.0	58.6	49.6	11.8	3	Yes
Morocco	7.6	171.4	163.7	21.5	1	
Cote d'Ivoire	5.7	112.9	107.1	20.0	1	
Nigeria	5.2	111.2	106.1	20.8	1	
Angola	4.6	69.8	65.2	17.0	1	
Malawi	3.1	32.0	28.8	13.7	4	Yes
Ethiopia	2.7	24.6	22.0	18.6	2	Yes

Notes: Gravity potential is the frictionless benchmark; missing trade is the difference. Ad-valorem cost is delivered transport cost as a share of cargo value. Values are GTAP gross flows and exceed official merchandise statistics. Each panel is ranked by actual value. Full 45-partner tables (actual, potential, missing, transport cost, border crossings and REC membership) are available from the accompanying TradeFuture output CSVs (Annex A).

A.3 Annex C — Uganda sector diagnostics

Input sourcing, GVC participation and comparative advantage by sector, from the MRIO use table and the Leontief inverse.

Table 4: Uganda: sector diagnostics — sourcing, GVC participation and RCA

Sector	RoW input share %	Intra-Afr input share %	Backward participation %	RCA index
Electricity/gas/water	24.2	6.6	30.1	0.24
Retail/hospitality	35.2	12.4	12.8	1.17
Petro/chem/minerals	9.3	6.9	14.0	0.76
Finance/business	8.3	2.1	6.5	0.96
Metals	12.3	17.8	25.6	0.46
Public admin/other	23.4	14.8	22.9	2.11
Transport svcs	27.8	10.4	18.9	0.52
Mining	5.8	2.4	3.7	2.01
Food & beverages	5.3	4.7	7.3	5.52
Machinery/electrical	15.6	10.9	17.0	1.51
Agric/forestry/fish	30.1	30.4	2.7	6.57
Post/telecom	6.7	1.8	3.6	0.59
Construction	29.2	12.7	46.9	5.41
Textiles	3.4	2.8	7.0	4.24
Other manuf.	4.9	62.1	41.3	4.11
Transport equip.	16.6	9.6	36.8	0.25
Apparel & leather	5.2	3.3	4.6	1.79

Notes: RoW and intra-African shares are of total intermediate input use (Section 6.1). Backward participation is the foreign value-added share of output (Section 6.2). RCA above 1 indicates comparative advantage (Section 7).

A.4 Annex D — Corridors and market access

Least-cost routing from Uganda to a representative span of African destinations, from the immediate EAC neighbourhood to the most distant markets reachable only by sea. Cost per tonne and ad-valorem in US\$ / %.

Table 5: Uganda: delivered cost and time to selected African markets

Destination	Cost/tonne (\$)	Time (h)	Crossings	Maritime	Ad-valorem %
Libya	684	598	4	Yes	34.2
Tunisia	616	560	3	Yes	30.8
Central African Republic	594	463	3	Yes	29.7
Algeria	539	522	2	Yes	26.9
South Sudan	451	395	3	Yes	22.5
Egypt	377	388	1	Yes	18.8
DR Congo	325	229	4		16.2
Ethiopia	372	345	2	Yes	18.6
Zimbabwe	278	166	4		13.9
Mozambique	333	332	1	Yes	16.6
Djibouti	318	305	1	Yes	15.9
Tanzania	131	71	2		6.5
Burundi	66	63	2		3.3
Kenya	49	37	1		2.4
Rwanda	40	33	1		2.0

Notes: Least-cost routing (TradeFuture spatial.jl); see Figure 9 for the full distribution. The full 45-destination table is available from the accompanying output CSVs (Annex A).

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