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Methodology note

I. Introduction

1. The present note provides a breakdown of the African continental input-output table is built. It covers data requirements, the standardization of national supply-and-use tables (ST/ESA/STAT/SER.F/74/Rev.1), the conversion of national input-output tables, the allocation of bilateral imports, the intercountry input-output framework of the Organisation for Economic Co-operation and Development (OECD),[1] the reconstruction of the rest-of-the-world account after additional African countries are represented separately, and quality assurance. Indicators of trade in value added are generated from the table using methodologies developed by the United Nations and OECD.[2]

2. The table does not replace national accounts and does not reconstruct the global economy from scratch. Its purpose is to make African economies more visible in a multi-regional input-output framework and in the analysis of global value chains. National supply-and-use tables, national accounts controls, correspondence tables, valuation matrices and trade data provide the country-level data. The OECD intercountry input-output framework provides the global accounting structure into which the data are incorporated.

3. The present note sets out the logic behind the way in which the input-output table is constructed and key choices affecting the results: country data, harmonization of national product and industry classifications, target-year updating, balancing of national supply-and-use tables, bilateral trade allocation and the reconstruction of the rest-of-the-world aggregate after the reallocation of its African components.

4. In the current table system, results are produced for 2020. The purpose of the next phase is to extend production to an interpolated time series for 2010–2020. In the present note, 2020 is therefore referred to as the target year.

II. Analytical purpose and overall workflow

5. Gross trade is calculated through the recording of each border crossing, which means that the same intermediate value can be counted more than once. Multi-regional input-output analysis is a method that links production, use,

[1] Norihiko Yamano and others, “Development of the OECD Inter Country Input-Output Database 2023”, OECD Science, Technology and Industry Working Papers, No. 2023/08 (Paris, OECD Publishing, 2023).

[2] Organisation for Economic Co-operation and Development, “Guide to OECD Trade in Value Added (TiVA) Indicators, 2025 edition”, Directorate for Science, Technology and Innovation, September 2025.

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trade, valuation and value added across countries and industries. The method is used to determine not only exports and imports, but also the domestic value that is retained, the industries that generate the retained domestic value, inputs that are imported, and final demand.

6. The table construction process consists of six stages: data collection; file conversion and screening; standardization, target-year updating and balancing of national supply-and-use tables; conversion to basic prices and to national industry-by-industry input-output tables; allocation of trade partner-specific imports; and integration of the tables into a balanced world matrix with explicitly represented African economies and a reconstructed rest-of-the-world account. Trade in value added indicators are then generated.

7. Across the process, the model with in which fixed product sales shares are assumed, commonly referred to as "model D", is used for the national input-output table transformation. Target-year national accounts are used to update benchmark supply-and-use tables, and data on bilateral trade determine trade-partner shares without overriding balanced import and export totals. Country valuation matrices are preferred, and average structures are used only when necessary. The rest of the world is a residual accounting block reconstructed after the incorporation of data from African countries that are represented explicitly.

8. The working notation distinguishes products, industries, countries, use columns, final-demand categories and boundary rows. A national supply-and-use table contains data on supply, use, imports, taxes, margins, final demand, output and value added. A national input-output table contains data on domestic intermediate use, final demand, imports, taxes, value added and output. The overall system stacks country-industry accounts into a single matrix. Each country-industry account must satisfy the core input-output closure condition: total output measured from sales must equal total output measured from use, within an agreed numerical tolerance.

III. Data inputs and collection standards

9. The data workbook used for the collection of country-level data is the first quality-assurance layer. For each country there must be at least a supply table at basic prices; a use table at purchasers' prices; product and industry correspondence tables; metadata on the year, currency, units and classifications; national accounts aggregate for target-year updating; and data on trade in goods and services. Valuation matrices are strongly preferred because they allow country-specific conversion from purchasers' prices to basic prices.

10. The data workbook has separate worksheets for metadata, correspondences, national accounts, output, gross value added, supply, use, and tax decomposition. The metadata worksheet is used to record whether the data or for a fiscal year or a calendar year used, the version of the System of National Accounts used, the activity and product classifications, the unit scale and the currency. These fields are operationally important: information on the unit determines the extent of rescaling, currency metadata determine the exchange rate used for conversion, and classification metadata determine how country-level rows and columns are matched to the classification used in the table.

11. In the product and industry correspondence worksheet, national codes are mapped into harmonized classes used in the table. The main rule is that the shares assigned from each national code to its target classes in the table must sum to one. A mapping may be one-to-one, many-to-one or one-to-many. One-to-many mappings should be narrowed where possible. Where they remain necessary, explicit distribution shares are required because the alignment scripts apply those shares mechanically to rows and columns.

12. The national accounts worksheet provides target-year controls when the benchmark supply-and-use table is compiled for year other than 2020. The worksheet is used to record output, value added, exports, imports, final expenditure, investment, inventories, taxes, subsidies and related aggregates. The output and gross value added worksheets provide time series by industry or product category.

13. The supply-table worksheet is used to record domestic output, imports, margins, taxes, subsidies and total supply. The use-table worksheet is used to record intermediate use, exports, final consumption, investment, inventories and total use.

14. The tax decomposition worksheet, when available, is used to record valuation information by product and use category, including trade margins, transport margins, value added tax, other taxes, purchasers' prices and basic prices.

15. Before standardization, the raw files are imported and screened. In extracts from country-level supply-and-use tables, text codes are retained; placeholders, separators and whitespace are cleaned; and totals are standardized. Trade in goods is read at the six-digit level of the Harmonized System and is mapped to the classification used in the table; trade in services is mapped through the Extended Balance of Payments Services Classification, Central Product Classification and Classification of Products by Activity. Goods and services data are then merged by reporter, partner and code.

IV. Standardization, updating and balancing of national supply-and-use tables

16. During the standardization stage, a country's benchmark supply-and-use information is harmonized, updated to the target year and balanced in a national supply-and-use table. This benchmark supply-and-use table provides the detailed product-by-industry structure. The target-year national accounts provide the macroeconomic controls. If a supply-and-use table exists for 2020, it is used directly. Otherwise, the nearest available supply-and-use table is selected and updated using national accounts data.

17. When the benchmark supply-and-use table is not for 2020, balancing is performed on its internal matrices without the boundary (that is, with the row and column sums of the observed matrix). Product and industry mappings are applied to supply and use and to output, value added and final-demand controls. This creates a common harmonized space in which the benchmark table structure and the target-year controls can be reconciled.

18. Target-year column controls are assembled separately for the supply and the use sides of the tables. On the supply side, they include industry-level output and the required supply-side columns, such as imports and taxes. On the use side, intermediate inputs by industry are derived as the difference between output and value added. Final-demand controls, including household consumption, government consumption, investment, inventories and exports, are then appended. These controls define the accounting boundary of the updated table.

19. Balancing follows a staged reconciliation. The first part of stage 0 is to harmonize accounting boundaries and ensure feasibility. If the supply grand total and the use grand totals differ beyond the tolerance level, the country-year is not balanced; if the difference is negligible, the supply grand total is used as the anchor and use grand total controls are scaled proportionally. Minimal support seeding and negligible perturbations are used only to resolve empty-support or double-singleton bottlenecks; other structural zeros are preserved.

20. The next step in stage 0 is the provisional construction of a common product-total vector. This vector is derived from benchmark-supply row totals and singleton information from the previous step. Double-singleton rows may pin a product total exactly. Column singletons impose lower bounds, and row singletons impose upper bounds. If the resulting bounds system is feasible, the provisional vector is chosen as the closest admissible vector to the benchmark row totals under the common grand total. If the bounds system is infeasible, stage 1 of the method is skipped.

21. If it is not skipped, stage 1 involves exact sequential balancing with fixed product totals. The supply and use tables are balanced in a cascade, first in one order and then, if needed, in the reverse order. The balancing objective is a generalized biproportional matrix-balancing divergence from the benchmark in which the sign pattern of the observed values is preserved. This approach keeps the balanced table as close as possible to the benchmark while satisfying the imposed row and column controls. If total convergence is reached, the balancing process ends. If not, the algorithm moves to stage 2.

22. Stage 2 involves exact joint balancing with endogenous product totals. Common product totals no longer must be fixed in advance. Instead, supply and use are balanced simultaneously under derived shared product totals, supply-side column controls and use-side column controls.

23. If stage 2 does not converge, stage 3 repairs fixed-total profiles when exact stages cannot produce a usable table without additional profile adjustment. Reliability weights, seed profiles, structural bounds and deviation caps are used to find a feasible profile that remains close to the original information. The repaired profile is then refitted through exact balancing.

24. Stage 4 is a last resort. Supply and use cores form one signed-cell system subject to supply and use column totals and product-balance constraints. Sign-preserving scaling is attempted first; if it stalls, selected margin controls are allowed to move within documented uncertainty bands.

25. After the balancing has been performed, totals and value added are rebuilt from the balanced supply and use blocks so that output, intermediate consumption and value added are internally consistent. Any country-specific valuation matrices are then standardized. Such matrices provide the margins, taxes and related valuation components needed to convert purchasers' prices to basic prices. For countries without usable valuation matrices, an average valuation structure is constructed from countries with complete valuation information.

26. Each available valuation matrix is first mapped to the common product and industry classification used in the table. It is then converted into valuation coefficients by mapping each valuation component to the corresponding accounting base. The coefficients are pooled across source countries, with transaction values used as weights where possible, to obtain an average product-by-use valuation structure. The resulting structure is applied to the balanced use table of any given country with missing valuation data and, where aggregate controls are available, rescaled so that total margins, taxes and other valuation components remain consistent with national accounts totals.

V. Valuation, the domestic-import split[3] and the transformation of national supply-and-use tables into national input-output tables

27. The balanced supply-and-use table is converted into the national input-output blocks for the continental system. The starting point is a balanced domestic supply block, intermediate use and final demand at purchasers' prices, imports, value added tax, other taxes on products, trade margins and transport margins. Product output at basic prices is calculated as total product use minus value added tax, margins, other taxes and imports. Value added tax is allocated across intermediate-use cells and deducted directly for final-demand categories where the valuation matrix provides such details.

28. Trade and transport margins are treated as reallocation matrices rather than ordinary taxes. Positive entries allocate margins to products, while negative entries offset the margins from the trade and transport rows. A complete margin matrix must have column sums equal to zero,

29. If allocated intermediate-use margins exceed the admissible intermediate-use base after value added tax, the excess is reallocated to final demand, with priority given to household consumption, non-profit institutions serving households, government consumption and gross fixed capital formation. This reallocation prevents intermediate, valued at basic prices, from becoming negative.

30. Other taxes and subsidies on products are allocated after value added tax and after margins have been reallocated. Import duties are handled explicitly so that the final basic-price use table remains aligned with supply-side tax totals. The resulting intermediate-use and final-demand blocks at basic prices are then validated against standardized valuation totals.

31. The separation of domestic and imported use (the domestic-import split) is performed at basic prices under an assumption that imports are used proportionally. For each product, imports are allocated across intermediate and final uses in proportion to total use at basic prices. Domestic use is then calculated as total use basic prices minus imported use.

32. The national symmetric input-output table is derived using fixed product sales shares. The supply matrix determines the industry market shares for each product. This structure is then used to transform domestic intermediate use, domestic final demand, imported intermediate use and imported final demand into industry space.

33. Domestic intermediate input-output cells are constrained to be non-negative while preserving each industry's total intermediate requirement. For the imports row in the integrated national input-output system, direct use totals are retained when they provide a more stable accounting line than the transformed block.

34. The national integrated input-output system combines the domestic intermediate-use and final-demand block, imports row, value added tax row, other taxes row, value added row, output row and output column. The two essential checks are the output cross-identity and the breakdown of industry inputs. For every industry, the output measured from the output row must equal the output measured from the output column. Industry output must also equal the sum of domestic intermediate inputs, imports, value added tax, other taxes and value added.

[3] The split between domestic production and imports is referred to as the "domestic-import split".

VI. Trade partner-specific import tables and trade boundaries

35. At this stage, each country has a balanced domestic input-output structure, a total import-use table at basic prices, and trade boundaries by product and partner. The next task is to break down the total import-use table into trade partner-specific import-use matrices while preserving the country's balanced national totals. This is necessary because each import flow in a multi-regional table must have an origin, not only an aggregate imports row.

36. Import data for goods and services are first harmonized with the common industry classification used in the table. The partner grid is then completed with missing partner-product cells represented as zeros rather than being omitted. This avoids confusion between unreported flows and partners that are outside the model.

37. The total import-use matrix is allocated row by row using product-level partner shares. Each partner-specific import-use matrix is then split into intermediate-use and final-demand blocks and transformed from product space into industry space using the same country-specific mapping as used to construct the national input-output table from the supply and use tables. The product-space matrices preserve the decomposition of imports by use; the industry-space matrices become origin-to-destination blocks in the continental matrix.

38. Once all named partners have been assigned, the rest-of-the-world import block is calculated as the difference between the total import-use table and the sum of trade partner-specific import-use tables. Where an African country was previously included in the rest-of-the-world aggregate but is now represented separately, the recalculated rest-of-the-world block is used as the source for imports into the country from the rest of the world in the continental matrix. The partner decomposition is validated by reconstructing the total import-use table from named trade partners plus the rest of the world.

VII. Construction of the continental matrix and reconstruction of the rest-of-the-world block

39. The continental matrix is constructed from a global intercountry input-output matrix in which the African component is replaced with country blocks for African economies that are represented explicitly. The process involves structured replacement, reallocation, reconstruction of the rest-of-the-world aggregate, and balancing. The guiding principle is to replace elements of the rest-of-the-world aggregate with explicitly represented country blocks where the necessary data are available, reallocate the African component that was previously embedded in the rest-of-the-world aggregate where necessary, and use the rest-of-the-world account only for the accounting difference that remains after the incorporation of data for explicitly represented countries.

40. African economies are incorporated into the continental matrix in two ways. Direct-replacement countries are already represented explicitly in the base world matrix. Their existing intercountry input-output rows and columns are removed and are replaced by country data used in the table. Countries previously included in the rest-of-the-world aggregate must be separated from it before being represented explicitly. Retained intercountry input-output countries remain explicit throughout the construction process. The original rest-of-the-world aggregate inherited from the base table is distinguished from the updated rest-of-the-world account after the incorporation of African countries and the balancing of the matrix.

41. The base matrix is the original intercountry input-output table with harmonization of the industry codes. After the harmonization, a total-preservation check is used to verify that harmonization has not changed the grand total of the matrix. Boundary rows for taxes less subsidies, value added and output are separated from the core transaction matrix and retained for later reconstruction.

42. For African direct-replacement countries, the old rows and columns are removed and replaced with blocks built from the country data used in the table. Replacement differences against retained destinations are treated as observed data. These differences are used to revise the use-side boundaries of the retained countries and, where relevant, the corresponding output targets. They are not absorbed into the rest-of-the-world residuals of the retained countries. An initial closure check is then used to compare the revised use-side boundary against the revised output target for each retained country-industry account. If the row side is below the target, the difference is added to the current rest-of-the-world column; if the column side is below the target, the difference is added to the current rest-of-the-world row vector.

43. For African countries previously included in the rest-of-the-world aggregate, before they are incorporated explicitly, the method estimates what portion of the original rest-of-the-world boundary, output, tax and value added components can be reassigned to them. The reassignment is done at the batch level, not country by country, and is capped at an upper share of the original rest-of-the-world component. The updated rest-of-the-world component is the original rest-of-the-world amount less the batch amount reallocated to the African countries now represented explicitly. The total world output thus remains the sum of the explicitly represented countries plus the updated rest-of-the-world component.

44. African export blocks for named partners are constructed from national export totals and product-level bilateral partner shares. For each destination partner, export controls are distributed across the trade partner’s use structure and, where market-share matrices are available, transformed from product space to industry space. African supplier rows are then appended to the corresponding destination-country blocks. African demander columns are built from domestic national input-output blocks, partner-specific import-use blocks, and, when available, exporter-side bilateral controls.

45. The import blocks recording flows from the rest of the world to African countries differ depending on the role of each country. For direct-replacement countries, the previous explicit import footprint is replaced as part of the direct-replacement package. For countries previously included in the rest-of-the-world aggregate, imports from the rest of the world are taken from the country’s own residual import-use block. This approach preserves the national import-use boundary of African countries now represented explicitly, instead of assigning them a residual inferred from intercountry input-output comparisons involving retained countries.

46. After the incorporation of rows and columns for African countries now explicitly represented, country totals are recomputed with rest-of-the-world rows and columns excluded. Rest-of-the-world rows for retained destinations are reconstructed by comparing the previous non-replacement control with the visible reconstructed non-replacement total. Direct-replacement effects are excluded because they are already represented in the revised boundaries and output targets. Rest-of-the-world columns for retained suppliers are reconstructed in the same way, by comparing revised sales targets with visible sales after the incorporation of African countries. If visible reconstructed values exceed the previous targets, the effective target is increased accordingly so that the rest-of-the-world entries do not become negative.

47. Exports to the rest of the world from countries previously included in the rest-of-the-world aggregate are derived from the national export boundary. They are calculated as total exports less exports already allocated to named partners. Boundary rows for taxes, value added, output and total use are appended from the input-output systems of African countries. Rest-of-the-world boundary rows are then calculated as the non-negative difference between effective targets and amounts already represented in the partially reconstructed system.

48. A second closure is applied after countries previously represented in the rest-of-the-world aggregate have been added, since incorporating these countries and reducing the rest-of-the-world aggregate can change the rest-of-the-world flows with both retained countries and African countries. A separate check is used to verify that the non-African submatrix has not been inadvertently changed. The updated rest-of-the-world account is then balanced. The rest-of-the-world domestic block is the remaining internal rest-of-the-world activity after direct replacement, batch reallocation, completion of the rest-of-the-world rows and columns, closure of the accounts of the countries now explicitly represented and the final balancing of the rest of the world account. The completed table is closed by computing the output column from row sums and by computing the final boundary row from column sums.

VIII. Calculation of trade in value added indicators

49. The transaction matrix, output vector, value added vector, import-use blocks, final-demand blocks and country-industry identifiers are extracted from the completed table. Technical coefficients are formed by dividing input flows by the corresponding output. The Leontief inverse is then used to trace direct and indirect production requirements. Value added coefficients assign value added to output. The combination of these components enables the calculation of domestic value added embodied in exports, foreign value added embodied in exports and value added embodied in final demand, as well as backward and forward global value chain participation measures and sources broken down by country and by industry.

50. The present note does not provide the full sequence of calculations for the trade in value added indicators. The OECD guide to trade in value added indicators should be used for indicator taxonomy, naming conventions and interpretation.[4]

IX. Quality assurance, reproducibility and implementation logic

51. Quality assurance covers inputs, national balancing, valuation, continental integration and calculations of trade in value added. Checks cover scripts, raw data, totals, correspondences, convergence, valuation identities, reconstruction of the rest-of-the-world account, boundary rows, coefficient matrices and indicator identities.

52. Diagnostics files are written as implementation outputs, creating an audit trail that shows where each country-year observation bundle passed the pre-specified checks, where it required a fallback and where it failed. The scripts used are modular because the statistical pipeline is modular. Raw data, standardized country objects, national input-output systems, partner-specific import tables, continental matrices and trade in value added outputs are stored

[4] Organisation for Economic Co-operation and Development, “Guide to OECD trade in value added (TiVA) indicators”, (2025).

separately to enable reviewers to identify whether a problem comes from source data, mapping, balancing, valuation, bilateral allocation, continental integration or indicator generation.

53. Future enhancements should be focused on four areas: more detailed and complete country valuation matrices, stronger documentation of country-specific exceptions, clearer review dashboards for balancing diagnostics, and improved metadata links between the table indicators and OECD conventions on trade in value added.

X. Practical interpretations of the table

54. The final table should be interpreted as a systematic multi-regional input-output table, not as a simple aggregation of national tables. Each African country block reflects data from supply and use tables and national accounts after harmonization and balancing. Each bilateral import block reflects national accounts-based import-use totals constrained by trade-partner shares for goods and services. Each block for a retained country remains anchored in the original intercountry input-output base, except where the incorporation of explicitly represented African countries requires a documented revision of the target. The updated rest-of-the-world account represents the rest of the world after these explicit changes; it is not an arbitrary balancing column.

55. This interpretation is important for policy use. When the table indicators show domestic value added in exports, regional value chain links, import dependence or absorption of final demand, the indicators inherit the strengths and limitations of the method used to construct the table. Country supply and use tables with high-quality data and detailed valuation matrices improve the reliability of estimates of domestic value added. Details and accurate trade boundaries improve the allocation of imported inputs among trade partners. Transparent reconstruction of the rest-of-the-world account improves the interpretation of linkages between Africa and the rest of the world. Conversely, weak correspondences, missing valuation matrices and incomplete trade-partner data should be documented because they affect the confidence placed in the resulting indicators.

Annex

Illustration of the mathematical construction behind the table

1. The present annex provides a compact mathematical illustration of the way in which the table is constructed. It does not refer to every detail of the scripts used to produce the table. Rather, its purpose is to show how the main accounting objects are moved from national supply and use tables to a balanced, multi-country input-output system.

2. For each country, the starting point is a national supply-and-use framework. The supply table contains domestic output by product and industry, together with valuation columns that connect supply at basic prices with supply at purchasers' prices. Domestic output at basic prices is represented by:

$$V^c = \left[v_{pi}^c\right]$$

Where:

c indexes countries

p indexes products

i indexes industries

v_{pi}^c is the output of product p by industry i in country c

Imports are denoted by m_p^c. Valuation columns are represented in:

$$R^c = \left[r_{p\ell}^c\right]$$

Where:

ℓ indexes such valuation components as trade margins, transport margins, taxes on products, subsidies on products or combined valuation categories, depending on the source table.

Total supply of product p in country c at purchasers' prices can therefore be expressed as:

$$s_p^{pp,c} = \sum_i v_{pi}^c + m_p^c + \sum_\ell r_{p\ell}^c.$$

This expression shows that the supply table records not only domestic production, but also imports and the valuation adjustments needed to compare supply with use measured at purchasers' prices. The use table records how products are absorbed by industries and final users. Immediate use at purchasers' prices is represented by:

$$U^{pp,c} = \left[u_{pi}^{pp,c}\right]$$

Final demand at purchasers' prices is represented by:

$$Y^{pp,c} = \left[y_{pf}^{pp,c}\right]$$

Where:

f indexes final-demand categories

Product use is then represented by:

$$d_p^{pp,c} = \sum_i u_{pi}^{pp,c} + \sum_f y_{pf}^{pp,c} + e_p^c + \Delta_p^c$$

Where:

e_p^c denotes exports

Δ_p^c captures changes in inventory and any statistical discrepancies reported separately

The core product-balance condition is therefore:

$$s_p^{pp,c} = d_p^{pp,c}$$

3. All source tables are mapped to the product and industry classification in the table. If M_P^c is the product concordance matrix and M_I^c is the industry concordance matrix, the mapped domestic supply matrix is expressed as:

$$\widetilde{V}^c = M_P^c V^c (M_I^c)'$$

And the intermediate use matrix is expressed as:

$$\widetilde{U}^{pp,c} = M_P^c U^{pp,c} (M_I^c)'$$

The same product mapping is applied to imports, exports, final demand and valuation columns.

4. The second step is balancing, if it is required. The balancing problem involves finding adjusted tables that remain close to the initial mapped tables while satisfying the required accounting constraints. It can be expressed as follows:

$$\min_{X^{2020}} D(X^{2020}, X^0) \quad \text{subject to} \quad AX^{2020} = b^{2020}$$

Where:

X^0 represents the initial mapped entries, comprising domestic supply, imports, valuation columns, intermediate use, final demand, exports and selected control totals.

$D(X^{2020}, X^0)$ is a distance measure that penalizes departures from the source data

$AX = b$ represents the accounting restrictions

5. The accounting restrictions include product balances, industry output totals, intermediate-consumption totals, final-demand totals, and the relationship between output, intermediate use and value added. Structural zeros are preserved unless explicit support repairs are needed to make the balancing problem feasible. Value added is reconstructed after balancing rather than treated as an unrelated external column. This ensures that output, intermediate consumption and value added form a coherent production account. Where strict balancing is feasible, source support and control totals are preserved as far as possible. Where it is not feasible, later fallback stages relax selected controls in a documented manner. Product-balance identities remain the organizing constraints, while less reliable margins, residual items and selected totals may move within controlled bounds.

6. The valuation matrix allocated across intermediate and final uses is partitioned as:

$$\bar{R}_U^c = [\bar{R}_{UI}^c \ \bar{R}_{UF}^c]$$

Intermediate use is then converted from purchasers' prices to basic prices as follows:

$\bar{U}_{bp}^c = \bar{U}_{pp}^c - \bar{R}_{UI}^c$ And final use is converted from purchasers' prices to basic prices as follows:

$$\bar{Y}_{bp}^c = \bar{Y}_{pp}^c - \bar{R}_{UF}^c$$

For countries without usable valuation matrices, an average valuation structure is created from countries with complete valuation information. Each available valuation matrix is first mapped to the classification used in the table and then converted into coefficients relative to the corresponding transaction base. The coefficients are averaged across all countries used for the calculation, preferably weighted by transaction value, and then applied to the use table of the missing country. Where aggregate controls exist for taxes or margins, the imputed valuation matrices are rescaled to match those controls.

7. The next step is to create the domestic input-output table using Model D. The domestic supply-and-use system is transformed into an industry-by-industry input-output block using the assumption of a fixed product sales structure. A transformation matrix (G^c) derived from the balanced supply structure allocates product use to the producing industries. The domestic intermediate transaction matrix for country c is as follows:

$$Z^{cc} = G^c U^{bp,c,\mathrm{bal}}$$

Where:

$U^{bp,c,\mathrm{bal}}$ is the balanced use matrix for country c at basic prices.

The same transformation is applied to final demand to obtain domestic final-demand blocks.

8. Imports are then allocated by source country. The share of imports by country c of product p supplied by partner r can be expressed as s_p^{rc}. The imported intermediate use and, analogously, imported final demand, are allocated using this share, thus producing bilateral product-use matrices. These matrices are then transformed into the bilateral input-output blocks Z^{rc} and Y^{rc}, where Z^{rc} records intermediate inputs produced in country r and used in country c, and Y^{rc} records final demand in country c for products produced in country r.

9. Finally, the intercountry structure is added, with domestic and bilateral country blocks assembled into the following matrix:

$$Z = \begin{bmatrix} Z^{11} & Z^{12} & \cdots & Z^{1C} \\ Z^{21} & Z^{22} & \cdots & Z^{2C} \\ \vdots & \vdots & \ddots & \vdots \\ Z^{C1} & Z^{C2} & \cdots & Z^{CC} \end{bmatrix}$$

Where:

Z^{cc} represents the diagonal blocks of the matrix

Z^{rc} represents the production from country r used as intermediate inputs in country c.

Final demand, by contrast, is assembled by stacking country final-demand matrices vertically, while keeping the same final-demand indicator columns:

$$Y = \begin{bmatrix} Y^1 \\ Y^2 \\ \vdots \\ Y^C \end{bmatrix}, \qquad Y^c \in \mathbb{R}^{n_c \times |F|}$$

Gross output is obtained by summing each intermediate-demand and final-demand row:

$$x = Z\mathbf{1}_N + Y\mathbf{1}_{|F|}$$

Where:

N is the total number of country-industry accounts

The technical coefficient matrix is expressed as:

$$A = Z\hat{x}^{-1}$$

Where:

$\hat{x}$ is the N-by-N diagonal matrix with the elements of x on the diagonal

The Leontief inverse is expressed as:

$$L = (I - A)^{-1}$$

10. The vector va, of length N, is formed by stacking all industry value added entries for 2020 and country c in the same order as the corresponding elements of x. The value added coefficients are expressed as:

$$g = va\hat{x}^{-1}$$

11. Details on the construction of trade in value added indicators are omitted from the present annex owing to space constraints.