GGDC RESEARCH MEMORANDUM *197*

The Role of Exports for Income and Job Creation in Sub-Saharan African Countries: New Evidence using the Africa Supply and Use Tables Database

Emmanuel Mensah and Gaaitzen de Vries

March 2024

university of groningen / groningen growth and development centre

The Role of Exports for Income and Job Creation in Sub-Saharan African Countries: New Evidence using the Africa Supply and Use Tables Database

Emmanuel Mensah[a] and Gaaitzen de Vries[b]

[a] Utrecht University and Groningen Growth and Development Centre, The Netherlands

[b] Groningen Growth and Development Centre, Faculty of Economics and Business, University of Groningen, The Netherlands

Abstract

This paper examines the role of exports for income and job creation in sub-Saharan African countries. It introduces the Africa Supply and Use Tables (ASUT) database, which provides annual data on the production structure of eleven countries from 1990 to 2019. For each country, official supply and use tables are benchmarked to national accounts and trade data that reflect production and usage by 20 sectors. Using input-output techniques, we document five key stylized facts: i) African economies face increased international competition, during a period in which the production process has been further fragmented; ii) An increasing share of domestic value-added exports (income content of exports) comes from manufacturing and services; iii) The income content of exports is becoming increasingly diversified, especially between 1990 and 2007, but continuing albeit at a slower pace from 2007 to 2019; iv) A rising number of manufacturing jobs are sustained by exports, increasing from 4.1 million workers in 1990 to 8.6 million workers by 2019; v) Inter-industry linkages are expanding, where the rising linkages are particularly observed in services sectors.

JEL classification: F14; F60; O19

Keywords: Employment; Income; Export composition; Supply and use tables; sub-Saharan Africa

Acknowledgments

We thank Reitze Gouma, Calumn Hamilton, Hagen Kruse, Ryan Marapin, and Pieter Woltjer for their excellent research assistance to the African Supply and Use Tables Database at the Groningen Growth and Development Centre (GGDC). We thank Christophe Degain, Catherine La Rosa-Elkaim, Mamadou Ngalgou Kane, Baba Madu, Anthony Krakah, and many statisticians at African NSIs for their helpful input and comments. Also thanks to Tristan Reed for sharing the measures of country's market size. Financial support from STEG/CEPR is gratefully acknowledged.

1. Introduction

The export of goods and services to serve foreign demand has long been considered important in fostering growth and poverty reduction. In Asian economies, such as South Korea and Taiwan, export-led growth strategies fuelled rapid economic expansion and served as a powerful catalyst for structural transformation, ushering in profound shifts in industries. In a recent influential paper, Goldberg and Reed (2023) underscored the pivotal role of demand in driving development. Goldberg and Reed (2023) argue that contemporary productive technologies must be leveraged at scale to achieve profitability. Consequently, producers in developing nations must seek entry into high-income foreign markets or broaden their middle-class consumer base to induce a demand-led growth.

This contrasts to the initial policies in sub-Saharan African economies during the 1950s and 60s. Most African countries were inward looking and followed import-substitution industrialization strategies. But during the past decades, many African economies have become increasingly export-oriented (Goldberg and Reed, 2023). This happened for a variety of reasons. The structural adjustment programs in the 80s and 90s often included trade liberalization measures, such as reducing tariffs and import restrictions, with the intent of promoting exports. In 2000, the African Growth and Opportunity Act was signed, offering trade preferences and incentives for eligible African economies to export to the United States. International organizations, such as the World Bank, USAID, and the International Monetary Fund (IMF), provided assistance and financing for export promotion programs (Cadot et al. 2015). Several African countries established export promotion agencies to provide support, information, and resources to local businesses looking to expand into international markets (Cadot et al. 2015). Finally, the success of the export processing zones in Mauritius were exemplary to other African economies (Subramanian, 2009). How did this outward-oriented shift contribute to income and employment growth?

This paper empirically studies the role of foreign demand for job and income generation in sub-Saharan African economies. The contribution is threefold. First, we use a novel measure of trade that captures the domestic value that is added to exports. Due to the international fragmentation of production, gross exports overestimate the contribution of economies that rely heavily on imported intermediates. Despite the widespread use of gross exports, it is an increasingly biased measure since intermediates trade is pervasive, and a measure of domestic value added to exports is therefore preferred (Timmer et al. 2013).

Second, we use the hypothetical extraction method proposed by Los et al. (2016) to explore the level and composition of exports for jobs and income. Studying shifts in the composition of exports is relevant, since many sub-Saharan African economies are considered major exporters of mineral resources, and it is argued that these exports generate fewer jobs compared to export of manufactured goods (Rodrik, 2016).

Third, we introduce the African Supply and Use Tables (ASUT) database. The ASUT database provides annual time series of supply and use tables (SUTs) for eleven African economies, namely Cameroon, Ethiopia, Ghana, Kenya, Mauritius, Nigeria, Rwanda, Senegal, South Africa, Tanzania, and Zambia, from 1990 to 2019. The ASUT adheres to national accounts data and has been constructed following the methods introduced by Temurshoev and Timmer (2011) and Dietzenbacher et al. (2013). The ASUT Database is combined with employment data from Kruse et al. (2023) at the same sectoral detail.

We use the new data to explore the role of the level and composition of exports for jobs and income in sub-Saharan African economies. Our results show that the overall number of jobs linked to foreign demand in the eleven sub-Saharan African economies almost doubled, reaching 26.5 million workers in 2019. The dependence on foreign demand for jobs and income in African countries increased from 1990 until 2007, then declined since 2007. The decline in jobs and income induced by exports in African countries is consistent with the broader literature that show exports dropped following the 2008 global financial crisis, dubbed “The great trade collapse” (Baldwin, 2009). Like global trends, jobs and value-added content in exports begin to recover in the 2010s but is well below pre-crisis level. However, there are contrasting levels and trends across countries, increasing in Ghana, Rwanda, Senegal, South Africa, and Tanzania, and declining in Cameroon, Ethiopia, Kenya, Mauritius, Nigeria, and Zambia. Finally, jobs related to exports of manufactured goods increased from 4.1 million workers in 1990 to 8.6 million workers by 2019. The shift in demand patterns underscores a transition from essentials to manufacturing and services

This paper relates to studies that use input–output tables to trace not only the jobs and value added in the exporting sector, but also those indirectly involved in the production process. For example, Johnson and Noguera (2012) find that for manufacturing products sizeable value might be added in non-manufacturing sectors delivering material and services inputs further upstream in the production process. This will depend on the strength of the domestic inter-industry linkages as stressed already by Hirschman (1958). Feenstra and Hong (2010) and Los et al. (2015) measure employment effects of exporting in China using input–output tables to capture both the direct and indirect effects. Many studies have followed up using this approach, but none so far have applied it to a large set of African

countries due to data constraints (Valentinyi, 2021). Most closely related to this paper is Pahl et al. (2022), who analyze the role of exports for jobs and productivity in a cross-country sample that includes four African economies. This paper contributes by providing for the first time a long-term macro-economic overview of the importance of foreign demand for income and jobs in sub-Saharan African countries.

The macroeconomic perspective in this paper employs input-output accounting identities to determine aggregate patterns and their importance. A clear limitation of this approach is the lack of power in identifying relations. Causal identification of specific policies typically requires detailed microdata, such as in Cadot et al. (2015) who study the productivity effects of an export promotion program in Tunisia. Yet, often in studies that get the identification right, the sample is not representative of the total economy, often confined to (formal) manufacturing firms (see e.g. van Biesebroeck, 2005). Furthermore, inter-industry linkages are often ignored. This paper documents that these linkages are not only important, but that their importance has actually grown over time. The analysis presented in this paper therefore contributes by framing identified micro-founded relations in a more coherent macro- perspective.

As argued by Goldberg and Reed (2023), the success stories in Africa during the post-1990s were not primarily fueled by export-oriented industrialization. Only a limited number of countries outside East and Southeast Asia witnessed substantial growth in manufacturing employment. Furthermore, in countries such as Ethiopia and Tanzania where manufacturing expanded, the majority of the growth occurred within smaller, informal firms, where the influence of scale economies is less likely to have played a substantial role (Diao et al., 2021). Our paper aligns with this view and quantifies the contribution of exports to jobs and income for a larger set of African economies.

The ASUT presented in this paper also aims to stimulate new research on structural transformation and economic growth in African economies. This includes the analysis of investment multipliers (Casal and Caunedo, 2023) and open economy multi-sector models of growth that quantify the importance of particular mechanisms or driving forces in structural change using input-output tables (Sposi, 2019; Sposi et al. 2021). Indeed, the main constraint on making more progress in understanding the role of input-output networks in economic development in general, and in structural transformation in particular, is data constraints (Valentinyi, 2021).[1] To support research in these and other areas, the ASUT database is publicly provided for free at www.ggdc.nl.

[1] Johnson (2018) also outlines several data and measurement challenges.

The remainder of the paper is structured as follows. Section 2 presents the content and main characteristics of the ASUT database, relegating a detailed country-by-country description of the sources and methods to an appendix. Section 3 presents the hypothetical extraction method. This method is used in section 4 to explore the role of exports for jobs and income generation in African countries. Section 5 provides concluding remarks.

2. The Africa Supply and Use Tables (ASUT) Database

This section introduces the Africa Supply and Use Tables (ASUT) Database. Sub-section 2.1 describes the content and main sources of the ASUT Database. It is observed that most national statistical institutes in Africa compile Supply and Use Tables (SUTs). In sub-section 2.2, we describe how these official SUTs from statistical offices are harmonized and standardized to meet criteria for international, intertemporal and internal consistency. In sub-section 2.3 we discuss benchmarking the harmonized SUTs to national accounts and detailed trade data to estimate annual time series of SUTs. Finally, sub-section 2.4 discusses the transformation of SUTs into input-output tables and the employment data. For a detailed treatment of country-specific sources and methods, we refer the reader to appendix C.

2.1 Content and sources

Table 1 presents the content of the ASUT database. The database provides annual supply and use tables for eleven African economies for the period 1990–2019. The countries included are: Cameroon, Ethiopia, Ghana, Kenya, Mauritius, Nigeria, Rwanda, Senegal, South Africa, Tanzania, and Zambia. These countries account for about 70 percent of sub-Sahara Africa's GDP. It includes countries from East Africa (Ethiopia, Kenya, Mauritius, Rwanda, and Tanzania), West Africa (Ghana, Nigeria, and Senegal), and Central and Southern Africa (Cameroon, South Africa and Zambia). The supply and use tables are valued at basic prices expressed in millions of national currencies. The database distinguishes the 20 main sectors of the economy, classified in accordance with the International Standard Industrial Classification (ISIC), revision 4. These sectors include agriculture, mining, construction, utilities, nine manufacturing industries, finance, business services, personal services, trade and transport services and public services.

Table 1: overview of content and sources

Countries included:	Cameroon, Ethiopia, Ghana, Kenya, Mauritius, Nigeria, Rwanda, Senegal, South Africa, Tanzania, and Zambia
ISIC rev. 4 sector	**Description**
A	Agriculture, forestry and fishing
B	Mining and quarrying
C10t12	Manufacture of food products; Manufacture of beverages; Manufacture of tobacco products
C13t15	Manufacture of textiles; Manufacture of wearing apparel; Manufacture of leather and related products
C16t18	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; Manufacture of paper and paper products; Printing and reproduction of recorded media
C19t22	Manufacture of coke and refined petroleum products; Manufacture of chemicals and chemical products; Manufacture of basic pharmaceutical products and pharmaceutical preparations; Manufacture of rubber and plastics products
C23t25	Manufacture of other non-metallic mineral products; Manufacture of basic metals; Manufacture of fabricated metal products, except machinery and equipment
C26t27	Manufacture of computer, electronic and optical products; Manufacture of electrical equipment
C28	Manufacture of machinery and equipment n.e.c.
C29t30	Manufacture of motor vehicles, trailers and semi-trailers; Manufacture of other transport equipment
C31t33	Manufacture of furniture; Other manufacturing; Repair and installation of machinery and equipment
D+E	Electricity, gas, steam and air conditioning supply; Water supply; sewerage, waste management and remediation activities
F	Construction
G+I	Wholesale and retail trade; repair of motor vehicles and motorcycles; Accommodation and food service activities
H	Transportation and storage
J+M+N	Information and communication; Professional, scientific and technical activities; Administrative and support service activities
K	Financial and insurance activities
L	Real estate activities
O+P+Q	Public administration and defence; compulsory social security; Education; Human health and social work activities
R+S+T+U	Arts, entertainment and recreation; Other service activities; Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use; Activities of extraterritorial organizations and bodies
Time period	1990–2019 (annual data)
Main Data	Supply tables in basic prices (national currency in millions) Use tables in basic prices (national currency in millions) Input-Output tables in basic prices (national currency in millions)
Principal sources	Supply and Use Tables; Social Accounting Matrices; National accounts; BACI product level trade data

We collected SUTs and Social Accounting Matrices (SAMs) from National Statistical Institutes (NSIs) and other sources. Most SUTs were obtained from the websites of NSIs and other online sources. For Nigeria and Senegal, SUTs were sourced through formal correspondence with the respective NSIs. For Ethiopia we use the social accounting matrices (SAMs) that were compiled by IFPRI in collaboration with the Central Statistics Agency of Ethiopia. For Ghana and Kenya, we use the 2005 SAM and 2003 SAM respectively, alongside SUTs that are available for other years.[2] An overview of the official SUTs and SAMs is presented in Table 2.[3]

Table 2: Overview official supply and use tables for sub-Saharan African countries

Country	Years	Source
Cameroon	1993-2019	Cameroon's National Institute of Statistics
Ethiopia	2005[a], 2011[a], 2018[a]	IFPRI and Central Statistics Agency of Ethiopia
Ghana	2005[a], 2013	Ghana Statistical Service
Kenya	2003[a], 2009, 2016	Kenya National Bureau of Statistics
Mauritius	2002, 2007, 2013, 2018	Statistics Mauritius
Nigeria	2010	National Bureau of Statistics
Rwanda	2001[b], 2006[b], 2011	National Institute of Statistics of Rwanda
Senegal	2014-2019	Agence Nationale de la Statistique et de la Démographie
South Africa	1993, 1998-1999, 2000, 2002, 2005, 2007-2018	Statistics South Africa
Tanzania	2007, 2015	National Bureau of Statistics
Zambia	2010	Central Statistical Office

[a] Social Accounting Matrix. [b] An intermediate use table is not available.

SUTs serve as a framework for national accounting purposes, providing a comprehensive understanding of the production process, the income generated from these production activities, and

[2] For Ghana and Kenya, the 2004 SUT and 2002 SUT were used by the NSI (with technical support from IFPRI) to construct the 2005 SAM and 2003 SAM respectively.

[3] Some SUTs that were compiled by NSIs could not be sourced. For example, the 2011 SUT for Ethiopia could not be sourced directly, although it was used by IFPRI to construct the 2011 SAM. We use the SAMs to back out the SUTs. For Zambia, we were unable to source the 1994 SUT.

the use of goods and services. This framework is used to estimate GDP from the production approach, the income approach, and the expenditure approach. In theory, the different approaches yield the same estimate of GDP. However, in practice discrepancies are observed. An official GDP estimate is then obtained using the SUT to reconcile the differences.

Compiling SUTs requires extensive economic surveys and detailed information on institutional and sectoral expenditure, income, and economic transactions. Collecting this information is challenging for NSIs with limited statistical capacity and resources. Nevertheless, most African countries compile and disseminate SUTs. A report by UNECA (2020) on the implementation of the 2008 system of national accounts showed that out of the 54 African countries, 37 countries compile supply and use tables. Out of the 37 countries, 22 compile SUTs annually. The 22 countries that compile SUTs annually are members of the Observatoire economique et statistique d'Afrique Subsaharienne (AFRISTAT), which includes two countries of the ASUT database, Cameroon and Senegal. The NSIs of the AFRISTAT members use the CRETES module, which is based on the French statistical system.[4] First, benchmark SUTs are estimated every five years, making use of economic census data. The recent economic surveys cover both formal and informal economic activities, further discussed below. Second, the benchmark SUTs are updated annually using 'non-survey' methods.

The remaining 15 countries compile SUTs every 5 years or over longer time intervals. South Africa compiles benchmark SUTs every five years since 1995, hence the benchmark years are 1995, 2000, 2005, 2010, and 2015. It updates SUTs for most years since 1993 using non-survey methods. Mauritius compiles SUTs every five years on the basis of the Census of Economic Activities. The other countries in the ASUT database compile SUTs every ten years, such as Nigeria which released the 2010 SUT and currently compiling the 2020 SUT. The benchmark and updated SUTs, shown in Table 2, are considered official SUTs in constructing the ASUT Database.

Over time, SUTs evolve as they are compiled using updated survey frames and new methodologies. For example, the National Bureau of Statistics of Nigeria estimated the 2010 SUT in accordance with the 2008 SNA and in ISIC rev. 4. It revised its survey frame to capture economic activities previously unmeasured, including new sectors such as entertainment, research, and patents and copyrights, in

[4] The CRETES software provides a full integration of concepts, definitions and methods for compiling national accounts. AFRISTAT member states have a common nomenclature for economic activities (NAEMA) and for products (NOPEMA). This serves as a crucial tool for member states to harmonize their statistical work, particularly when collecting data and compiling national accounts. These classification systems are rooted in the United Nations International Nomenclatures, such as the International Standard Industrial Classification of All Economic Activities (ISIC Rev 4) and the Central Product Classification (CPC version 2). These international standards enable meaningful comparisons with non-French speaking African countries in our dataset. In essence, the concepts, classifications, and methodologies employed in constructing SUTs and national accounts remain consistent across countries.

addition to a broader coverage of services, particularly informal services. It used a sample frame of 851,628 establishments (NBS 2014a, b). Similarly, the Kenyan National Bureau of Statistics compiled a new SUT in 2016. It used new surveys to improve coverage of economic activities in the informal sector (KNBS, 2022). For Ghana, the 2005 SAM is based on industry information from the 2003 Industrial Survey which covers the formal industrial sector. Conversely, the 2013 SUT was constructed using the integrated business enterprise survey, which is the first non-household economic census covering all sectors, including informal economic activities (GSS, 2023). A similar approach is followed by Rwanda (NISR 2014), Mauritius (SM 2022), Tanzania (NBS 2019), and Zambia that all aim for a comprehensive coverage of informal sector activities (CSO 2014, 2017). For South Africa, the 2010 benchmark SUT implemented the 2008 SNA and refined the method for calculating financial intermediation services indirectly measured. In turn, the 2015 benchmark SUT refined the methods for calculating trade and transportation margins on products, for calculating net taxes on products, and for calculating trade services (STATS SA, 2021).

The main sources used to construct the SUTs are economic censuses, living standard surveys, informal sector surveys, administrative data from the national tax and revenue office, and administrative data and financial statements from ministries and government agencies. The sources aim to cover both formal and informal economic activities. To provide some further detail, we discuss here the recent SUT compilation approaches for Zambia, Ghana, and Kenya. The 2010 SUT of Zambia was constructed using an economic census and a non-farm informal sector survey. The economic census did not cover productive activities conducted by unincorporated enterprises in the household sector that are unregistered and/or are less than a specified size in terms of employment, and that have some production for market or for own final use. The non-farm informal sector survey was conducted to cover these activities. These informal activities accounted for 33.6 percent of GDP in Zambia in 2010 (CSO, 2014, 2017). Ghana constructed the 2013 benchmark SUT using the Integrated Business Enterprise Survey (IBES). Phase I of the IBES produced an exhaustive business register for the total economy. Phase II of the IBES sampled all firms with more than 50 employees and randomly selected representative firms which employ less than 50 workers. This survey design did not completely capture informal manufacturing activities. The IBES II data was therefore complemented by data from the non-farm enterprise module of the Ghana Living Standard Survey (GLSS) round six. According to the data from IBES and GLSS, the informal economy is estimated to account for 29.2% of GDP in Ghana in 2013 (GSS, 2023). For Kenya's 2016 Supply and Use Table, informal economic activities are measured using data from the 2016 Micro, Small, and Medium Enterprise Survey and the 2015/2016 Kenya Integrated Household Budget Survey, and the Integrated Survey of Services 2017, while formal sector activities are measured using information from the 2016 Census of Establishments

and the 2016 and 2017 Census of Industrial Production. Estimation of informal manufacturing was notably improved using data from both the household budget survey and the Micro, Small, and Medium Enterprises survey. Ghana, Kenya, and Zambia estimate informal activities using non-farm surveys or a combination of non-farm enterprise surveys and household surveys. For the 2011 SUT of Rwanda, the estimation of informal sector output is based on data from the 2011 Household Living Condition Survey (Enquête Intégrée des Conditions de Vie 3, see NSIR (2014)). Whilst enterprise surveys aim to capture data related to the economic activities of enterprises, household surveys focus on the economic circumstances and living standards of households. These differences in sources and approaches are likely to result in disparities in the accuracy of estimating informal sector activities.

National statistical offices differ in their approach to calculating gross output and intermediate inputs. Ghana derives manufacturing gross output and intermediate input use directly from the IBES II survey for the 2013 SUT. Data is subsequently extrapolated to non-benchmark years using output and intermediate input data derived from annual financial statements of manufacturing firms obtained from the Ghana Revenue Authority (GSS, 2023). Kenya's National Bureau of Statistics derives manufacturing output and intermediate input use from censuses and surveys for benchmark years. For homogenous products, the statistical office uses volume indexes to extrapolate gross output. For heterogeneous products, benchmark estimates are extrapolated to other years using values derived from sales turnover reported in the Monthly Survey of Industrial Production (KNBS, 2022). In contrast, Tanzania estimated manufacturing output for the 2015 benchmark year using the volume index estimated from the 2013 Census of Industrial Production and the 2015 Annual Survey of Industrial Production. Gross output at current prices was calculated by reflating gross output at constant prices using the consumer price index for corresponding industries. Next, a fixed input-output ratio is applied to gross output at constant prices to derive intermediate input in constant prices. Intermediate input in constant prices is reflated using a weighted consumer price index for industries to obtain intermediate input in current prices (NBS 2019).

The compilation of SUT requires international trade data, which is typically sourced from customs offices. However, official customs data does not capture the pervasive smuggling and overwhelming role of informal cross-border trade in African countries. In their recent estimation of SUTs, African statistical institutes conduct cross-border informal trade surveys to adjust official customs data. For example, the 2016 SUT for Kenya aims to incorporate improved estimates of trade using a cross-border informal trade survey (KNBS, 2022).

In a nutshell, most national statistical institutes in Africa compile supply and use tables. Progress is made to improve the accuracy of these tables by making use of new sources and methods. While this

progress is welcomed, it affects the intertemporal consistency of time series SUTs. For example, how can we combine the 2005 SUT of Ghana, which is based on a formal industrial survey, with the 2013 SUT, which is based on all non-household firms covering all sectors of the economy? The next sub-section discusses how we harmonized the SUTs, national accounts data, and employment to progress towards internal, intertemporal, and international consistency.

2.2 Harmonization and Standardization

The aim is to estimate consistent time series supply and use tables. The supply and use tables should distinguish the 20 main sectors of the economy in the columns and the 20 main products in the rows. Values should be at basic prices expressed in millions of national currencies. This requires harmonization of the benchmark SUTs. As discussed in the previous subsection, SUTs are typically available for a limited set of years and once released by the statistical institute, revisions are rare. National Accounts time series on the other hand are frequently revised. These revisions can be substantial, especially at the level of the 20 sectors distinguished in the database. Most African countries revised their GDP in the 2010s in accordance with the 2008 SNA, leading to substantial adjustments of GDP and industry data (de Vries et al. 2015; Mensah 2020). This can result in discrepancies between information from the latest version of the National Accounts and the published SUT for that year. In our approach, any revision of the National Accounts leads to adaptation of the (official) benchmark SUTs to ensure they match. To estimate the time series SUTs, we follow the approach proposed by Dietzenbacher et al. (2013). It requires time series for (gross) output and value added by sector, imports and exports by product and final use by use category. These data act as constraints when generating time series SUTs, using the so-called SUT–RAS method (Temurshoev and Timmer, 2011). The remainder of this sub-section outlines the key harmonization procedures for the benchmark SUTs and the time series national accounts data. The next sub-section describes the SUT-RAS method for estimating time series SUTs.

Although the statistical concepts, classifications and definitions used for the construction of national SUTs are standardized[5], differences in products-by-industry disaggregation and price valuations are common. For example, whilst the SUTs of countries like Cameroon, Mauritius, Tanzania, and South Africa are very detailed in terms of products and industries distinguished, the SUTs from countries like Ghana, Kenya and Rwanda are typically condensed with little or no details for manufacturing industries (see country notes in Appendix C for details). To harmonize the SUTs and resolve

[5] The recent SUTs from NSIs are typically compiled in accordance with the 2008 System of National Accounts (SNA), ISIC Rev. 4 for industries, and Central Product Classification Version 2.1 for products.

inconsistencies over time, we convert national SUTs into standard tables with 20 sectors and 20 products using concordance tables. Table 1 shows the 20 sectors and Appendix Table B1 the 20 products distinguished.

The distinction of 20 products and sectors was deliberate, aimed at striking a balance between sector detail and data availability from African countries. In instances where a country's Supply and Use Tables provide a more detailed breakdown, we aggregated up to the 20 products and sectors. Conversely, for countries with more condensed tables, we disaggregated the data using supplementary information from national accounts or UNIDO's industrial statistics.

Supply is typically valued at basic prices, whereas intermediate use is valued at purchaser's prices.[6] To ultimately generate input-output tables, it is essential for both the supply and use tables to adhere to a consistent pricing concept. By incorporating estimates of margins and net taxes, the data at purchasers' prices in the use table are converted into basic prices. This involves the deduction of taxes, as well as trade and transportation margins. It requires two valuation matrices, one containing product-specific trade and transportation margins and the other containing net taxes on products. The valuation matrices are typically not available from African NSIs and need to be estimated.[7] We closely follow Dietzenbacher et al. (2013). First, the margins and net tax rates by product are extracted from the supply tables and preserved to the greatest extent feasible. Second, these rates are proportionally applied to the rows of the use table.

Finally, we observe country-specific idiosyncrasies. We observe statistical discrepancy between total use and total supply for some countries. These discrepancies can be substantial, especially for the 1990s. For example, in the 1993 SUT of South Africa, the discrepancy is up to 11% of total use for agricultural products. This is labelled as a "residual" in the use table. Similar discrepancies by industry are observed for Nigeria. We distributed the residuals proportionally across final demand categories for each product.

Next we harmonize national account data used in the benchmarking of the SUTs. The SUTs are linked with consistent national account data on value added, output, and expenditure as well as product level trade data for 1990-2019. The national account data on value added is taken from the Economic Transformation Database (ETD, Kruse et al. 2023). The ETD, combined with the 2-digit manufacturing database (Kruse et al. 2023), provides consistent time series of value added for the 20 sectors (see Table 1). The ETD is created through a thorough investigation of the availability and reliability of statistical sources on a country-specific basis. Recent estimates of sectoral value added which covers

[6] For Ethiopia, gross output and value added are at producer prices.
[7] Valuation matrices are not available for any of the countries considered, except for Tanzania.

both formal and informal activities are used and linked to historical series. This linking procedure adjusts the levels for years in which informal activities are undercounted to reflect current estimates while maintaining historical growth rates. Moreover, international consistency is achieved by adhering to the System of National Accounts for value added, which aligns with the classification used in SUTs.

Gross output by sector are often not provided in the national accounts. To construct a consistent time series for sectoral gross output, we acquire data from NSIs for recent years, which generally aligns with the output data from official SUTs. In section 2.1, we delved into how NSIs in Africa estimate output, particularly in the manufacturing sector. The NSIs also report sectoral output data in the United Nations Official Country Database (UNOCD). To ensure consistency in gross output with both value added and intermediate inputs, we use output data from SUTs or NSIs as benchmark. We interpolate or extrapolate from benchmark years using the historical series reported in the UNOCD. For manufacturing industries, we extrapolate from benchmark years using output data from UNIDO INDSTAT (2022 version). This approach adjusts output levels in non-benchmark years to reflect recent estimates covering both formal and informal activities while maintaining the historical growth rate. This adjustment ensures consistency with the SUTs and value added data.

Next, we obtain data for final use categories from the Penn World Tables, version 10. These final use categories are household consumption inclusive of consumption by nonprofit organizations serving households, government consumption, gross fixed capital formation, exports, imports, and changes in inventories. These final demand categories add up to the GDP as calculated from the expenditure perspective. These expenditure categories are harmonized in a way that is consistent across countries and over time (see Feenstra et al, 2015).

Finally, we harmonize trade data addressing two fundamental issues i) cross-border informal trade and ii) inappropriate product classification. Official customs data do not account for smuggling and cross-border informal trade. However, as discussed above, most NSIs estimate cross-border informal trade using supplementary survey data when constructing the SUTs. Therefore, we use trade data from SUTs as benchmark and extrapolate from benchmark years using trade data from the BACI database (Gaulier and Zignago, 2010). A second issue we deal with is the likely misclassification over time of products that are closely related. For example, for Ghana, trade in mining and basic metal products often shows erratic patterns suggesting products are misclassified in the reporting. The share of mining in total goods exports increases from 3% in 2010 to 21% in 2011, whereas the export share of basic metal manufactures falls from 48% to 31% between 2010 and 2011. Our investigation reveals the mining of gold and other precious metals, which should be classified under mining, and the production and refining of precious metals such as gold, which should be classified under the

manufacture of basic precious and other non-ferrous metals, are often mixed up in the reported UN commodities trade database (and BACI by extension). To harmonize and address such erratic patterns, we use the trade data from official SUTs as benchmark level estimates. We analyze trade data from the BACI database to identify erratic patterns in product pairs. By summing trade data from the two products that mirror each other plausibly due to misclassification, we use the growth trend derived from this aggregated value to extrapolate from benchmark years for these product pairs. This methodology yields trade shares that are consistent with benchmark SUTs and also improves consistency over time.

2.3 Estimating time series supply and use tables for African countries

A distinctive feature of the ASUT is that it is grounded in national statistics. This subsection first describes the linking of official supply and use tables with time series data on production and expenditure from the national accounts. In a second step, we distinguish domestically produced and imported intermediate and final use. The exposition here is parsimonious, because we closely follow established procedures (Temurshoev and Timmer 2011; Dietzenbacher et al. 2013).

Figure 1 illustrates a typical supply (panel a) and use table (panel b). The grey areas represent the harmonized annual time series data from national accounts. The figures also show that supply and use tables are of the product-by-sector dimension. Therefore, linking SUTs with national accounts data (which are classified by sector) and international trade data (which are product based) is straightforward. Time series from the national accounts for (gross) output and value added by sectors, total imports and total exports, and final use by use category were used as constraints to estimate annual SUTs using the SUT-RAS method (Temurshoev and Timmer, 2011). This approach uses the bi-proportional updating method, commonly referred to as the RAS technique, for updating SUTs. The SUT–RAS method requires initial estimates, which are given by the SUT data described earlier. These initial estimates are iteratively adapted, where the information in the grey cells is taken as given and fixed. The SUT-RAS process yields estimates for the supply table, use table, and the final use matrix, all presented in basic prices.

Figure 1: Illustration Supply and Use table

a. Supply table

	Sector 1	Sector 2	Sector n	Imports	Supply at basic prices
Prod 1	Supply				
Prod 2					
Prod n					

	Sector Gross Output	Total Imports	Total Supply

b. Use table

	Sector 1	Sector 2	Sector n	FU1	FU2	FUn	Exports	Use at basic prices
Prod 1	Intermediate Use							
Prod 2								
Prod n								
	Sector Intermediate Use			Total Final Use			Total Exports	Total Use
	Sector Value Added							

Notes: the grey area is the external time series data used in combination with the official supply and use tables to estimate time series SUTs using the SUT-RAS program.

The estimated time series SUTs do not distinguish domestically produced and imported use. Panel b of Figure 1 shows the use of each product (both locally produced and imported) by each sector and final use categories (consumption by households and government, investments, inventories, and gross exports). The distinction between domestically produced and imported intermediate use is essential for key research applications. For example, Los et al. (2016) show that domestic value-added in gross exports (DVA) and the measure of vertical specialization (VS) introduced by Hummels et al. (2001) can be computed from national input-output tables that distinguish domestic and imported intermediate inputs (further discussed in section 3).

We distinguish domestically produced intermediate use and imported intermediate use, and domestically produced final use and imported final use following Dietzenbacher et al. (2013). For each product, we determine the share of its imports that goes to intermediate consumption, to final consumption, and to gross fixed capital formation (the so-called end-use categories) using the Broad Economic Categories classification. Within each end-use category, a proportionality assumption was used for allocation. Hence, when allocating intermediate use by sectors, we applied consistent ratios between imported use and total use across sectors. Unlike the standard proportionality assumption, country import shares varied across end-use categories but remained constant within each of these categories.

2.4 Supplementary data: input-output tables and employment

The final step involves transforming the supply and use tables into symmetric input-output tables. To achieve symmetric industry-by-industry input-output tables, two transformation methods were considered: Model C and Model D (See Eurostat manual, 2008). Model C assumes a fixed industry sales structure for secondary products, while Model D assumes a fixed product sales structure. Model D is preferred due to its greater empirical plausibility and avoidance of negative entries in columns

where nonnegative values are expected, making it the dominant choice in the transformation process (Dietzenbacher et al. 2013).

The resulting input-output tables are depicted by Figure 2. A key characteristic of the input-output tables of the ASUT database is that imported intermediate and final use are distinguished. This distinction is used in the empirical analysis to measure the domestic value added in exports (income content of exports) and the job content of exports.

Figure 2: Symmetric Input-Output tables in the ASUT database

<table>
<tr><td></td><td></td><td colspan="6">Use or consumption</td><td></td><td></td></tr>
<tr><td></td><td></td><td>Sector 1</td><td>Sector 2</td><td>Sector n</td><td>FU1</td><td>FU2</td><td>FUn</td><td>Exports</td><td>GO</td></tr>
<tr><td rowspan="6">Supply</td><td>Sector 1</td><td colspan="3" rowspan="3">Domestically produced Intermediate Use</td><td colspan="3" rowspan="3">Domestically produced Final Use</td><td rowspan="3">Sector Exports</td><td rowspan="3">Sector Gross output</td></tr>
<tr><td>Sector 2</td></tr>
<tr><td>Sector n</td></tr>
<tr><td>Sector 1</td><td colspan="3" rowspan="3">Imported Intermediate Use</td><td colspan="3" rowspan="3">Imported Final Use</td><td rowspan="3"></td><td rowspan="3">Sector Imports</td></tr>
<tr><td>Sector 2</td></tr>
<tr><td>Sector n</td></tr>
<tr><td></td><td>Total</td><td colspan="3">Sector Intermediate Use</td><td colspan="3">Total Final Use</td><td>Total Exports</td><td>Total imports</td></tr>
<tr><td></td><td>VA</td><td colspan="3">Sector Value Added</td><td colspan="6"></td></tr>
<tr><td></td><td>GO</td><td colspan="3">Sector Gross Output</td><td colspan="6"></td></tr>
</table>

Finally, employment data for all 20 sectors are taken from the ETD and its accompanying 2-digit manufacturing database (Kruse et al. 2023).[8] The ETD defines employment as all persons engaged. This concept of employment covers paid employees, self-employed and (un)paid family workers. Employment information is typically absent from a country's national accounts since it is not part of the system of national accounts. To ensure comprehensive coverage of the entire working population, including both formal and informal workers, the ETD uses employment data from population censuses. Population censuses are typically conducted every ten years in African countries. Labor

[8] For manufacturing industries, we applied the shares computed from the 2-digit manufacturing database to disaggregate total manufacturing employment from the ETD.

Force Surveys (LFS) and establishment surveys are used to indicate trends between censuses. This employment concept aims to ensure internal consistency with value added from the time series SUTs.

3. Methodology

We use the ASUT database to measure domestic jobs and income from exports for the eleven African economies, adopting the approach introduced by Koopman et al. (2014). Koopman et al. (2014) derive a decomposition of gross exports through manipulation of accounting identities. Los et al. (2016) simplify this decomposition and show how the hypothetical extraction method can be used to measure the jobs and domestic value added induced by gross exports.

The basic input-output accounting identity states that all output is either used as intermediate input or for final demand. Consider two countries, a sub-Saharan African country (*s*) and the Rest of the World (*r*). In a two-country context, this can be written as

$$\begin{bmatrix}\mathbf{x}_s\\ \mathbf{x}_r\end{bmatrix} = \begin{bmatrix}\mathbf{A}_{ss} & \mathbf{A}_{sr}\\ \mathbf{A}_{rs} & \mathbf{A}_{rr}\end{bmatrix}\begin{bmatrix}\mathbf{x}_s\\ \mathbf{x}_r\end{bmatrix} + \begin{bmatrix}\mathbf{y}_{ss} & \mathbf{y}_{sr}\\ \mathbf{y}_{rs} & \mathbf{y}_{rr}\end{bmatrix}\mathbf{i}\,,$$

in which $\mathbf{x}_s$ stands for the vector of gross output levels of sectors in *s*. **A** contains the input coefficients a_{ij}, which give the value units of intermediate goods from sector *i* required to produce one value unit of gross output in sector *j*. $\mathbf{A}_{ss}$ represents the domestically purchased requirements of sectors in country *s*, while $\mathbf{A}_{sr}$ gives the requirements by sectors in *r* of products bought from sectors in *s*. For final demand, the vectors $\mathbf{y}_{ss}$ and $\mathbf{y}_{sr}$ represent the values of flows from sectors in country *s* to all domestic final users and to final users in *r* respectively. **i** is a column vector where all elements are unity, implying that it sums the elements in each of the rows of the matrix **Y**. Separating out exports of intermediate and final products from *s* to *r*, we can write

(1) $$\begin{bmatrix}\mathbf{x}_s\\ \mathbf{x}_r\end{bmatrix} = \begin{bmatrix}\mathbf{A}_{ss} & \mathbf{0}\\ \mathbf{A}_{rs} & \mathbf{A}_{rr}\end{bmatrix}\begin{bmatrix}\mathbf{x}_s\\ \mathbf{x}_r\end{bmatrix} + \begin{bmatrix}\mathbf{y}_{ss} & \mathbf{0}\\ \mathbf{y}_{rs} & \mathbf{y}_{rr}\end{bmatrix}\mathbf{i} + \begin{bmatrix}\mathbf{e}_s\\ \mathbf{0}\end{bmatrix}.$$

In this equation, the vector $\mathbf{e}_s$ represents the values of exports by each of the sectors in *s.* This includes exports of intermediates as well as final products ($\mathbf{e_s} = \mathbf{A}_{sr}\mathbf{x}_r + \mathbf{y}_{sr}$). Equation (1) can be expressed as

$$\begin{bmatrix}\mathbf{x}_s\\ \mathbf{x}_r\end{bmatrix} = \mathbf{A}^*\begin{bmatrix}\mathbf{x}_s\\ \mathbf{x}_r\end{bmatrix} + \mathbf{Y}^*\mathbf{i} + \begin{bmatrix}\mathbf{e}_s\\ \mathbf{0}\end{bmatrix}.$$

Where $\mathbf{A}^* = \begin{bmatrix} \mathbf{A}_{ss} & \mathbf{0} \\ \mathbf{A}_{rs} & \mathbf{A}_{rr} \end{bmatrix}$ and $\mathbf{Y}^* = \begin{bmatrix} \mathbf{y}_{ss} & \mathbf{0} \\ \mathbf{y}_{rs} & \mathbf{y}_{rr} \end{bmatrix}$.We can solve this equation for $\mathbf{x}_s$ and $\mathbf{x}_r$ by rewriting it as:

$$\begin{bmatrix} \mathbf{x}_s \\ \mathbf{x}_r \end{bmatrix} = (\mathbf{I} - \mathbf{A}^*)^{-1}\mathbf{Y}^*\mathbf{i} + (\mathbf{I} - \mathbf{A}^*)^{-1}\begin{bmatrix} \mathbf{e}_s \\ \mathbf{0} \end{bmatrix}.$$

When we pre-multiply this expression by a row vector $\mathbf{v}_s$ consisting of value added to gross output ratio for country *s* and zeros elsewhere, we arrive at GDP of *s*:

(2) $$GDP_s = \mathbf{v}_s\begin{bmatrix} \mathbf{x}_s \\ \mathbf{x}_r \end{bmatrix} = \mathbf{v}_s(\mathbf{I} - \mathbf{A}^*)^{-1}\mathbf{Y}^*\mathbf{i} + \mathbf{v}_s(\mathbf{I} - \mathbf{A}^*)^{-1}\begin{bmatrix} \mathbf{e}_s \\ \mathbf{0} \end{bmatrix}.$$

This equation provides a decomposition of GDP in *s* and Koopman et al. (2014) define domestic value added (VAX-D) in exports of *s* as the last element on the right-hand side of (2).[9]

$$VAXD_s = \mathbf{v}_s(\mathbf{I} - \mathbf{A}^*)^{-1}\begin{bmatrix} \mathbf{e}_s \\ \mathbf{0} \end{bmatrix},$$

which can be simplified as:[10]

(3) $$VAXD_s = \tilde{\mathbf{v}}_s(\mathbf{I} - \mathbf{A}_{ss})^{-1}\mathbf{e}_s.$$

This is the measure of domestic value added in exports.[11] If we let the row vector $\tilde{\mathbf{v}}_s$ consist of the employment to gross output ratio for country *s* and zeros elsewhere, it measures the job content of exports.

4. Income and job creation sustained by exports: five key results

This section uses the ASUT database to describe five key stylized facts regarding the importance of foreign demand. Throughout we focus on the years 1990, 2007, and 2019 because our data starts in 1990 and ends in 2019, and 2007 marks the end of a period as the global financial crisis struck. The

[9] We follow the notation proposed by Los and Timmer (2018), to distinguish the various GVC measures and guidelines on which measure to use for what type of questions. Los and Timmer (2018) refer to domestic value added in exports as VAX-D.

[10] Because $\mathbf{v}_s = [\tilde{\mathbf{v}}_s \quad \mathbf{0}]$ only the upper part of $(\mathbf{I} - \mathbf{A}^*)^{-1}$ remains after multiplication.

[11] The hypothetical extraction approach by Los et al. (2016) shows VAX-D is grounded in a Leontief production function.

five key stylized facts do not depend on the particular choice of beginning or ending years as the observations we discuss are gradual, unless noted otherwise.

#1 Increasing international competition and production fragmentation. During the past decade, the nature of international competition fundamentally altered. We start this section by examining trends in international competition and production fragmentation, and study both trends from the demand side. Goldberg and Reed (2023) emphasize the role of scale economies for development, which brings the demand side to the fore. They argue that modern, productive technologies need to be deployed at scale to become profitable. Hence, producers in low-income countries tend to be at a disadvantage for lack of access to large enough markets. Goldberg and Reed (2023) introduce two new measures of a country's market size, which are *i*) the size of the global population that is integrated with the home economy, and *ii*) the average income of the rest of the world that is integrated with the home economy.

The first two columns of Table 3 show both measures for the set of SSA economies.[12] For comparability, we show the unweighted averages for the years 1990, 2007 and for 2015 [the latest year for which the measures were computed by Goldberg and Reed (2023)]. Both measures go back further in time, and Goldberg and Reed (2023) point out that Africa was an early integrator, with many of its largest economies joining GATT early on. Up until the 2000s, Africa witnessed substantial market growth connected to its participation in trade agreements like GATT, with an increasing number of richer countries joining in. However, the scenario shifted in 2001 with China's entry into the WTO, leading to a decline in relative income. This altered the dynamics for African economies, transforming their markets from being simply open to rich buyers to having a competitor within their income range. Additionally, the 2000s saw a relative decrease in Africa's international population market share, attributed to its faster population growth compared to the global average.

To examine the reliance of African nations on foreign demand, we analyze the GDP of these countries by breaking it down into two components: the portion influenced by domestic demand and the portion influenced by foreign demand. The latter component is termed as 'domestic value added exports' as described by Koopman et al. (2014). This denotes the quantity of domestically generated value that is encompassed within total exports. To achieve this, we utilize equation (3) and incorporate the value added to gross output ratios in vector **v**. Gross exports and domestic value-added exports (VAX-D), both as a percentage of GDP, are shown in the bottom rows of Table 3.

[12] Mauritius is excluded, because it is an outlier that experienced strong deindustrialization during the past decades (see Rodrik, 2016).

Table 3. Outward orientation

	1990	2007	2015	2019
Relative population of integrated market[a]	0.04	0.10	0.10	[b]
Relative GDP per capita of integrated market[a]	5.48	4.77	4.26	[b]
Gross exports (% of GDP)	18.7	22.5	20.2	20.0
DVA exports (% of GDP)	15.8	19.2	17.0	17.3

Notes: unweighted average for SSA economies, excluding Mauritius. [a] Goldberg and Reed (2023). [b] not available.

The findings suggest a gradual increase in VAX-D, which rose from approximately 15.8% in 1990 to reach 19.2% in 2007 and declining to 17.3% in 2019. This indicates a rising importance of foreign demand for domestic income until 2007. The percentages denoting the domestic value added content of exports are notably lower than the share of gross exports in GDP, indicating the domestic value added component of exports remains consistently below one (Johnson and Noguera, 2012). The trend in VAX-D is similar to that for gross exports, but the changes are more pronounced for gross exports. This relates to differences in the growth rates of gross values and domestic value added due to rising production fragmentation and hence increased trade in intermediates (Timmer et al. 2013).

Among the SSA countries analyzed, a pattern of divergence emerges (see final column of Appendix Table B3). In five countries - Ghana, Rwanda, Senegal, Tanzania, and South Africa - there has been a distinct increase in VAX-D. This upward trajectory in these economies reflects an evolving dependence on catering to foreign final demand. Conversely, six SSA countries - namely Cameroon, Ethiopia, Kenya, Mauritius, Nigeria, and Zambia - experienced a decline in their VAX-D percentages during at least one of the periods analyzed. This decline indicates a potentially reduced emphasis on foreign demand as a driver of domestic income. The variability in income induced by foreign demand is substantial across SSA countries. Notably high percentages were recorded in Mauritius (34.9%) and Zambia (29.9%) in 2019, underscoring the importance of foreign demand. In contrast, Kenya (10.1%) and Ethiopia (6.7%) display considerably lower dependence on foreign demand.[13]

[13] Appendix A compares the estimates of VAX-D from the ASUT database to those from the OECD ICIO tables. There are four African countries in the OECD ICIOTs that are also included in the ASUT database, namely Cameroon, Nigeria, Senegal, and South Africa. The estimates of VAX-D are strongly correlated across these two databases.

Comparing VAX-D to other countries helps put reliance on foreign demand by African countries in perspective. Los et al. (2015) report Brazil, India, and the US each having a share of around 10%, China at approximately 20%, and Germany and Russia at about 30%. Interestingly, smaller nations such as Austria, Belgium, the Netherlands, Sweden, South Korea, and Taiwan exhibited even higher ratios (Timmer et al., 2013), underscoring their larger reliance on foreign demand.

In a nutshell, the trends indicate that African economies faced increased international competition during the past decades. In addition, this happened during a period in which the production process was further fragmented. Besides these aggregate trends, our estimates suggest substantial country heterogeneity in the importance of foreign demand for domestic income generation.

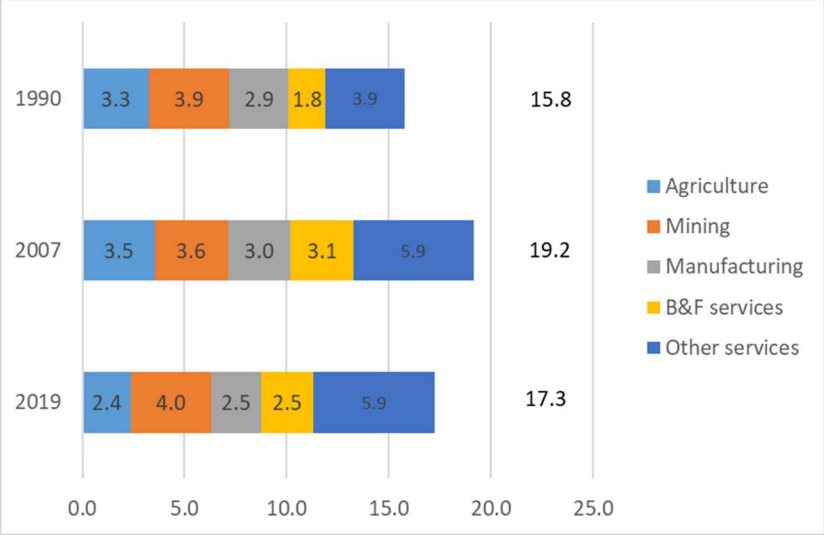
#2 Shift in domestic value-added exports towards manufacturing and services. In Figure 3, domestic value-added exports by sector are shown for the years 1990, 2007, and 2019. The VAX-D is computed for each of the twenty sectors using equation 3, and then aggregated into five broader sectors: agriculture, mining, manufacturing, finance and business services, and other services. The figure displays the unweighted average for Sub-Saharan African (SSA) economies, with detailed results for each individual SSA economy available in Appendix Table B3.

The findings indicate that a substantial share of domestic value-added exports are attributable to manufacturing and in particular to services. This finding is surprising, because trade in many African nations is dominated by the exports of natural resources. For instance, Ghana's main export product is gold, while Nigeria is reliant on oil and petroleum exports. Thus, estimating income from exports rather than using gross export values, generates new insights. Indeed, when examining gross values, there are discernible differences in the shares. In 2007, the manufacturing share is 9% based on gross exports, a significant contrast to the 3% based on domestic value-added exports. These differences are particularly evident in the services sector, where the value added is often indirect. Consequently, shares based on gross exports tend to underestimate the income generated by services through exports. For instance, in 2007, the share of business and finance services is 2.2% based on gross exports, contrasting with the 3.1% calculated based on value-added exports. Between 1990 and 2007, there was an increase in income derived from business and finance services, as well as other services, which encompass both direct and indirect services. The indirect services include, for instance, the provision of financial services.

There is a small increase in the value-added export share of GDP from manufacturing, rising from 2.9% to 3.0% between 1990 and 2007. Which industries are responsible for this expansion? Our findings

suggests this originates from industries C16 to C25, encompassing manufacturing activities related to natural resources, such as petroleum refining and fabricated metal products (see Appendix Table B1). However, by 2019, this share drops to 2.5%. The decline can be attributed to the same industries; for example, the sectoral value-added exports of minerals, basic and fabricated metals (C23 to C25) experienced a decrease from 0.9% to 0.5%. This decline in the manufacturing export share is almost entirely accounted for by the 0.6% decrease in the nominal value-added exports of these specific industries.[14]

Figure 3. Sectoral domestic value added from exports (% of GDP)



Notes: B&F services are business and finance services (ISIC rev. 4 codes JtK).

#3: Increasing diversification of value -added content of exports. Initially, low-income nations specialize in simple goods, focusing on a narrow range of products (Imbs and Wacziarg, 2003). With economic growth, they transition to more complex products, diversifying the range of exported products. The shift involves moving from exporting raw materials to complex manufactured goods. Schott (2004) redirected the focus from overall product groups (e.g., apparel versus machinery) to specific varieties within those groups (e.g., simple t-shirts versus designer dresses). The capital intensity of the Italian textile industry, for instance, may surpass that of the Ethiopian industry not

[14] Part of these changes in sectoral shares are due to changes in relative prices. For example, crude oil prices rose from 28 US$ per barrel in 2000 to 94$ in 2008, dropped and then peaked again in 2012 at 109$, whereas services prices are much less volatile. Addressing this issue requires input-output tables in previous years' prices, which is an important task for future data development.

solely due to labor efficiency but because the two countries manufacture fundamentally different goods.

Recent research on export specialization has revealed unexpected instability in product export specialization (Daruich et al, 2019). Export rankings show no persistence, with new top products and destinations replacing old ones. This pattern is unlikely to be solely attributed to measurement error. The substantial share of idiosyncratic variance (approximately 30%) at the source-product-destination level further highlights the challenge in predicting export success based on source country characteristics. Yet, the surprising findings might stem from overlooking the reality that countries no longer export just products but undertake activities due to the fragmented nature of the production process. In the contemporary global landscape, nations engage in activity-oriented trade rather than product-centric exchanges. The significant reduction in communication and coordination costs has spurred the decentralization of production across borders.

We consider diversification in exports, by exploring value added exports for each of the twenty sectors. To assess the level of diversification in a country's exports, one can calculate the Herfindahl index. This index is derived by summing the squared shares of sectoral value-added exports. The resulting numerical value serves as an indicator of the concentration or diversification within the export sectors of the economy. Lower Herfindahl index values suggest a higher degree of export diversification, indicating that a country is less reliant on a few sectors for its export revenue. In contrast, higher values signify a more concentrated export structure, highlighting dependence on a limited set of sectors for economic exports.

The results for Sub-Saharan African (SSA) economies, as shown in Table 4, indicate a noteworthy trend. The aggregate trend suggests a consistent increase in diversification between 1990 and 2007, which continued albeit at a slower pace from 2007 to 2019. Notably, the diversification in value-added exports is particularly evident in countries such as Ethiopia, Rwanda, and Tanzania during the period spanning from 1990 to 2007. These findings suggest key African countries are experiencing substantial diversification in their value-added exports. The diversification of value-added content of exports can contribute to economic resilience by reducing dependency on specific sectors, thereby mitigating risks associated with commodity price volatility. It is important to note, however, that certain key products may be responsible for the value-added exports of various sectors, especially in the context of the indirect provision of services.

Table 4. Herfindahl index

Country	1990	2007	2019
Cameroon	0.10	0.13	0.14
Ethiopia	0.63	0.39	0.20
Ghana	0.14	0.12	0.21
Kenya	0.23	0.16	0.16
Mauritius	0.14	0.15	0.15
Nigeria	0.41	0.37	0.39
Rwanda	0.35	0.22	0.15
Senegal	0.11	0.13	0.12
Tanzania	0.33	0.13	0.15
South Africa	0.14	0.12	0.10
Zambia	0.22	0.13	0.15
Average SSA	0.26	0.19	0.17

Notes: Herfindahl index is the sum of squared shares of value-added exports by each of the twenty sectors in a particular country*year. It ranges from 0 to 1, with lower values indicating higher levels of diversification.

#4: Rising number of manufacturing jobs sustained by exports. Gross trade in many African nations is often dominated by the exports of natural resources. Despite the substantial contribution of these resources to exports, concerns linger regarding the job opportunities generated by mining activities. It is argued that exporting products beyond mining, especially manufactured goods, holds greater potential for employment generation. In this subsection, we explore the relationship between the export composition and employment dynamics. Shifting the focus from income patterns to employment, we can modify the row vector $\tilde{\mathbf{v}}_s$ in equation (3). Specifically, this adjustment involves configuring the row vector to represent the employment to gross output ratio.

The first three columns in Table 5 present the quantity of jobs (in thousands) supported by exports. As in previous cases, the 20 sectors are consolidated into five sectors. Table 5 aims to dissect elements of the export vector, shedding light on the workforce stimulated by exports of agricultural, mining, and manufacturing products, as well as services. For example, employment induced by agricultural exports is estimated by setting all elements in the export vector **e**, except agricultural exports, to zero. A similar procedure is adopted for the exports of mining, manufacturing, and services.

Exports of agricultural products account for 6.4 million workers in 1990, rising to 10.4 million by 2007. However, a marked shift occurred thereafter. By 2019, employment induced by agricultural exports

reduced to 7.9 million workers. In stark contrast, jobs related to exports of manufactured goods rose from a modest 4.1 million workers in 1990 to 8.6 million workers in 2019. This transition aligns with the expansion of exported manufacturing products, the manufacturing renaissance (Kruse et al. 2022), and the increasing participation in manufacturing global value chains (Rodrik, 2018).

Mining, despite its substantial share in gross exports, generates little employment. While it does contribute to employment to some extent, the workforce it sustains is notably less considering its prominent contribution to exports. Comparatively, mining even yields less employment than agricultural exports in countries such as Nigeria and South Africa.[15]

While services might not carry the weight of traditional industrial sectors, their role in employment creation is undeniable. In particular, business and financial services exports induced employment growth at a noteworthy pace. Starting at 0.1 million workers in 1990, to 0.4 million by 2007 and rose further to 1.1 million by 2019. This phenomenon is intertwined with the rapid expansion of the services sector (de Vries, 2015), reflecting evolving economic structures away from agriculture and towards manufacturing and services activities.

This overarching trend is observable across most Sub-Saharan African (SSA) countries, albeit with exceptions (discussed below). The last columns in Table 5 provide context to the sectoral jobs supported by exports by presenting it as a share of total employment. Notably, in the aggregate, jobs sustained by exports exhibited a faster growth rate than the overall workforce from 1990 to 2007. However, post-2007, the growth rate of jobs derived from exports lagged behind the growth rate of the aggregate labor force. Mauritius, for instance, was rapidly de-industrializing over the past decades (Rodrik, 2016), which is mirrored in the diminished share of induced employment from manufacturing exports. Conversely, other African nations have industrialized, as suggested by our analysis. In Rwanda, the share of employment induced by manufacturing exports increased from 1% in 1990 to 5.8% by 2019. Similarly, Ghana experienced growth, with the share rising from 2% in 1990 to 4.7% in 2019, reflecting a parallel trend in industrial expansion.

Table 5. Number of jobs sustained by foreign demand

	Jobs induced by foreign demand (thousands)			Share (in total employment)		
from:	1990	2007	2019	1990	2007	2019

[15] Country-specific results are available upon request.

Agriculture	6,406	10,430	7,858	6.3%	6.6%	3.2%
Mining	1,895	2,715	2,392	1.9%	1.7%	1.0%
Manufacturing	4,077	7,746	8,643	4.0%	4.9%	3.5%
B&F services	106	425	1,106	0.1%	0.3%	0.4%
Other services	1,146	3,027	6,545	1.1%	1.9%	2.6%
Total	13,628	24,343	26,544	13.3%	15.5%	10.7%

Notes: B&F services are business and finance services (ISIC rev. 4 codes JtK).

#5: Growing inter-industry linkages. Inter-industry linkages are limited at lower levels of economic development and only tend to increase as countries develop, a trend documented by Chenery et al. (1986) and recently emphasized by Valentinyi (2021). The average pattern of these linkages is depicted in Table 6, illustrating jobs sustained by foreign demand for the five broad sectors, namely agriculture, mining, manufacturing, business and finance services, other services, and the overall economy in 1990, 2007, and 2019. In this context, direct jobs pertain to the exporting sector, while indirect jobs encompass those in other sectors associated with the exporting sector. Direct and indirect jobs are measured using time series of country- and industry-specific employment to gross output ratios as the requirements vector in equation (3), and by diagonalizing the vector **e**. Table 6 reports aggregate results, where the country-specific results are aggregated before estimating the share of direct and indirect jobs involved in exports.

Examining the overall trend, we observe a gradual expansion of domestic linkages, evident in the rising share of workers who are indirectly involved in export-related activities. The share increases from 28% in 1990 to 37% in 2019. This shift is in particular discernible for agriculture, business and finance services, and other services, with the notable exception being manufacturing. Furthermore, the analysis reveals substantial variation in the proportion of indirect workers engaged in exports. This variation ranges from low involvement in agriculture to high engagement in mining and manufactured products, with services falling in between. The levels and trends underscore the dynamic interplay between exports, employment, and industrial development.

Table 6. Number of direct and indirect jobs sustained by foreign demand

	Agricultural products			Mining products			Manufacturing products		
	Direct	Indirect	Sum	Direct	Indirect	Sum	Direct	Indirect	Sum

Average SSA (weighted)

1990	98	2	100	48	52	100	40	60	100
2007	97	3	100	21	79	100	38	62	100
2019	93	7	100	21	79	100	41	59	100

	B&F services			Other services			Total economy		
	Direct	Indirect	Sum	Direct	Indirect	Sum	Direct	Indirect	Sum
1990	76	24	100	76	24	100	72	28	100
2007	77	23	100	77	23	100	70	35	105
2019	64	36	100	64	36	100	63	37	100

Notes: Average SSA (weighted). B&F services are business and finance services (ISIC rev. 4 codes JtK).

5. Concluding remarks

A pathfinding paper by Valentinyi (2021), commissioned by the STEG project, argues that the main constraint on making more progress in understanding the role of input-output networks in economic development in general, and in structural transformation in particular, is data constraints (Valentinyi, 2021).

This paper presented the African Supply and Use Tables (ASUT) database. The ASUT database is grounded in national statistics and adheres to national accounting principles. To construct the ASUT database, we harmonize and standardize official SUTs from NSIs and benchmark them to national accounts data. We examine country-specific data sources to address inconsistencies, structural undercounting, and misclassifications, aiming to achieve internal, intertemporal, and international consistency. The ASUT database provides annual time series of supply and use tables (SUTs) and Input-Output tables (IOTs) for 11 major African economies. These countries account for about 70% of GDP in sub-Saharan Africa.

We use a novel input-output method to explore the role of exports for jobs and income in African countries. The input-output analysis based on the ASUT database reveals five key results for African economies. Firstly, these economies face increased international competition during a period in which the production process has become more fragmented. Secondly, there is a growing share of domestic value-added exports attributable to manufacturing and, more importantly, services. Thirdly, there is an increase in the diversification of value-added content of exports, especially between 1990 and 2007, and this trend continues, albeit at a slower pace, from 2007 to 2019. Fourthly, the number of manufacturing jobs sustained by exports has risen, increasing from 4.1 million workers in 1990 to 8.6

million workers by 2019. Finally, there is a noticeable growth in inter-industry linkages, particularly observed in the services sector.

As new research on the role of demand in development comes to the fore (Goldberg and Reed, 2023), this paper presents evidence on the role and composition of foreign demand for jobs and income in sub-Saharan Africa. In the process, we noted that the majority of African countries are not only constructing supply and use tables but also improving their estimates. However, there still exist major statistical challenges (Devarajan, 2013). The future likely holds improvements in the availability of measures for both current and historical periods. The ASUT Database serves as a valuable initial resource and it may serve as a useful benchmark for any researcher constructing country-specific data for sub-Saharan African economies.

References

Aragie, E., Thurlow, J. (2021). 2018 Social Accounting Matrix for Ethiopia: A Nexus Project SAM. Data Paper. Washington, DC: International Food Policy Research Institute (IFPRI). doi: 10.2499/p15738coll2.134821. https://doi.org/10.2499/p15738coll2.134821.

Ahmed, H. A., Tebekew, T, Thurlow, J. (2017). 2010/11 Social Accounting Matrix for Ethiopia: A Nexus Project SAM. Washington,DC: International Food Policy Research Institute (IFPRI). http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/131505/filename/131720.pdf

Baldwin, R (2009), 'The Great Trade Collapse: Causes, Consequences and Prospects', CEPR Press, Paris & London. https://cepr.org/publications/books-and-reports/great-trade-collapse-causes-consequences-and-prospects

CSO (2014). Gross Domestic Product 2010 Benchmark Estimates Summary Report. Central Statistical Office, Republic of Zambia

CSO (2017). 2 0 1 0 Supply, Use And Input Output Tables Report. Central Statistical Office, Republic of Zambia

Daruich, D., Easterly, W., & Reshef, A. (2019). The surprising instability of export specializations. *Journal of Development Economics*, *137*, 36-65.

Devarajan, S. (2013). Africa's statistical tragedy. *Review of Income and Wealth*, 59, S9-S15.

Diao, X., Ellis, M., McMillan, M., and Rodrik, D. 2021. Africa's manufacturing puzzle: Evidence from Tanzanian and Ethiopian firms. NBER Working Paper No. 28344

Diao, X., McMillan, M., Rodrik, D. (2019). The Recent Growth Boom in Developing Economies: A Structural-Change Perspective. In: Nissanke, M., Ocampo, J. (eds) The Palgrave Handbook of Development Economics. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-14000-7_9

Dietzenbacher, E., B. Los, R. Stehrer, M. Timmer, and G. J. de Vries, "The Construction of World Input–Output Tables in the WIOD Project," Economic Systems Research25 (2013):71–98.

Ethiopian Development Research Institute (EDRI); Institute of Development Studies (IDS); and International Food Policy Research Institute (IFPRI). 2014. Ethiopia Social Accounting Matrix (SAM), 2005-06. Addis Adaba; and Washington, DC: Ethiopian Development Research Institute (EDRI); and International Food Policy Research Institute (IFPRI) [dataset]. http://dx.doi.org/10.7910/DVN/28527

Eurostat. (2008) Eurostat Manual of Supply, Use and Input-Output Tables. Luxembourg, Eurostat.

Feenstra, Robert C., Hong, Chang, 2010. China's exports and employment. In: Feenstra, R.C., Wei, Shang-Jin (Eds.), China's Growing Role in World Trade. University of Chicago Press, Chapter 5.

Feenstra, R C., Inklaar R, and Timmer, M P (2015). "The Next Generation of the Penn World Table." *American Economic Review*, 105 (10): 3150-82**.**

Gaulier, G., and S. Zignago (2010). 'BACI: International Trade Database at the Product-Level. The 1994–2007 Version'. CEPII Working Paper 2010-23. Paris: Centre d'Études Prospectives et d'Informations Internationales. https://doi.org/10.2139/ssrn.1994500

Goldberg, P. K., & Reed, T. (2023). Presidential Address: Demand-Side Constraints in Development. The Role of Market Size, Trade, and (In) Equality. *Econometrica*, 91(6), 1915-1950.

GSS (2023). National Accounts Manual: Sources and Methods. *Ghana Statistical Service, April 2023*

Hirschmann, A. O. (1958). The Strategy of Economic Development. Yale University Press, New Haven, Connecticut.

Hummels, D., Ishii J., and Yi, K M. 2001. "The Nature and Growth of Vertical Specialization in World Trade." Journal of International Economics 54 (1): 75–96.

Imbs, J., & Wacziarg, R. (2003). Stages of diversification. *American economic review*, *93*(1), 63-86.

International Food Policy Research Institute (IFPRI). 2021. 2018 Social Accounting Matrix for Ethiopia. Washington DC: IFPRI [dataset]. https://doi.org/10.7910/DVN/NAAJII. Harvard Dataverse. Version 1.

Johnson RC. 2018. Measuring Global Value Chains. Annual Review of Economics Vol. 10:207-236 https://doi.org/10.1146/annurev-economics-080217-053600

Johnson RC. 2014. Trade in intermediate inputs and business cycle co-movement. Am. Econ. J. Macroecon. 6:39–83.

Johnson RC, Noguera G. 2012a. Accounting for intermediates: production sharing and trade in value added. J. Int. Econ. 82:224–36

Koopman R, Wang Z, Wei SJ. 2014. Tracing value-added and double counting in gross exports. Am. Econ. Rev. 104:459–94

KNBS (2022). Revision and Rebasing of National Accounts: Sources and Methods. Kenya National Bureau of Statistics

Kruse, H., E. Mensah, K. Sen and G. de Vries (2023). A Manufacturing (Re)Naissance? Industrialization in the Developing World. *IMF Economic Review* **71**, 439–473

Los, B., & Timmer, M. P. (2018). *Measuring bilateral exports of value added: a unified framework* (No. w24896). National Bureau of Economic Research.

Los B, Timmer MP, de Vries GJ. 2016. Tracing value-added and double counting in gross exports: comment. Am. Econ. Rev. 106:1958–66

Los, B., Timmer MP, de Vries G J. 2015. How important are exports for job growth in China? A demand side analysis, Journal of Comparative Economics, Volume 43, Issue 1, 19-32

McMillan, M; Zeufack A. (2022). "Labor Productivity Growth and Industrialization in Africa." *Journal of Economic Perspectives*, 36 (1): 3-32**.**

Mensah B, Owusu S, Foster-McGregor N, Szirmai A. (2023). Structural Change, Productivity Growth and Labour Market Turbulence in Sub-Saharan Africa, *Journal of African Economies*, Volume 32, Issue 3, 175–208, https://doi.org/10.1093/jae/ejac010

Mensah, E. B. (2020). Is sub-Saharan Africa deindustrializing? (No. 2020-045). United Nations University-Maastricht Economic and Social Research Institute on Innovation and Technology (MERIT).

NBS (2014a). Methodology Notes On Gross Domestic Product (GDP) Rebasing Exercise. Nigeria Bureau of Statistics

NBS (2014b). Nigerian GDP Post Rebasing Revision 1981 to 2010. Nigeria Bureau of Statistics

NBS (2019). The Revised National Accounts Statistics for Tanzania Mainland Base Year 2015: Sources and Methods. *National Bureau of Statistics, Ministry of Finance And Planning, United Republic of Tanzania*

NISR (2014). The 2011 Supply Use Table: An Explanatory Note. National Institute of Statistics of Rwanda, June 2014.

Pahl S, Timmer MP, Gouma R, Woltjer PJ. (2022). Jobs and Productivity Growth in Global Value Chains: New Evidence for Twenty-five Low- and Middle-Income Countries, The World Bank Economic Review, Volume 36, Issue 3, August 2022, Pages 670–686, https://doi.org/10.1093/wber/lhac003

Rodrik, D. 2016. Premature deindustrialization. Journal of Economic Growth 21: 1–33

Schott, P. K. (2004). Across-product versus within-product specialization in international trade. *The Quarterly Journal of Economics*, *119*(2), 647-678.

SM (2022). Concepts, Definitions, Data Sources and Methods for compiling Annual National Accounts Estimates. *Statistics Mauritius*

Sposi, M., Yi, K. M., Zhang, J. 2021. Deindustrialization and industry polarization. NBER Working Paper No. 29483.

Sposi, M. (2019). Evolving comparative advantage, sectoral linkages, and structural change, Journal of Monetary Economics, Volume 103, 2019, Pages 75-87.

Sposi, M; Yi, K; Zhang, J. (2018). Accounting for Structural Change Over Time: A Case Study of Three Middle-Income Countries

STATS SA (2021). National Accounts: Sources and Methods. *Statistics South Africa*

Temurshoev, U. and Timmer, M.P. (2011), Joint estimation of supply and use tables. Papers in Regional Science, 90: 863-882. https://doi.org/10.1111/j.1435-5957.2010.00345.x

UNECA(2020). Progress Report on the Implementation of the 2008 System of National Accounts in Africa. Statistical Commission for Africa, United Nations Economic Commission for Africa.

Valentinyi, A. (2021). Structural Transformation, Input-Output Networks, and Productivity Growth. STEG Pathfinding Paper.

Appendix A: Comparison to other datasets

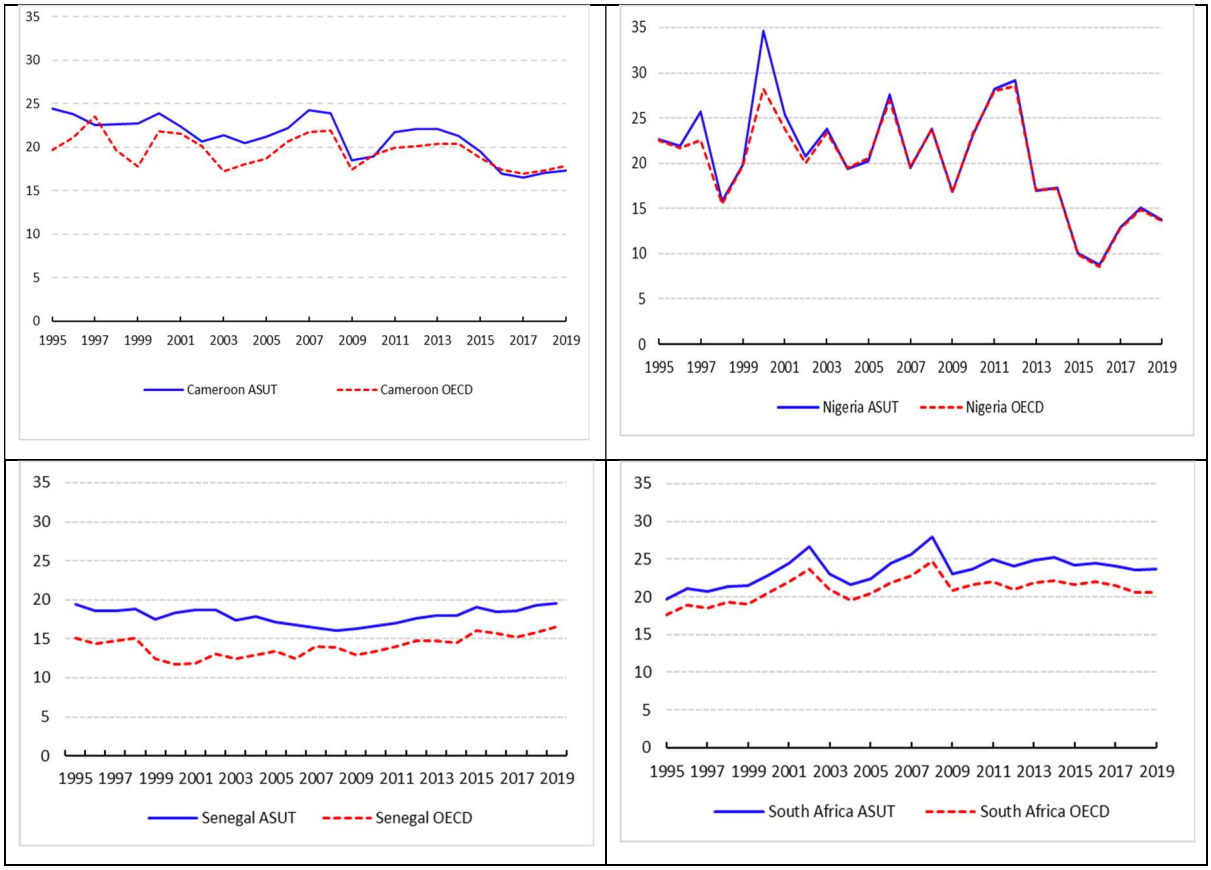
This appendix compares the findings to alternative datasets that include sub-Saharan African countries. In particular, the November 2022 release of the OECD Inter-Country Input-Output Tables (ICIOTs) includes five sub-Saharan African nations: Cameroon, Ivory Coast, Nigeria, Senegal, and South Africa. These tables are compiled for the time span between 1995 and 2020, enabling a comparative analysis with the ASUT dataset, which pertains to the period from 1995 to 2019.[16]

Figure A1 shows the average exports of value added (VAX-D) as a percentage of GDP for Cameroon, Nigeria, Senegal, and South Africa using both the ASUTs and ICIOTs datasets. Two observations arise from this comparison. Firstly, there is a notable correlation between the datasets in terms of how value-added measures align, corroborating findings highlighted by Johnson (2014) in a broader context. The findings presented here indicate the correlation extends to sub-Saharan African countries, often characterized by data of perceived lower quality. The overall pairwise correlation between the two datasets is substantial, ranging from 0.56 for Senegal to 0.99 for Nigeria (using the Spearman rank correlation method).

Secondly, when based on the ASUT dataset, the levels of VAX-D ratios tend to be higher for Senegal and South Africa. This disparity might be attributed to various factors, including the treatment of re-exports, which are excluded in the ASUT dataset. Nonetheless, other factors such as the estimation of the domestic intermediate use matrix could also contribute to this disparity, necessitating further in-depth investigation. It is worth noting that the VAX-D ratio does not consistently manifest as higher in the ASUTs compared to the ICIOTs, as evidenced in the cases of Cameroon and Nigeria.

Figure A1. Value added exports as a share of GDP, comparisons

[16] The Ivory Coast is not included in the ASUT dataset. Additionally, a related dataset to the ICIOTs, the Trade in Employment release 2021, only furnishes employment data by industry for South Africa. This limits a comparison of the job content in exports for SSA countries based on the ASUT and ICIOT dataset.



Notes: OECD refers to the estimates based on the OECD ICIOTs, November 2022 release.

Appendix B: Tables and Figures

Table B1. Products distinguished in the ASUT database

CPC 2.1 Division	***Product label in ASUT database***	***Description***
D01t04	Agriculture	Agriculture, forestry and fishery products
D11t16	Mining	Ore and mineral products
D21t25	Food	Meat, fish, fruits, vegetables, oils and fats; Dairy products and egg products; Grain mill products, starches and starch products; other food products; Beverages ; Tobacco products
D26t29	Textiles	Yarn and thread; woven and tufted textile fabrics; Textile articles other than apparel; Knitted or crocheted fabrics; wearing apparel; Leather and leather products; footwear
D31t32	Wood, paper & printing	Products of wood, cork, straw and plaiting materials, pulp, paper and paper products; printed matter and related articles

D33t36	Fuel, Chemicals & Rubber	Coke oven products; refined petroleum products; nuclear fuel Basic chemicals; Other chemical products; man-made fibers; Rubber and plastics products
D37, D41t42	Metals & Non-metallic minerals	Glass and glass products and other non-metallic products n.e.c. Basic metals; Fabricated metal products, except machinery and equipment
D45t48	Electronics	Office, accounting and computing machinery; Electrical machinery and apparatus; Radio, television and communication equipment and apparatus; Medical appliances, precision and optical instruments, watches and clocks
D43t44	Machinery	General-purpose machinery; Special-purpose machinery
D49	Transportation equipment	Transport equipment
D38	Other manufacturing	Furniture; other transportable goods n.e.c.
D17t16, D94	Utilities	electricity, gas and water Sewage and waste collection, treatment and disposal and other environmental protection services
D53t54	Construction	Constructions; Construction services
D61t63	Trade	Wholesale trade services; Retail trade services; Accommodation, food and beverage services
D64t68	Transport	Passenger transport services Freight transport services; Rental services of transport vehicles with operators; Supporting transport services; Postal and courier services
D81t89	Business services	Business and production services
D71	Financial services	Financial and related services
D72t73	Real estate	Real estate services; Leasing or rental services without operator
D91t93	Public administration	Public administration and other services provided to the community as a whole; compulsory social security services; Education services; Human health and social care services
D95t99	Other services	Services of membership organizations ;Recreational, cultural and sporting services; Other services; Domestic services; Services provided by extraterritorial organizations and bodies

Table B2: Other variables

Variable	*ASUT Label*	*Description*
Columns		
xCONS_h	Household consumption	Final consumption expenditure by households
xCONS_g	Government consumption	Final consumption expenditure by government
xGFCF	Gross fixed capital formation	Gross fixed capital formation
xINV	Changes in inventories	Changes in inventories and valuables
xX	Exports	Exports
xM	Imports	Imports
xSUP_bas	Total Supply at Basic Prices	Total Supply at Basic Prices
xMRG	Trade and Transport Margins	Trade and Transport Margins
xTXSP	Taxes less Subsidies on products	Taxes less Subsidies on products
xSUP_pur	Total Supply at Purchaser Prices	Total Supply at Purchaser Prices
Rows		
xII	Intermediate Inputs	Intermediate Inputs
xVA	Value Added	Value Added at basic prices
xGO	Gross Output	Gross Output at basic prices

B3. Sectoral value added exports as a % of GDP, by country

		Sector					
		Agriculture	Mining	Manufacturing	B&F services	Other services	Total
Cameroon	1990	4.0	2.6	7.7	3.5	5.7	23.6
Cameroon	2007	3.8	5.9	4.3	4.1	6.2	24.2
Cameroon	2019	3.4	4.2	2.7	2.2	4.8	17.3
Ethiopia	1990	4.6	0.1	0.4	0.1	0.6	5.8
Ethiopia	2007	7.5	0.3	0.7	0.8	3.1	12.4
Ethiopia	2019	2.5	0.0	0.4	0.6	3.1	6.7
Ghana	1990	2.1	0.6	1.8	1.4	1.9	7.8
Ghana	2007	3.4	1.4	3.4	2.8	4.8	15.8
Ghana	2019	2.5	8.6	3.2	2.4	4.3	21.0
Kenya	1990	6.3	0.3	2.8	1.3	3.7	14.3
Kenya	2007	5.9	0.4	4.7	1.8	4.8	17.6
Kenya	2019	3.1	0.3	1.8	1.6	3.2	10.1
Mauritius	1990	9.0	0.1	16.9	6.4	13.7	46.1
Mauritius	2007	1.9	0.1	10.8	8.4	20.7	42.0
Mauritius	2019	0.8	0.0	5.9	13.3	14.9	34.9
Nigeria	1990	0.9	12.6	2.2	1.3	2.9	20.0
Nigeria	2007	1.1	11.2	1.5	1.3	4.5	19.5
Nigeria	2019	0.9	8.2	1.5	0.5	2.7	13.8
Rwanda	1990	3.2	0.1	0.6	0.8	0.9	5.6
Rwanda	2007	2.4	0.8	0.8	5.2	3.1	12.3
Rwanda	2019	3.3	1.2	2.0	4.9	4.8	16.3
Senegal	1990	1.8	0.7	4.4	3.5	5.5	15.9
Senegal	2007	1.2	0.6	3.5	4.5	6.5	16.4
Senegal	2019	2.4	3.2	3.3	3.8	6.9	19.6
Tanzania	1990	3.8	0.1	1.2	0.4	1.3	6.9
Tanzania	2007	4.2	2.2	2.5	2.2	4.8	16.0
Tanzania	2019	3.2	3.4	1.6	2.3	3.7	14.2
South Africa	1990	0.9	6.8	5.3	2.1	5.8	20.9
South Africa	2007	0.6	7.0	5.9	4.0	8.2	25.6
South Africa	2019	0.8	5.1	5.6	3.2	9.0	23.6
Zambia	1990	5.1	15.2	2.8	3.8	10.3	37.1
Zambia	2007	5.2	6.4	3.0	4.1	13.2	31.9
Zambia	2019	1.5	5.3	2.4	4.0	16.7	29.9

Notes: B&F services are business and finance services (ISIC rev. 4 codes JtK).

Appendix C. Country-specific sources and methods

This appendix describes the country-specific data sources and methodologies. It describes the benchmark SUTs, national accounts, sectoral production, and trade data that serve as the basis for estimating the time-series national supply and use tables (SUTs).

1. Cameroon

Cameroon compiles annual Supply and Use Tables (SUTs). We obtained time series SUTs for the period 1993-2019. These SUTs have been harmonized and benchmarked to consistent time series data on expenditure, production and trade. The table and notes below explains the sources and harmonization procedure. The information is divided into two segments: one focusing on the Benchmark SUTs, and the other addressing external data requirements.

	Data	Sources	Notes
Benchmark SUTs	SUTs, 1993-2019	NSI	Annual SUT time series from 1993 to 2019 are used as our benchmark tables
External data requirements	Total VA, 1990-2018	ETD	Total VA from ETD is used as our GDP estimate for the period 1990-2018
	Total VA, 2019	2019 SUT	The total VA from the ETD is updated to 2019 using total VA data from the 2019 SUT.
	Expenditure shares, 1990-2019	PWT10	Household consumption share, government consumption share, investment share, export share, import share and share of inventories in GDP are computed from PWT10
	Sectoral value added to gross output (VAtGO) ratios, 1990-2019	SUTs	The sectoral VAtGO ratios are computed from the SUTs
	Sectoral value added shares, 1990-2019	ETD and SUTs	Sectoral shares are computed from the ETD and SUTs. See notes below.
	Sectoral exports and imports shares, 1990-2019	SUTs and BACI	Sectoral trade shares from 1990-1992 are computed from the BACI database

Sectoral trade shares for 1993-2019
are computed from SUTs

Preparing the Benchmark SUTs

- To estimate SUT time series for Cameroon, we use 48 products by 48 industries supply and use tables from the NSI for 1993-2019. Because we have detailed supply and use tables for almost all the years we study, we aggregate the SUTs to the 20 ASUT sectors in ISIC Rev.4.
- The SUPPLY table is estimated in basic prices whereas the USE table is estimated in purchaser's prices. The difference between basic price and purchaser's price is sector-specific trade and transport margins and taxes net subsidies. In order to estimate ASUT time series for Cameroon, the USE table needs to be transformed to basic price. To express the USE table in basic price, the so-called valuation matrices – which contains sector-specific trade and transport margins and net taxes - must be deducted from USE table. The valuation matrices (margins matrix and net taxes on products matrix) are not available from NSI. We estimate the valuation matrices using the procedure outline above in the general sources and methods.

Preparing External Data Requirements

- ***GDP at basic prices*** is total value added from the ETD. The total value added from the ETD is updated from 2018 to 2019 using data from the 2019 SUT.
- ***Sectoral value added shares*** are computed from the ETD except for the manufacturing industries. The sectoral value added shares for manufacturing industries are estimated from SUTs.
- ***Expenditure shares*** (Consumption, Investment, Imports, Exports, and Inventory) are computed from the PWT10.0.
- ***Value added to gross output (VAtGO) ratios*** for all industries are calculated from the SUTs for 1993-2019. We then extrapolated backwards to 1990.
- ***Sectoral exports and exports shares*** for all industries are computed from the SUTs for the 1993-2019. For the period 1990-1992, the shares are calculated from the BACI database.

2. Ethiopia

This study constructs three benchmark SUTs for Ethiopia using the 2005, 2011, and 2018 social accounting matrices (SAMs). The SAMs are constructed by IFPRI and its partners, and it is publicly available on Dataverse. The main distinguishing feature of the ASUT is that is grounded in national statistics therefore our preferred source of benchmark tables is NSI. However, SUTs are not available from the NSI of Ethiopia. Despite indication from UNECA's(2020) report that NSI of Ethiopia estimates SUTs, we did not find SUTs from NSI. As a second best solution, we use the SAMs compiled by IFPRI, which is equally grounded in national statistics.[17] The table below summarizes all sources. The notes below also show how the SAMs were transformed into SUTs and how the external data requirements were compiled.

[17] We carefully examine the sources used in compiling the SAMs. Our study show that the underlying data was mostly sourced from official statistics and estimates are consistent with national accounts data on expenditure, income, and value added as well as official trade data.

	Data	Sources	Notes
Benchmark tables	2005, 2011, 2018 SAMs	IFPRI and partners**	The SAMs are transformed to SUTs and used as benchmark tables.
External data requirements	Total VA, 1990-2018	ETD	This is used as our GDP estimate for 1990-2018
	Total VA, 2019	UNOCD	Used to update the Total VA to 2019
	Expenditure shares, 1990-2019	PWT10	Household consumption share, government consumption share, investment share, export share, import share, and share of inventories in GDP are calculated from PWT10
	Sectoral value added to gross output ratios, 1990-2019	SUTs, UNIDO INDSTATS (2022),	VAtGO ratios for all sectors in 2005, 2011, and 2018 are calculated from benchmark SUTs. The VAtGO ratios for manufacturing industries in non-benchmark years are calculated from the UNIDO INDSTATS (2022). See notes
	Sectoral value added shares, 1990-2019	ETD and its 2-Digit Manufacturing Database	Sectoral value added shares are computed from these sources.
	Sectoral exports and imports shares, 1990-2019	SUTs and BACI	Exports and imports from the SUTs are used as benchmark trade data. We extrapolate backwards from 2005 and interpolate between benchmark years using data from BACI database.

**Notes: IFPRI partners include (*i*) Ethiopian Development Research Institute (EDRI), (*ii*) Institute of Development Studies at University of Sussex, and (*iii*) Economic and Policy Analysis Unit, Addis Ababa, Ethiopia. Partner (*i*) and (*ii*) were involved in the construction of 2005 SAM and partner (*iii*) was involved in the construction of 2011 SAM. The 2011 and 2018 SAMs are the so-called "nexus" SAMs. The nexus SAMs are compiled together with national statistical agencies.

Preparing the Benchmark SUTs

- The **2005 SAM** distinguishes 42 production activities (sectors) and 61 commodities (products). It also identifies accounts for private consumption, government, exports, imports,

investments, trade margins, and transport margins (Ahmed et al., 2017). The underlying sources document provides a mapping of activities and commodities to ISIC Rev 3.1.

- The **2011 SAM** distinguishes 70 activities. Each activity corresponds to a set of industries according to the ISIC Revision 4. Based on a concordance between ISIC industries and Harmonized System products (HS Version 2007), activities and commodities have a one-to-one mapping. It identifies all relevant information on consumption and investments as well as aggregate accounts for net taxes, trade margins, transports margins, and the rest of the world.
- The **2018 SAM** classifies production into 42 activities, with each activity corresponding to a specific group of industries as defined by the ISIC Rev.4 classification. Based on a concordance between ISIC industries and Harmonized System products (HS Version 2012), there is a one-to-one mapping between activities and commodities. It distinguishes household's own consumption from marketed consumption of commodities. It has detailed information on investment, net taxes, trade margins, transports margins, and transactions with rest of the world.
- First, we map all activities and commodities to ISIC Rev. 4 for all the SAMs.
- The SAMs are then transformed into SUTs as follows: First, we combine information from the marked output matrix, transaction costs matrix, net taxes vector, and imports vector to create the supply tables. Second, we create the use tables using information from the intermediate use matrix, final consumption matrix, investment, and exports vectors. The resulting three SUTs has different dimensions: 61 products by 42 industries for 2005 SUT, 70 products by 70 industries for 2011 SUT, and 42 products by 42 industries for the 2018 SUT. We concord all the SUTs to the 20 ASUT sectors adopted for this study (see Table A1 above).
- The activity accounts (and the resulting supply tables) are typically valued at producer prices whiles the in commodity accounts (and the resulting use tables) are valued at purchaser's price, i.e., inclusive of indirect taxes and transactions cost margins. We express the supply and use tables in basic prices.

Preparing External Data Requirements

- ***GDP at basic prices*** is total value added from the ETD. The total value added from the ETD is updated from 2018 to 2019 using data from UNOCD.
- ***Sectoral value added shares*** are computed from the ETD except for the manufacturing industries. The sectoral value added shares for manufacturing industries are estimated from ETD's unpublished 2-digit manufacturing database.
- ***Expenditure shares*** (Consumption, Investment, Imports, Exports, and Inventory) are computed from the PWT10.0. Inventory share is all zero in the benchmark table. A cross check with PWT10 show zeros at the aggregate level from 1990 to 2019.
- ***Value added to gross output (VAtGO) ratios:*** Gross output data in recent decades are not available in the UNOCD and from the NSI. However, for manufacturing industries available in the UNIDO INDSTATS (2022) for most years. As a result, VAtGO ratios for manufacturing sector are calculated from the UNIDO INDSTATS (2022) in non-benchmark years. VAtGO ratios for all sectors in 2011 are calculated from the benchmark SUT. For non-manufacturing sectors VAtGO ratios are calculated from the benchmark SUTs. We extrapolate backwards from the 2005 and interpolate between benchmark years.
- ***Sectoral exports and exports shares:*** Exports and imports from the SUTs are used as benchmark trade data. We extrapolate backwards from 2005 and interpolate between benchmark years using data from BACI database.

3. Ghana

In recent years, the Ghana Statistical Service (GSS) has undertaken substantial endeavors towards the construction of a social accounting matrix (SAM) and supply and use tables (SUTs). Two tables are publicly available on the GSS website: 2005 SAM and 2013 SUT. The underlying SUT of the 2005 SAM and the 2013 SUT have been established as primary benchmark tables for the 2010 and 2018 GDP rebasing, respectively. The 2005 SAM, which is an update of a 'provisional' 2004 SAM (GSS, 2006), was constructed using data from the 2003 Industrial Survey, 2005/06 Ghana Living Standard Survey (GLSS5), revised agricultural data from the Ministry of Food and Agriculture (MOFA) and data on government revenues and expenditures from the Ministry of Finance and Economic Planning (MOFEP). The 2013 SUT was constructed using the Integrated Business Enterprise Survey (IBES), which is the first non-household economic census covering all sectors in Ghana. The Phase 2 of the IBES provided essential data for estimating the 2013 SUT and the subsequent rebasing of the country's Gross Domestic Product.[18] Within the context of this study, the 2005 SAM and the 2013 SUT are adopted as our benchmark datasets. These tables have been effectively employed in the estimation and rebasing of GDP, aligning with the ASUT criteria, which necessitates its foundation in national statistical data. The table below summarizes the sources used to construct SUT time series for Ghana. The notes below outlines the procedure used in compiling and harmonizing the sources.

	Data	**Sources**	**Notes**
Benchmark tables	2005 SAM	NSI and IFPRI	The SAM was transformed to SUT and used as benchmark table
	2013 SUT	NSI	This table served as a benchmark table
External data requirements	Total VA, 1990-2018	ETD	This is used as our GDP estimate for 1990-2018
	Total VA, 2019	NSI	It is used to update the Total VA from ETD to 2019
	Expenditure shares, 1990-2019	PWT10	The proportions of Gross Domestic Product (GDP) allocated to household consumption, government consumption, investment, exports, imports, and inventories are computed from PWT10 data.
	Sectoral value added to gross output ratios, 1990-2019	NSI , SUTs, UNOCD, UNIDO INDSTATS (2020)	VAtGO ratios are calculated utilizing data from NSI, SUTs, and UNOCD, with the exception of manufacturing industries during non-benchmark

[18] For complete sources for the estimation of the 2013 SUT and subsequent GDP estimate see GSS(2023).

		years. For these specific cases, the VAtGO ratios pertaining to manufacturing industries in non-benchmark years are estimated by drawing on data from UNIDO INDSTATS (2022). See notes
Sectoral value added shares, 1990-2019	ETD, NSI, and the 2-Digit Manufacturing Database	Sectoral shares were computed from these three sources. See notes below
Sectoral exports and imports shares, 1990-2019	SUTs, NSI, and BACI	Total exports and imports are split into goods (agriculture, mining, manufacturing industries) and services using data from NSI. The sectoral trade shares for goods industries and services industries are calculated using information from BACI, SUTs, and NSI. See notes below.

Preparing the Benchmark SUTs

- The **2005 SAM** provides estimate of the structure of the Ghanaian economy. In addition, it provides detailed information on 56 production sectors, six factors of production, household income and spending in rural and urban areas, the government budget, and the balance of payments. It distinguishes activity account, which is valued at producer's price, and commodity account, which is valued at purchaser's price.
- First, we map all activities and commodities to ISIC Rev. 4. We then map the 2005 SAM into a SUT as follows: Information is extracted from the marked output matrix, transaction costs matrix, taxes vector, and imports vector to create the supply table in basic price. The use table is created using information from the intermediate use matrix, final consumption matrix, investment, and exports vectors. After transforming the SAM to SUT, we concord the SUT to the 20 ASUT sectors in Table A1. We express the use table in basic price by subtracting the valuation matrices from the use matrix in purchaser's price.
- Next, we harmonized the **2013 SUT**. The 2013 SUT is 20 products by 20 industries SUT with detailed information on production, consumption, factor income, capital formation, transaction margins, and net taxes on products. International Standard of Industrial Classification Revision 4 (ISIC Rev.4) was used to classify activities and commodity flows in the 2013 ASUT, which neatly maps to the ASUT sectors in Table A1 except for the manufacturing industries. Manufacturing industries are aggregated to one sector called "Manufacturing". We split aggregate manufacturing reported in the 2013 SUT into the nine manufacturing industries in Table A1 using gross out shares and intermediate input shares calculated from UNIDO INDSTAT (2022) for the SUPPLY matrix and USE matrix, respectively.

- The SUPPLY table is estimated in basic prices whereas the USE table is estimated in purchaser's prices. The difference between basic price and purchaser's price is sector-specific trade and transport margins and taxes net subsidies. To express the USE table in basic price, first, we build two valuation matrices for margins and net taxes on products, respectively, following the WIOD methodology (Dietzenbacher et al., 2013). The valuation matrices are subtracted from the use matrix in purchaser's price to obtain the use matrix in basic price.

Preparing External Data Requirements

- ***GDP at basic prices*** is total value added from the ETD. The total value added from the ETD is updated from 2018 to 2019 using data from NSI.
- ***Sectoral value added shares*** are computed from the ETD except for the manufacturing industries. The sectoral value added shares for manufacturing industries are calculated from ETD's unpublished 2-digit manufacturing database.
- ***Expenditure shares*** (Consumption, Investment, Imports, Exports, and Inventory) are computed from the PWT10.0.
- ***Value added to gross output (VAtGO) ratios*** of manufacturing industries are calculated from the UNIDO INDSTATS (2022) for all years. For all other sectors, *VAtGO* are calculated from sectoral gross output and value added data from NSI from 2013-2019, UNOCD from 1995 to 1999, and the 2005 SUT. We then interpolate or extrapolate for years we do not have primary information.
- ***Sectoral exports and exports shares*** are calculated in two steps. First, total exports and imports are split into goods and services using data from NSI. Second, exports and imports from the SUTs are used as benchmark trade data. We extrapolate backwards from 2005, forward from 2013, and interpolate between benchmark years using data from BACI database. We benchmark the shares from the second step to the goods and services shares computed from the NSI in the first step.

4. Kenya

For Kenya, we construct benchmark SUTs for the years 2003, 2009, and 2016. The benchmark tables are compiled from the 2003 SAM, 2009 SUT, and 2016 SUT. The 2003 SAM was compiled by Kiringai et al. (2006), a project which jointly involved the Kenya Institute for Public Policy Research and Analysis (KIPPRA) and the International Food Policy Research Institute (IFPRI). The 2009 and 2016 SUTs are constructed by the Kenya National Bureau of Statistics (KNBS)[19]. The 2009 and 2016 SUTs are used to estimate and rebase the GDP of Kenya. The tables and notes below summarizes the sources and the compilation of the Kenyan data.

	Data	Sources	Notes
Benchmark tables	2003 SAM	KIPPRA/IFPRI	The SAM was used to construct benchmark SUT for 2003.
	2009 and 2016 SUTs	NSI	They are used as benchmark tables

[19] We are grateful to Bernadette Wanjala for providing the condensed version of the 2009 SUT.

External data requirements	Total VA, 1990-2018	ETD	This is used as our GDP estimate for 1990-2018
	Total VA, 2019	UNOCD	It is used to update the Total VA to 2019
	Expenditure shares, 1990-2019	PWT10	Household consumption share, government consumption share, investment share, export share, import share, and share of inventories in GDP are calculated from PWT10
	Sectoral value added to gross output ratios, 1990-2019	UNOCD and UNIDO INDSTATS (2020)	VAtGO ratios are calculated from the UNOCD except for the sub-sectors of manufacturing. The sectoral VAtGO ratios for manufacturing industries are estimated from the UNIDO INDSTATS (2022). See notes
	Sectoral value added shares, 1990-2019	ETD and its 2-Digit Manufacturing Database	Sectoral shares of value are calculated from these sources. See notes below
	Sectoral exports and imports shares, 1990-2019	SUTs and BACI	Exports and imports shares are calculated from the SUTs as benchmarks and the BACI database.

Preparing the benchmark SUTs

- The 2003 SAM contains data on 50 commodities and 50 economic activities, as well as imports and the appropriate final use categories. It also includes information on net taxes and trade margins. The activity account is valued at producer price and commodity account is valued at purchaser's price. The SAM also distinguishes between own consumption of activities and consumption of commodities that are marketed. Agriculture accounts for the majority of households own consumption.
- To begin, we map all activities and commodities to ISIC Rev. 4. However, in some cases the mapping is not possible, as the benchmark data is too aggregated, and thus the aggregate industry need to be split up (in this case *Metals and machines*). This is done by using gross output (GO) shares and intermediate input shares for the supply table and use table, respectively. We rely on external UNIDO INDSTATS (2022) data to compute the shares. We use these shares to proportionally allocate the values across the more detailed industries. For

example, if one industry produces more gross outputs relative to the other related industries, then it receives a larger share of the gross outputs that is produced in the more aggregate industry in the supply table.

- To generate the supply table in basic price, we use data from the output matrix, transaction costs matrix, taxes vector, and imports vector. In same manner, we construct use table in purchaser's price utilizing data from the investment and exports vectors, final consumption matrix, and intermediate use matrix. The use table is expressed in basic price by deducting valuation matrices from the use table valued at purchaser's price. The SUT is then aggregated to the 20 ASUT sectors in Table A1.
- The 2009 SUT includes 81 economic activities and 151 commodities, imports, and the relevant final use categories. It also reports data on taxes and trade margins. The use table is valued at purchaser prices, while the supply table valued at basic prices. The industries in the benchmark table are classified using an ISIC Rev. 4 classification, which readily corresponds to the ASUT sectors in Table A1.
- We used the condensed version of the 2016 SUT from KNBS. The condensed 2016 SUT covers 20 products and 20 industries SUT with detailed information on production, consumption, factor income, capital formation, transaction margins, and net taxes on products. ISIC Rev.4 is used to distinguish the industries, which corresponds to the ASUT sectors in Table A1. However, the manufacturing sector is less disaggregated, it is only classified into two sectors: manufacture of food products, beverages and tobacco products(C10t12) and other manufacturing. We split other manufacturing into eight industries corresponding to sector C13t15 to C31t33 in Table A1. The total value of other manufacturing in the supply and use tables are proportionally allocated to the eight manufacturing industries using gross out shares and intermediate input shares calculated from the 2009 SUT.
- Total margins and tax data for 2009 and 2016 SUTs are reported per products. We allocate the margins and taxes between the industries and the relevant final use categories using a fixed percentage, where we assume that margins and taxes are proportional to consumption of the commodity. We use the tax and margins data to construct the use table in basic prices. This provides us with a set of benchmark supply and use tables denoted in basic prices covering 20 products and industries for the years 2003, 2009, and 2016.

Preparing external data requirements

GDP at basic prices. Having constructed the benchmark SUTs, we turn to the external data collection for Kenya for the period 1990-2019. We collect data on total Gross Value Added (GVA) at basic prices from the Economic Transformation Database (ETD) (de Vries et al., 2021). We update to 2019 using data from UNOCD

Sectoral value added shares: GVA by industry at basic prices from the Economic Transformation Database (ETD) (de Vries et al., 2021). The ETD provides data until 2018, and values for 2019 are computed by extrapolating the ETD estimates using the trend in the data from the United Nations Official Country database (UNOCD).

- ***Expenditure shares*** *:*Data on the expenditure components of GDP (computed as shares of total GDP) is calculated from the Penn World Table (PWT) database (Feenstra et al., 2015).
- ***Value added to gross output (VAtGO) ratios*** of manufacturing industries are calculated from the UNIDO INDSTATS (2022) for all years. For all other sectors, *VAtGO* are calculated from sectoral gross output and value added data from UNOCD.
- ***Sectoral exports and exports shares***: exports and imports from the SUTs are used as benchmark trade data. We extrapolate backwards from 2003, forward from 2016, and interpolate between benchmark years using data from BACI database.

5. Mauritius

Mauritius NSI compiles SUT every five years with updates in between some reference years. For example, the NSI compiled update of the 2002 SUT in 2003 and again in 2004. The recent release of the 2018 SUT means the NSI has till date compiled eight SUTs for reference years 1997, 2002, 2003, 2004, 2005, 2007, 2013 and 2018. Our estimation focuses on the 2002, 2007, 2013 and 2018 releases. All the SUTs underlie different vintages of the Mauritius national accounts data. For example, the benchmark 2018 SUT is used to derive and reconcile GDP estimates and the rebasing of Mauritius' national accounts to reference year 2018.

The SUTs distinguishes several industries and products, produced in accordance with the 2008 System of National Accounts (SNA), ISIC Rev. 4, and Central Product Classification Version 2.1. Statistical concepts and definitions used for the construction of SUT are adopted from United Nations (UN) Handbook on "Supply, Use and Input-Output Tables with Extensions and Applications". The main sources for the compilation of the SUT are: Census of Economic Activities (CEA), which is also compiled every five years since 2002, agricultural statistics, Household Budget Surveys, balance of payments data of the Bank of Mauritius, financial statements of enterprises, external trade statistics, government financial statistics, tax administration data, stock data of the Revenue Authority, etc. The SUTs are grounded in national statistics which satisfy the ASUT inclusion criterium. The table and notes below summarizes the sources of data used to construct SUT time series for Mauritius.

	Data	**Sources**	**Notes**
Benchmark Tables	2002, 2007, 2013, and 2018 SUTs	NSI	The main benchmark tables used in the estimation
External data requirements	Total VA, 1990-2018	ETD	This is used as our GDP estimate for 1990-2018
	Total VA, 2019	NSI	It is used to update the GDP estimate to 2019
	Expenditure shares, 1990-2019	PWT10	The proportions of Gross Domestic Product (GDP) allocated to household consumption, government consumption, investment, exports, imports, and inventories are computed from PWT10 data.
	Sectoral value added to gross output (VAtGO) ratios, 1990-2019	SUTs, UNOCD, UNIDO INDSTATS (2022)	VAtGO ratios calculated from the SUTs, complemented with data from UNOCD. UNIDO INDSTATS (2022)

Sectoral value added shares, 1990-2019	ETD and its 2-Digit Manufacturing Database	Sectoral shares were computed from these sources. See notes below
Sectoral exports and imports shares, 1990-2019	SUTs, BACI, and NSI	The sectoral trade shares for goods industries and services industries are calculated using information from SUTs, BACI, and NSI. See notes below.

Preparing Benchmark SUTs

- The 2002, 2007, 2013, and 2018 SUTs of Mauritius are highly disaggregated by products and industries: The 2002 SUT distinguishes 59 industries and 66 products, the 2007 and 2013 SUTs distinguish 57 industries and 57 products, and the 2018 SUT distinguished 65 industries and 59 products. The SUTs are produced in accordance with ISIC Rev. 4 and Central Product Classification Version 2.1.
- In the supply tables, domestic production is valued at basic prices. Whilst goods imports are valued at cost, insurance, and freight (CIF), which is consistent with the valuation for production, total imports are measured on a free on board (FOB) basis. To reconcile the two valuations a column titled 'CIF/FOB adjustment' is included in the supply tables. The supply tables also show columns for distribution margins and taxes less product subsidies. All the use tables are valued at purchasers' prices.
- Use tables in purchaser's price is converted into basic prices by deducting margins and taxes less subsidies at the product level.
- We concord all the SUTs to the 20 products by 20 industries classification adopted for this study (see Table A1).

Preparing External Data Requirements

- ***GDP at basic prices*** is total value added from the ETD. The total value added from the ETD is from 1990-2018. It is updated to 2019 using data from NSI.
- ***Sectoral value added shares*** are also calculated from the ETD except for the manufacturing industries. For manufacturing industries, we used the shares from the SUTs as benchmark then interpolate between benchmark years using data from ETD's unpublished 2-digit manufacturing database.
- ***Expenditure shares*** (Consumption, Investment, Imports, Exports, and Inventory) are computed from the PWT10.0.
- ***Value added to gross output (VAtGO) ratios*** are calculated from UNOCD and the SUTs except for manufacturing industries in non-benchmark years. VAtGO ratios for manufacturing industries are calculated from UNIDO INDSTATS (2020). From the SUTs, UNOCD and UNIDO INDSTATS (2020) we obtained sectoral value added and gross output data which we used to compute the VAtGO ratios. We extrapolate for years which data is not available.
- We use VAtGO ratios calculated from the SUTs are used as benchmarks. For non-manufacturing sectors, we interpolate between benchmark years using data from UNOCD.

For manufacturing industries, we interpolate between benchmark years using data from the UNIDO INDSTATS (2022)

- ***Sectoral exports and exports shares*** are calculated in two steps. First, total exports and imports are split into goods and services using data from UNOCD. From equation xx we calculate the sectoral shares using data from COMTRADE. COMTRADE data on trade in services starts from 2000. We extrapolate backwards to 1990 using trade in services trend from UNOCD data.
- Exports and imports data for service industries between benchmarks are interpolated with trends of the aggregate service sector from UNOCD data.

6. Nigeria

Benchmark Table	Data	Sources	Notes
Benchmark SUT(s)	2010 SUT	NSI	The main benchmark table used in the estimation
External data requirements	Total VA, 1990-2018	ETD	This is used as our GDP estimate for 1990-2018
	Total VA, 2019	NSI	Used to update the Total VA from ETD to 2019
	Expenditure shares, 1990-2019	PWT10	Estimate of consumption share, investment share, export share, import share and share of inventories in GDP were based on PWT10
	Sectoral value added to gross output ratios, 1990-2019	SUT, UNOCD, UNIDO INDSTATS (2020)	VAtGO ratios were computed from the UNOCD except for the sub-sectors of manufacturing in non-benchmark years. The VAtGO ratios for manufacturing industries in non-benchmark years were estimated from the UNIDO INDSTATS (2020). For benchmark year 2010, the VAtGO ratio were calculated from the SUT. See notes below.
	Sectoral value added shares, 1990-2019	NSI, ETD, and its 2-Digit Manufacturing Database	Sectoral shares were computed from these three sources. See notes below
	Sectoral exports and imports shares, 1990-2019	UNOCD, COMTRADE, and 2010 SUT	Total exports and imports are split into goods (agriculture, mining, manufacturing industries) and services using data from UNOCD. The sectoral trade shares for goods industries and services industries are calculated using

information from COMTRADE and the 2010 SUT.

Preparing the 2010 Benchmark Table

- The 2010 supply and use table of Nigeria is the main benchmark table used in SUT-RAS. It is the only existing SUT of Nigeria. It is compiled using the 2008 SNA and ISIC Rev. 4. The table is highly disaggregated (340 products by 46 industries) with all the sectoral details required for the SUT time series estimation.
- The 2010 SUT have two issues that we resolve as follows: First, while sector C28 is separated in the products category, it not distinguished in the industries category. Other manufacturing has a relatively high values in primary production and intermediate use. Value added for other manufacturing sector (C31-C33) is high compared to what is reported in national accounts. We assume the C28 is included in other manufacturing category for industry. We split other manufacturing category into C28 and C31-31 using gross output shares and intermediate input shares for the supply and use tables, respectively, using data from the UNIDO INDSTATS 2 (2022 version), assuming common product sales shares of the sub-industries.
- Total supply in purchaser's price is not equal to total use in purchaser's price. We distributed the discrepancies proportionally across final demand categories for each product.
- The 2010 SUT consists of 340 products by 46 industries that we easily map to the 20 ASUT sectors defined in Table A1.
- Use table in purchaser's prices is converted into basic prices by deducting valuation matrices from the use table in purchaser's prices. The valuation matrices contain transactions margins and taxes less subsidies at the product level, respectively. To construct product-specific margins and taxes, total margins and taxes are redistributed using the approach of Dietzenbacher et al. (2013).

Preparing External Data Requirements

- ***GDP at basic prices*** is the total value added from the ETD. The total value added from the ETD is from 1990-2018. It is updated to 2019 using data from NSI.
- ***Sectoral value added shares*** are also calculated from value added data published by Nigerian NSI. The NSI has highly disaggregated value added data that goes back to the 1981. ETD values for Nigeria is obtained from this source as a result the shares from NSI data is the same as the shares from ETD. Since NSI has detailed manufacturing industries, we calculated the value added shares from this source.
- ***Expenditure shares*** (Consumption, Investment, Imports, Exports, and Inventory) are computed from the PWT10.0.
- ***Value added to gross output (VAtGO) ratios*** are calculated from UNOCD and the SUTs except for manufacturing industries in non-benchmark years. VAtGO ratios for manufacturing industries are calculated from UNIDO INDSTATS (2020).
- ***Sectoral exports and exports shares*** are calculated in two steps. First, total exports and imports are split into goods and services using national accounts data from NSI. Second, goods and services trade from NSI are further disaggregated using data from BACI database.

7. Rwanda

Background

Rwanda is one of the few countries in Africa that regularly compiles SUT. According to the UNECA (2018) report on the implementations of 2008 SNA in Africa, Rwanda estimates SUTs every five years. Between 2000 and 2011 Rwanda had compiled three SUTs each corresponding to the main household surveys (Enquête Intégrée des Conditions de Vie, EICV) completed in the years 2001, 2006 and 2011 (NISR, 2014). According to the NISR, the 2001 and 2006 SUTs formed the basis for estimating the annual and quarterly series of GDP since 2001 until a new benchmark SUT was compiled in 2011. However, the 2001 and 2006 SUTs ae limited to (summary) production account and commodity flow account, i.e., without an intermediate use matrix and an income account.

The 2011 SUT, which is the main benchmark table for Rwanda in the ASUT, was compiled with significant improvements and innovations. The most significant improvement is the introduction of the intermediate use matrix, allowing for the estimation of sectoral input-output coefficients. The second improvement relates to integration of new data sources that was not previously available, most importantly, the new estimation of government final consumption expenditure and capital formation from the MINECOFIN's Financial Management Database; the estimation of Input-output ratios, trade margins, NGOs' final consumption from the 2011 Integrated Business Enterprise Survey (IBES); and estimates of informal cross-border trade from the NISR/BNR Informal cross border trade survey. Other improvements include revision of CIF/FOB adjustments to the customs value of imports; the development of new benchmark estimates for the construction sector; analysis of informal activity recorded in the EICV3; the use of corporate tax data to supplement VAT data; the inclusion of public sector enterprises subsidies (NISR, 2014).

The final improvement relates to methodology, the 2008 System of National Accounts (SNA2008) and the latest revision of the International Standard Industrial Classification (ISIC Rev.4) are used to prepare the 2011 SUT, which led to several changes, notably, the treatment of imputed bank services charges [Financial Intermediation Services Indirectly Measured(FISIM)]. The methodological improvement in SNA2008 meant that FISIM could simply be allocated to the consumers of imputed bank services instead of deducting it as an adjustment from total value added.

Despite the methodological improvements in the 2011 SUT, it had several weaknesses. First, the SUT has no supply matrix, which implies that there is no secondary production. This is a strong assumption given the strong spillover effects of some sectors on secondary sectors. For example, financial sector has strong linkages with economic activities in Rwanda. This was made evident by the estimation procedure ex post. After fulfilling external data requirements, the SUT-RAS program automatically generates secondary production for financial services. To generate supply matrix (make matrix) we diagonalized sectoral output from the production account. In line with the assumption by NIRS that there is no secondary production, off diagonal elements in the supply matrix were zeros. To check the reliability of this approach, we performed several basic tests. For example, we checked whether the row identity [$II_s + VA_s \equiv GO_s$] and the column identity (Total Demand≡Total Supply) hold for the generated Supply table and the Use table obtained from the NISR. Second, we checked whether important indicators such as the VAtGO ratios, expenditure shares, and Value added shares are consistent with external data sources such as the UNOCD, PWT10, and the ETD, respectively. All the tests were satisfied. The second weakness of the 2011 SUT is that it does not have income account. However, lack of income account does not limit it use in the current research since the ASUT does not incorporate a socioeconomic account.

The table below summarizes the Benchmark tables and external data used to estimate the SUT time series for Rwanda.

	Data	Sources	Uses
Benchmark Tables	2001 and 2006 SUTs	NSI	These SUTs do not have intermediate use matrix but good summary accounts on production and uses. We estimate full SUTs using the summary accounts and SUT-RAS procedure.
	2011 SUT	NSI	The main benchmark table used in the SUT-RAS program
External data requirements	Total VA, 1990-2018	ETD	This is used as our GDP estimate for 1990-2018
	Total VA, 2019	NSI	Used to update the Total VA from ETD to 2019
	Expenditure shares, 1990-2019	PWT10	Used to calculate consumption share, investment share, export share, import share and share of inventories in GDP
	Sectoral value added to gross output ratios, 1990-2019	SUTs, UNOCD, UNIDO INDSTATS (2020)	VAtGO ratios were computed from the SUTs and UNOCD except for the sub-sectors of manufacturing in non-benchmark years. The sectoral VAGO ratios for manufacturing industries in non-benchmark years were estimated from the UNIDO INDSTATS (2020)
	Sectoral value added shares, 1990-2019	ETD, NSI, and its 2-Digit Manufacturing Database	Sectoral shares were computed from these three sources. See notes below
	Sectoral exports and imports shares, 1990-2019	BACI, SUTs, and NSI	Total exports and imports are split into goods (agriculture, mining, manufacturing industries) and services using data from NSI. The sectoral trade shares for goods industries and services industries are calculated using information from SUTs and BACI.

Preparing the 2011 Benchmark SUT(s)

- The 2011 SUT is of 34 products-by- 12 industry dimension.
- The intermediate consumption matrix from NSI contained (near-zero) negative values in sector C31t33. Because SUT-RAS does not permit negative values, we replace the negative

values with zeros. And because the negative values were negligible, replacing with zeros did not affect the overall balance of the table.

- We concord the SUTs to ISIC Rev.4 in Table A1. The products in the 2011 SUT are of sufficient details that allowed us to easily concord to the 20- ASUT classification. The 2011 SUT has 12-industry classification with only 3 manufacturing industries: food, textile, and other manufacturing, implying that other manufacturing is the sum of sectors C16t18 to C31t33. We redistribute 'other manufacturing' to these seven industries using gross out shares and intermediate input shares calculated from UNIDO INDSTAT (2022) for the supply matrix and use matrix, respectively, assuming common product sales shares of the sub-industries.
- The supply table is estimated in basic prices whereas the use table is estimated in purchaser's prices. For the ASUT time series, the use table need to be transformed to basic price concept. The difference between basic price and purchaser's price is sector-specific trade and transport margins and taxes net subsidies. To express the use table in basic prices, sector-specific trade and transport margins and net taxes are deducted from the use table in purchaser's prices.
- The 2001 and 2006 SUTs have summary accounts containing total supply and total intermediate use. We use these information, concorded to the ASUT sectors in Table A1, as hard constraints, and using the structure of the interior use matrix from 2011 SUT, we estimate full SUT using the SUT-RAS procedure.

Preparing External Data Requirements

- ***GDP at basic prices*** is total value added from the ETD. The total value added from the ETD is from 1990-2018. It is updated to 2019 using data from NSI.
- ***Sectoral value added shares*** are also calculated from the ETD except for the manufacturing industries. Sectoral value added shares for manufacturing industries are computed from NSI national accounts data, which has value added data on manufacturing industries from 1999-2019. From 1990-1998, sectoral value added shares for manufacturing industries are derived from ETD's 2-digit manufacturing database.
- ***Expenditure shares*** (Consumption, Investment, Imports, Exports, and Inventory) are computed from the PWT10.0.
- ***Value added to gross output (VAtGO) ratios*** are calculated from UNOCD and the SUTs. From the UNOCD we obtained sectoral value added and gross output for 1989 which we used to compute benchmark sectoral VAtGO ratios for 1990. We estimated sectoral VAtGO ratios from the SUTs, which we use as benchmarks. We then interpolate between benchmark years.
- ***Sectoral exports and exports shares*** are calculated in two steps. First, total exports and imports are split into goods and services using data from NSI. Total exports and imports of goods and services from NSI are further disaggregated by products using detailed product-level shares from the BACI database.

8. Senegal

	Data	Sources	Notes
Benchmark Tables	2014-2019 SUTs	NSI	Benchmark tables used in the SUTRAS program

External data requirements	Total VA, 1990-2018	ETD	This is used as our GDP estimate for 1990-2018
	Total VA, 2019	2019 SUT	Used to update the Total VA from ETD to 2019
	Expenditure shares, 1990-2019	PWT10	Used to calculate consumption share, investment share, export share, import share and share of inventories in GDP
	Sectoral value added to gross output ratios, 1990-2019	SUTs, UNOCD and UNIDO INDSTATS(2020)	VAtGO ratios were computed from the SUTs and UNOCD except for manufacturing industries in non-benchmark years. The sectoral VAtGO ratios for manufacturing industries in non-benchmark years were estimated from the UNIDO INDSTATS (2020)
	Sectoral value added shares, 1990-2019	ETD and its 2-Digit Manufacturing Database	Sectoral shares were computed from these sources. See notes below
	Sectoral exports and imports shares, 1990-2019	SUTs	Total exports and imports are split into goods (agriculture, mining, manufacturing industries) and services using data from UNOCD. The sectoral trade shares for goods industries and services industries are calculated using information from COMTRADE, SUTs, and NSI. See notes below.

Preparing the Benchmark SUTs

- Senegal NSI is making effort to construct SUT every year as part of the new Africa TiVA project. We obtain SUTs for the period 2014-2019 from the NSI. The SUTs are 27 products-by- 27 industry classification. We concord to the 20 ASUT sectors according to ISIC Rev.4 in Table A1.
- Most sectoral classification of the SUTs correspond to the ASUT sectors in Table A1 except for the manufacturing industries. Manufacturing industries are classified into Food (C10t12), Textile (C12t15), Metals (C23t25), and other manufacturing. We split other manufacturing reported in the SUTs into the remaining six manufacturing industries in Table A1 using gross out shares and intermediate input shares calculated from UNIDO INDSTAT (2022) for the supply matrix and use matrix, respectively. We do this assuming common product sales shares of the sub-industries.
- The supply table is estimated in basic prices whereas the use table is estimated in purchaser's prices. Use table in purchaser's price is converted into basic prices by deducting margins and taxes less subsidies at the product level.

Preparing External Data Requirements

- ***GDP at basic prices*** is total value added from the ETD. The total value added from the ETD is updated from 2018 to 2019 using data from SUT.
- ***Sectoral value added shares*** are computed from the ETD except for the manufacturing industries. The sectoral value added shares for manufacturing industries are estimated from ETD's 2-digit manufacturing database.
- ***Expenditure shares*** (Consumption, Investment, Imports, Exports, and Inventory) are computed from the PWT10.0.
- ***Value added to gross output (VAtGO) ratios*** for manufacturing industries are calculated from the UNIDO INDSTATS (2020) for all years. For non-manufacturing sectors *VAtGO* are calculated from sectoral gross output and value added data from NSI and UNOCD.

- ***Sectoral exports and exports shares*** are calculated using data from the SUTs as benchmark data. We backcast to 1990, using data from the BACI database.

9. South Africa

	Data	Sources	Notes
Benchmark Tables	1993, 1998-1999, 2000, 2002, 2005, and 2007-2018 SUTs	NSI	Benchmark tables used in the SUTRAS program
External data requirements	Total VA, 1990-2018	ETD	This is used as our GDP estimate for 1990-2018
	Total VA, 2019	NSI	Used to update the Total VA from ETD to 2019
	Expenditure shares, 1990-2019	PWT10	Used to calculate consumption share, investment share, export share, import share and share of inventories in GDP
	Sectoral value added to gross output ratios, 1990-2019	SUTs	VAtGO ratios were computed from the SUTs
	Sectoral value added shares, 1990-2019	ETD and its 2-Digit Manufacturing Database	Sectoral shares were computed from these sources. See notes below
	Sectoral exports and imports shares, 1990-2019	SUTs	The sectoral trade shares for all industries are calculated using information from the SUTs.

Preparing the Benchmark Tables

- South Africa has very detailed SUTs for most years starting from 1993. We simply concorded the tables into the20 products- by-20-industry classification adopted in this study.
- There is a column called "Residual" in the use tables that reflect statistical discrepancy between total use and total supply. These discrepancies are sometimes significant for some products especially in the 1990s. For example, in 1993 discrepancy is up to 11% of

total use for agricultural products. We distributed the residuals proportionally across final demand categories for each product.

- Use table in purchaser's price is converted into basic prices by deducting margins and taxes less subsidies at the product level.

Preparing External Data Requirements

- ***GDP at basic prices*** is simply total value added from the ETD. The total value added from the ETD is from 1990-2018. It is updated to 2019 using data from NSI.
- ***Sectoral value added shares*** are also calculated from the ETD except for the manufacturing industries. Sectoral value added shares for manufacturing industries are computed from ETD's unpublished 2-digit manufacturing database.
- ***Expenditure shares*** (Consumption, Investment, Imports, Exports, and Inventory) are computed from the PWT10.0.
- ***Value added to gross output (VAtGO) ratios*** are calculated from the SUTs for all industries except for non-benchmark years. Values in between benchmark years are interpolated.
- ***Sectoral exports and exports shares*** are also calculated using data from SUTs for benchmark years. We interpolate in between benchmark years using trends from NSI trad data.

10. Tanzania

Tanzania NSI compiles SUT every decade. The most recent SUTs available were compiled in 1992, 2007, and 2015. We use the 2007 and 2015 SUTs as benchmarks to construct SUT time series for Tanzania. The most recent compilation of national accounts statistics was based on the 2015 SUT. The main data sources used in the compilation of 2015 SUT were: Annual Agriculture Survey 2014/15; Agricultural and Livestock Sample Census 2007/08; National Panel Survey 2014/15; Census of Industrial Production 2013; Household Budget Survey 2011/12; Integrated Labour Force Survey 2014; Trade and Transport Margin Survey; special study on Non-Profit Institution Serving Households 2015; Import and export of goods and services; Government Finance Statistics (GFS) and Value Added Tax (VAT) data.

These surveys and sources provided detailed information for the NSI to construct 138 products by 84 industries SUT. For example, the Trade and Transport Margin Survey allowed the NSI to construct matrices for net taxes, transport, and trade margins. The 2015 SUT has 8 (138 products by 84 industries) matrices. These include: Use in purchaser's prices, trade margins, transport margins, net taxes on products, supply in basic prices, use in back prices, imported use matrix, and domestic use matrix. Unlike the 2015 SUT, the 2007 SUT has only two matrices: supply in basic prices and use in purchaser's prices. Therefore, we redistributed total trade and transport margins and net taxes across products to calculate use table in basic prices. The table below summarizes the sources used to construct SUT time series for Tanzania.

	Data	Sources	Notes
Benchmark Tables	2007 and 2015 SUTs	NSI	The main benchmark table used in the SUTRAS program

External data requirements	Total VA, 1990-2018	ETD	This is used as our GDP estimate for 1990-2018
	Total VA, 2019	UNOCD	Used to update the Total VA from ETD to 2019
	Expenditure shares, 1990-2019	PWT10	Used to calculate consumption share, investment share, export share, import share and share of inventories in GDP
	Sectoral value added to gross output ratios, 1990-2019	SUTs, UNOCD, UNIDO INDSTATS (2020)	VAtGO ratios were computed from the SUTs and UNOCD except for the sub-sectors of manufacturing in non-benchmark years. The sectoral VAtGO ratios for manufacturing industries in non-benchmark years were estimated from the UNIDO INDSTATS (2022)
	Sectoral value added shares, 1990-2019	ETD and its 2-Digit Manufacturing Database	Sectoral shares were computed from these sources. See notes below
	Sectoral exports and imports shares, 1990-2019	BACI, SUTs, and NSI	The sectoral trade shares are calculated from the following sources. See notes below.

Preparing the 2007 and 2015 Benchmark SUTs

- The 2007 and 2015 SUTs were highly disaggregated, internally consistent and contained all information needed to build benchmark tables. We concorded the tables into the 20 products-by-20-industry classification adopted in this study.
- Use table in purchaser's price is converted into basic prices by deducting margins and taxes less subsidies at the product level.
- In the 2007 SUT, there is a large negative value for consumption of nonresident on territory which is equal to positive value of exports of nonresident on territory. They cancel out so we do not add them to the benchmark table. We applied the same procedure for expenditures by residents abroad on the imports side.
- In the 2007 SUT, financial services (esp. FISIM) in TZA have a larger total value in the supply than use table. The value in the supply table was replaced with the value from the use table.

Preparing External Data Requirements

- ***GDP at basic prices*** is the total value added from the ETD. The total value added from the ETD is from 1990-2018. It is updated to 2019 using data from NSI.
- ***Sectoral value added shares*** are also calculated from the ETD except for the manufacturing industries. Sectoral value added shares for manufacturing industries are computed from ETD's 2-digit manufacturing database.
- ***Expenditure shares*** (Consumption, Investment, Imports, Exports, and Inventory) are computed from the PWT10.0.

- ***Value added to gross output (VAtGO) ratios*** are calculated as follows. The VAtGO ratios calculated from the SUTs are used as benchmark. For non-manufacturing industries, we backcast, interpolate between benchmark years , and extrapolate using data from UNOCD. For manufacturing industries, we backcast, interpolate between benchmark years, and extrapolate using data UNIDO INDSTATS (2022).
  Sectoral exports and exports shares are calculated using data from the SUTs as benchmark data. We backcast to 1990, interpolate between benchmark years, and extrapolate to 2019 using data from the BACI database.

11. Zambia

Background

The NSI of Zambia has compiled only two SUTs in the past 30 years. The most recent SUT was compiled in 2010. The NSI compiled the last SUT in 1994 during the rebasing of the national accounts. For the ASUT, we did not have access to the 1994 SUT, therefore, the 2010 SUT is used as the main benchmark table. The 2010 SUT has been compiled following the 2010 benchmarking of National Accounts. It follows the recommendations of the 2008 Systems of National Accounts (2008 SNA) and the 2008 Eurostat Manual on Supply, Use and Input-Output Tables (CSO, 2010).

The 2010 SUT provides highly disaggregated data at the product and industry level. It consists of 123 products and 24 industries, giving us sufficient details to map into the ASUT sectors in table A1. Products and industries are classified using the Central Product Classification (CPC 2.1) and the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 4), respectively. Information on the formal and informal sectors used to compile the 2010 SUT was based on data from the 2010 benchmarking exercise. For the formal sector, data was sourced from the Economic Census and Financial Reports of Government Institutions. Informal sector estimates were based on the 2010 Living Conditions Monitoring Survey, the Non-farm Informal Sector Survey, the Crop Forecast Survey, and the 2010 Census of Population and Housing among others. In table and notes below, we discuss how we prepare the 2010 SUT and external data requirements for the SUT-RAS program.

Benchmark Table	Data	Sources	Notes
Benchmark SUT(s)	2010 SUT	NSI	The main benchmark table used in the SUT-RAS program
External data requirements	Total VA, 1990-2018	ETD	This is used as our GDP estimate for 1990-2018
	Total VA, 2019	NSI	Used to update the Total VA from ETD to 2019
	Expenditure shares, 1990-2019	PWT10	Used to calculate consumption share, investment share, export share, import share and share of inventories in GDP
	Sectoral value added to gross output ratios, 1990-2019	SUTs, UNOCD, UNIDO INDSTATS (2020)	VAtGO ratios were computed from the UNOCD except for the sub-sectors of manufacturing. The sectoral VAtGO ratios for manufacturing industries

		were estimated from the UNIDO INDSTATS (2020).
Sectoral value added shares, 1990-2019	NSI, ETD, and its 2-Digit Manufacturing Database	Sectoral shares were computed from these three sources. See notes below
Sectoral exports and imports shares, 1990-2019	BACI, and 2010 SUT	

Preparing the 2010 Benchmark Table

- The 2010 SUT was sufficiently disaggregated by products and industries. The published version of the 2010 SUT consists of 66 products and 24 industries. We map the products and industries to the 20 ASUT sectors defined in Table A1.
  However, for industries the manufacturing sector was aggregated into only two categories: manufacturing and green manufacturing. We sum the (non-green) manufacturing and green manufacturing to get aggregate manufacturing indicators. We redistribute 'total manufacturing' into the 9 sub-sectors defined in Table A1 using gross out shares and intermediate input shares calculated from UNIDO INDSTAT (2022) for the supply matrix and use matrix, respectively.
- Use table in purchaser's price is converted into basic prices by deducting margins and taxes less subsidies at the product level.
- To obtain product-specific margins and net taxes, we construct valuation matrices following (Dietzenbacher et al., 2013).

Preparing External Data Requirements

- ***GDP at basic prices*** is the total value added from the ETD. The total value added from the ETD is from 1990-2018. It is updated to 2019 using data from NSI.
- ***Sectoral value added shares*** are also calculated from the ETD except for the manufacturing industries. Sectoral value added shares for manufacturing industries are computed from UNIDO INDSTATS 2020, the 2010 SUT and NSI.
- ***Expenditure shares*** (Consumption, Investment, Imports, Exports, and Inventory) are computed from the PWT10.0.
- ***Value added to gross output (VAtGO) ratios*** are calculated from UNOCD and the SUTs except for manufacturing industries in non-benchmark years. VAtGO ratios for manufacturing industries are calculated from UNIDO INDSTATS (2022).
  Sectoral exports and exports shares are calculated using data from the 2010 SUT as benchmark data. We backcast to 1990 and extrapolate to 2019 using data from the BACI database.