Constructing input-output tables and a CGE database for Afghanistan

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Abstract

Creating a database consistent with Global Trade Analysis Project (GTAP) and to be functional as a Computable General Equilibrium (CGE) database is problematic and requires a considerable amount of information and a number of data manipulation steps. Therefore, very few articles provide details about the database creation process. With such purpose, in this paper, we describe and document numerous aspects of constructing a Social Accounting Matrix (SAM) for a single country (i.e. developing country). In order to obtain our objectives, we introduce Conversion and projection methods and use Afghanistan as the case study. The conversion method converts the 2017 Afghanistan Supply and Use table into a CGE database. The projection method project the IO tables and SAM from 2016 and 2019 backward to estimate the SAM for the remaining GTAP reference years (2014, 2011, 2007, 2004). This method is based on the Compound Annual Growth Rate (CAGR). It is likely that as we project the required matrices we violate the balancing condition. Therefore, we use generalized iterative scaling method (KRAS) to ensure that the balancing condition holds. There are four main contributions of this paper: First, the construction of the first Afghanistan IO tables (65 sectors) for the year 2017 and, subsequently, the first Afghanistan SAM. Second, Backward projection of the SAM from 2016 and 2019 in order to obtain SAM for the remaining GTAP reference years. The method we developed can also be used for forward projection, imputing missing wages, and updating and estimating employment data. Third, integrate Afghanistan into the GTAP Data Base. Fourth, even though these conversion and projection methods have been applied to the case of Afghanistan, we document data compilation procedures such that our approaches can be easily applied to create other countries or regions.

Keywords: Database, input-output table, computable general equilibrium (CGE), Afghanistan.

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1 Introduction

An increasing number of academic articles and quantitative policy reports applying the Input-Output (IO) analysis and CGE modeling have used the GTAP Data Base. GTAP (Global Trade Analysis Project) is a global network of researchers and policymakers conducting quantitative analysis of international policy issues. GTAP's goal is to improve the quality of quantitative analysis of global economic issues within an economy-wide framework (Rueda-Cantuche, Revesz, et al., 2020). Recent applications span areas ranging from carbon emission and climate changes, agricultural economics and policy, trade policy and free trade agreements, and the analysis of global value chain, productivity, and international trade. The GTAP Data Base links individual countries and regions and describes global bilateral trade patterns, international transport margins, and protection matrices(Aguiar et al., 2016). The GTAP Data Base covers 121 countries and 20 aggregate regions of the world for each reference years. In terms of sectoral coverage, GTAP Data Base considers 65 products and services (Aguiar, Chepeliev, et al., 2019). The GTAP Data Base requires IO tables at basic prices with a distinction between domestic and imported uses and IO tables at producer prices, including separated matrices of taxes less subsidies on product (Huff et al., 2000).

One potential transformation of the GTAP Data Base is its conversion from a format based on IO tables into a Social Accounting Matrix (SAM) (McDonald & Thierfelder, 2004). A SAM is an extension of the symmetric Input-output Table (IOTs), A widely used framework to provide detailed information on the flow of goods and services and as well as on the structure of production cost.(Stahmer, 2004). SAM is one of the most important component of the CGE database and an essential tool for policy analysis (Round, 2003). SAM is a standard, comprehensive, and economy-wide database recording data about all transactions between economic agents in a specific economy, in, particular SAM seeks to capture in more detail the employment features of the economy(Mainar-Causapé et al., 2018). The database in the SAM format is of importance because it contains information regarding the structure of the economy, it is formally part of the System of National Accounts (SNA)(UN, 1993 (Roos et al., 2015).

Creating a database consistent with GTAP and to be functional as a CGE database is problematic and requires a considerable amount of information and a number of data manipulation steps. Therefore, very few articles provide details about the database creation process. With such purpose, in this paper we describe and document numerous aspects of constructing SAM for a single country (i.e. developing country) consistent with the required structure of the GTAP Data Base. In order to obtain our objectives, we introduce Conversion and projection methods and use Afghanistan as the case study. The conversion method converts the 2017 Afghanistan Supply and Use table into the required structure of the GTAP database. We describe the unique features captured in the Afghanistan SUT as well as that of the CGE database. In describing the SUT we identify data issues that had to be addressed before the database could be constructed. The projection method project the IOts and SAM from 2016 and 2019 backward to estimate the SAM for the remaining GTAP reference years (2014, 2011, 2007, 2004). This method is based on the Compound Annual Growth Rate (CAGR). It is likely that as we project the required matrices we violate the balancing condition. Therefore, in each step in the database projection stages, we use generalized iterative scaling method (KRAS) to ensure that the balancing condition holds. And finally documenting data compilation from different sources and consolidation into a data apt for CGE model such that our approach can be applied to create other countries or regions.

There are four main contributions of this paper: First, the construction of the first Afghanistan IO tables (65 sectors) for the year 2017 and, subsequently, the first Afghanistan SAM. Second, Backward projection of the SAM from 2016 and 2019 in order to obtain SAM for the remaining GTAP reference years. The method we developed can also be used for forward projection, imputing missing wages, and updating and estimating employment data. Third, integrate Afghanistan into the GTAP Data Base. Fourth, even though these conversion and projection methods have been applied to the case of Afghanistan, we document data compilation procedures such that our approaches can be easily applied to create other countries or regions.

This paper is organised as follows: Section 2 describe the structure of the single region GTAP database. Section 3 describe the stages and step wise application of the conversion method. The official data sources are reviewed in section 4. Section 5 describe the database creation process. Section 6 describe backward projection methodology. section 7 conclude.

2 Structure of the single region GTAP Data Base

The single region databases that form the basis for the GTAP Data Base originate from a variety of sources. In the early phase of processing, they undergo relatively mechanical procedures which bring them close to the commodity and industry aggregation required by GTAP. In this section, we illustrate the structure of the single region database and briefly describe the production of the standard GTAP Data Base. First, we explain the single region IO database and its conversion from a format based on IO table into a SAM. Second, we provide a summary of the GTAP Data Base construction process, this involves the pre-update manipulation of the original single region IO database, updating, and final assembly.

2.1 GTAP Data Base Construction procedure: Main Steps

The Global Trade Analysis Project (GTAP) is a global network of researchers and policymakers conducting quantitative analysis of international policy issues(Harslett, 2013). The Sectoral Analysis of Liberalisation of Trade in East Asian Region (SALTER) database and model is the basis for the GTAP system. The inconsistency of bilateral trade data was one of the main problem faced by SATLER. Fortunately, this was an issue that researchers at Purdue had worked on an approach to reconcile trade data. In exchange for the reconciled trade data, The SALTER project shared its core structure of the IO tables with the GTAp (Powell, 2007). To date, 10 version of the GTAP database have been released. The current release, GTAP 10, include five reference year 2004, 2007, 2011, 2014, and 2017, as well as 121 countries and 20 aggregate regions for 65 products and services (Aguiar, Corong, & McDougall, 2019) .

Creating a database is problematic and requires many adjustments. (Aguiar et al., 2016) and (Harslett, 2013) describe the steps involved in construction of GTAP database. The production of GTAP Data Base relies on the contribution of many individuals and organizations throughout the world. Individuals contribute the best available IO tables for their countries, while other experts contribute the macroeconomic, trade, protection, and other data required. The Center for Global Trade Analysis, the home for GTAP, coordinates these contributions and produces a usable, globally consistent database that is fully documented, publicly available, and updated regularly (Aguiar et al., 2016). The GTAP Data Base is created in three major steps.

The first major step is to standardise each single region database to the GTAP form via a sequence of specific and generic adjustments. (Huff et al., 2000) describes the GTAP requirements of the IO table contribution. In general, it is required that each contributor of the dataset ensure that the dataset is internally consistent before it is sent to the GTAP: for example, in the contributed trade dataset, exports must equal imports once the difference in valuation is taken into account (Harslett, 2013). After receiving an IO table from a contributor, it is checked to ensure that each table is balanced, original data have been mapped according the GTAP concordances, tax rates are plausible, values that should be positive are positive, and there are no unreasonable or unexplained entries. The single region IO table is seldom constructed in the GTAP format and therefore requires region-specific adjustment (Harslett, 2013). Adjustment are made to each region's IO tables to convert them to the GTAP format.

Once accepted, the IO tables go through a number of stages before they can be integrated into the GTAP Data Base. First, agriculture production targets are applied to certain IO tables before the main data construction phase. The IO tables are adjusted as part of the FIT procedure. This is an additional to the subsequent FIT procedure that is applied to all commodities and regions (E. Corong, 2020). Second, many tables contain inappropriate treatment of government services. Most IO tables contributed to GTAP apply the Standard national accounting conventions, but some do not. For those that do not, modifications are made in the construction process to rectify the problem (E. Corong, 2020). Third, IO tables that represent fewer than 65 sectors are disaggregated to conform to the current sector listing. Other adjustment includes the sign check for example, all pre tax commodity usage values are non-negative, and post tax value are also strictly positive, and all factor usage values are non-negative, and the sectoral balance condition check, for example, that in each sector total is equal to total cost (E. Corong, 2020).Additionally, representative IO table, and composite region IO tables are also constructed in the first step.

In the second major step, the domestic databases are then prepared for updating and adjusting procedures, i.e. the FIT process. The FIT process is used to fit the data, the IO tables, therefore, undergo the largest changes during the FIT process. Some international data sets are required in the process pertaining to the IOTs (Walmsley et al., 2012). The international data sets are macroeconomic data, agriculture IO data, trade data, protection data, and energy data. The international data sets obtained from different international organizations are made consistent with each other (E. Corong & McDougall, 2020). Regional IOTs can be inconsistent with data collected from international organizations, they can have different base years and can be based on different underlying data collections. The FIT process updated and adjusted regional IOT data so that they are consistent with constraints derived from the data collected from international organizations. The FIT procedure is a data processing system which modifies raw IOTs by updating regional IOTS to the base reference years, removing any remaining discrepancies between regional IOT and international data, and eliminating changes in stock from the database (Harslett, 2013).

The third and final major step in creating the GTAP database is to combine the updated single region databases and parameters into a large multi-region database. The final data assembly module is where the various international data set and domestic databases are put together to construct the main global database. In this step, the global set, parameters, energy volumes, and tax rates files undergo some minor, final processing. The assembly procedure involves disaggregation of labor payments, revision of factor employment data, merging the interim global data file with bilateral trade data, protection data, and capital stock, rebalancing the database, and further checks. In the data assembly, the main task is merging the interim global data file with the trade, protection, and capital stock data. Various data adjustments are needed, these include: international trade and transport margins data and capital stock and depreciation estimates are calculated, the implied revenues/payments associated with the trade-related protection measures are calculated, the value of trade at market prices is calculated, factor payments data and value of firms' purchases of intermediate purchases are adjusted, regional saving is calculated and included as a data array. The global data summary file and tax rates summary files are also generated in the final assembly module (E. Corong & McDougall, 2020).

2.2 Basic structure of the CGE database

The IOTs are derived from the supply and use table. Supply and Use tables are a central part of national accounts of a country. SUTs describe the whole economy by industry, and they consist of two interlinked tables: the supply table and the use table. The supply table shows the supply of goods and services by domestic production and imports. The Use table provides information on the use of goods and services and shows the use of goods and services by type of use as intermediate consumption or final consumption. Use table also shows the components of value-added. Once balanced, the supply and the use tables can be integrated into a single matrix, often referred to as the SUTs framework. In this table, the total supply by product equals the total use by product. (Mahajan et al., 2018).

Input-Output table (IOTs) is an accounting framework and provides a detailed description of an economy's circular flow of goods and services, therefore, constitutes an essential tool in empirical economic research and structural analysis, and is constructed from observed data for a particular economic area (Miller & Blair, 2009). Table (1) illustrates the basic structure of the single region GTAP IO database. The CGE model requires a database with separate matrices for basic flow, tax, and margin flow for both domestic and imported sources to domestic and foreign users, as well as matrices for the factors production. And as will explain in the next section that the GTAP Database is based on the Salter, therefore we explain the basic structure of the Salter single region IO database.

The column headings in the main part of the figure (Supply-Use Table) Identify the following users:

- Domestic producers divided into *65* industries
- A single representative household
- Government demand
- Investment
- Changes in inventories
- Export

The entries in each column show the structure of the purchases made by the users identified in the column heading. The first and second rows represent the direct sale or use of 65 commodities, from both domestic and imported sources, to intermediate and final users valued at basic prices. The source-specific commodities are used by industries as intermediate to current production and capital formation, are consumed by households and government, are exported, or are added to or subtracted from inventories. In the IO database, no imported commodity is exported without being processed in a domestic industry. (E. L. Corong & Horridge, 2012).

Table 1: The structure of a single region IO Database

			Supply-Use Matrix					
			1	2	3	4	5	6
			Intermediate Usage	Investment	Household	Government	Changes in Inventories	Export
		Dimension	65	1	1	1	1	1
1	Domestic Commodities	65	65 x 65	65 x 1	65 x 1	65 x 1	65 x 1	65 x 1
2	Imported Commodities	65	65 x 65	65 x 1	65 x 1	65 x 1	65 x 1	65 x 0
3	Taxes on Domestic Commodities	65	65 x 65	65 x 1	65 x 1	65 x 1	65 x 1	65 x 1
4	Taxes on imported Commodities	65	65 x 65	65 x 1	65 x 1	65 x 1	65 x 1	65 x 0
5	Trade Margins	49	49 x 65	65 x 1	65 x 1	65 x 1	65 x 0	65 x 1
6	Transport Margins	49	49 x 65	65 x 1	65 x 1	65 x 1	65 x 0	65 x 1
7	Labor	5	5 x 65					
8	Capital	1	1 x 65					
9	Land	1	1 x 65					
10	Industry taxes	1	1 x 65					

The third and fourth row represents the tax matrices. These matrices show the taxes paid in the delivery of domestic and imported commodities to the different users. Taxes on commodities include value added taxes, and duties on imports and taxes other taxes on products (Mahajan et al., 2018). Taxes will have a positive value, and subsidies will be negative. A positive value indicates a tax associated with the delivery of commodities from the domestic and imported sources to the intermediate input and final consumption. A negative value is interpreted as a subsidy (Roos et al., 2015).

Sales or uses also include sales of transport or margin commodities to the global transport pool, which are used to supply international transportation services for exporting goods from one country to another (Roos et al., 2015). A special feature of the GTAP model is the detailed treatment of margins. Three of the 65 GTAP commodities are also modes of transport or margin commodities in the GTAP Data Base (Walmsley et al., 2012). Margins' activities include wholesale trade, retail trade, and transport. The fifth and sixth row represents the value of commodities used as trade and transport margins to facilitate the flow of commodities from both domestic and imported sources to the intermediate and final use. There are flows that do not require any margins, and therefore the values in these matrices are zero. This is mainly for services commodities (Roos et al., 2012).

The primary factors included in the GTAP Data Base are agricultural land, natural resources, labor, and capital. Labor information is available for five types (Aguiar, Corong, & McDougall, 2019). Rows seven, eight, and nine provide a breakdown of the cost of primary factors used by production sectors. The inclusion of these factors allows the model to determine the percentage change in the sector-specific demand for factors due to a change in relative prices. Row seven shows the purchases of labor by producing sectors, row eight contains the supply of capital to each producing sector, and row nine contains the value of agricultural land used by each producing sector. Producing sectors also pay production taxes. Taxes on production consist of all taxes that industries incur as a result of engaging in production, independently of the quantity of the goods and service product or sold (Mahajan et al., 2018). Row ten contains all the production taxes.

3 Conversion Method: Stages and Stepwise application

The Conversion method consist of 26 steps grouped into ten stages i.e (1) conversion use tabe, (2) conversion supply table, (3) compilation of IOT and split the use matrix, (4) construction of labour compensation matrix, (5) estimation of compensation to land and natural resources, (6) estimation of compensation to capital, (7) allocation of taxes on product, (8) distribution of income and factor taxes, (9) construction of trade and transport margins and import duties matrices, and (10) trade-link of international trade. The scheme is outlined below and then described in more details in section five.

Stage 1: Convert the Use table from the old industry and product classifications into the new industry and product classifications. The Use table is valued in Purchasers' prices and includes a matrix of intermediate and final consumption. In the intermediate use matrix (**A**) industries or columns are more aggregated and products or rows are more disaggregated than the GTAP classifications. The conversion method transforms the intermediate consumption matrix **A** from the old classification and dimensions into the new classifications and dimensions. In the final demand matrix, there is direct matching between columns, therefore the conversion of the final use table is simple row aggregation.

Stage 2: Convert the supply table from the old product classification into the new product classification and obtain the production matrix. The supply table is valued at basic prices and consists of various sources of supply, margins, and import duties. The initial vectors of domestic consumption, import, and margins are much more disaggregated than GTAP required for the compilation of IOTs. Therefore, the conversion process with a very highly detailed level is nothing more than a pure reallocation of value to a new set of products. Using simple matrix algebra the domestic output column is transformed into the production matrix, and the Make matrix is obtained by transposing the production matrix.

Stage 3: Compile the IOT and split the use matrix. A transformation of SUTs to symmetric IOT is required if the supply table has off-diagonal (secondary products) elements. The initial supply table only has the primary product. Therefore, the use table obtained in the first stage is the symmetric IOT. It is essential to split the use matrix into the domestic use matrix and the import use matrix. The transformation method splits the use matrix into the domestic use and import use matrices.

Stage 4: Construct the labor employment and compensation matrices. Statistical information on the nominal monthly wages is not available, therefore the construction method starts with the estimation of monthly nominal wages using the Compound Annual growth rate (CAGR). The employment matrix has ILO occupations in rows and industries in columns. A transformation matrix map the ILO occupations and industries into the GTAP occupations and industry. Labor compensation is obtained by the multiplication of wages and employment matrices.

Stage 5: Construct the compensation for land and natural resources. The data on the compensation for land and natural resources is not available. Therefore, the procedure applied by Hertel et al. (2020) is used in order to calculate the compensation for land and natural resources.

Stage 6: Estimate compensation to capital. To calculate fixed capital consumption, the data obtained from WDI on the fixed capital consumption is normalized to the value provided by national statistics, and then normalized fixed capital consumption is used to adjust labor income share. The allocation method equally allocate fixed capital consumption to all the production sectors, and re-normalize the decomposition of value added. To calculate capital consumption, the procedure convert labour income, compensation to land and natural resources, and capital depreciation into percentage share of value added. For each sector we add the percentage shares, in case if its less then one, the residual is our compensation to capital, and in case if its more then one we re-adjust all the shares to equal one, and assume that the capital depreciation is equal to the compensation to capital. Then adjust labor income share to equal the official value available from national statistics.

Stage 7: Allocate taxes on products to the relevant use categories. The data on the product taxes are provided by the IMF Government Financial Statistics (GFS). The value of general taxes and excise taxes is proportionally allocated to the relevant use categories in the intermediate and final use matrices. General taxes and excise taxes are aggregated into a single matrix. column-wise summation of the taxes on the product matrix gives a row vector of net taxes on the product. To add that vector into IOTS, The allocation method re-scales the value-added, intermediate consumption, and final use matrices.

Stage eight: distribute income and factor taxes. Social security contribution, taxes on payroll, and personal income taxes are assigned to labor and distributed *pro rata* between five GTAP labor types. Corporate income taxes and property taxes are distributed proportionally between capital, land and natural resource. It assumed that all other factor employment taxes to bear equally on all factors, therefore it is distributed *pro rata* across all eight GTAP primary factors (the five kinds of labor, capital, agricultural land, and natural resources). Finally, all taxes are added into income taxes and factor taxes matrices, and their column wise summation is added as row vectors to the value added matrix.

Stage 9: Convert the trade and transportation margins, and import duties vectors into matrices. The conversion method map trade and transport margins, and import duties vectors into intermediate and final consumption.

Stage 10: Trade-link the international trade. The import use table obtained in the third stage is still aggregated over all countries of origin. Using international import statistics and import ratios, the import use table is disaggregated into bilateral import use tables. Equivalently, information obtained from international statistics is used to split up the export column into the matrix of bilateral export.

3.1 Stepwise application of the method

- Stage 1: Conversion Use table
    1. Step 1: Convert the industries or columns of the intermediate consumption matrix **A** From NSIA's classification (old classification) into the GTAP classification (new classification)
    2. Step 2: Adjust the conversion coefficient matrix and consequently the intermediate consumption matrix.
    3. Step 3: Convert the products or rows of the intermediate consumption matrix **A** From the old classification into the new classification
    4. Step 4: Convert the final consumption matrix from the old classification into the new classification
- Stage 2: Conversion supply table
    1. Step 1: Map the initial vectors of domestic output, imports, trade and transport margins, import duties, and total supply from the old classification into the new classification
    2. Step 2: Transform the domestic output columns into the production matrix, and calculate the Make matrix
- Stage 3: Compilation of IOT and distinction between domestic and import use tables
    1. Step 1: Transform The Use table into Symmetric IOT, and check accounting identities and non-negativity
    2. Step 2: Split the use matrix into the domestic use matrix and import use matrices
- Stage 4: Construction of labor employment and compensation matrices
    1. Step 1: Estimate missing wages by occupations and economic activities
    2. Step 2: Generate The employment matrix with ILO occupations in rows and GTAP sectors in columns
    3. Step 3: Construct the labor compensation matrix, with GTAP occupations in rows and sectors in columns
    4. Step 4: Re-scale the labor compensation matrix
- Stage 5: Compensation for land and natural resources
    1. Step 1: Estimate compensation to land and natural resources
- Stage 6: Estimation of Compensation to capital
    1. Step 1: Calculate capital consumption and adjust the labor income share
    2. Step 2: Allocate the capital depreciation into the sectors

3. Step 3: Calculate compensation to capital
4. Step 4: Re-scale the compensation to labor, and re-adjust non-labor compensation

- Stage 7: Allocation of taxes on products
  1. Step 1: Assign general taxes on goods and services and excise taxes to the taxable use categories
  2. Step 2: Adjust the intermediate and final use matrices to the value of general and excise taxes
- Sate 8: Distribution income and factor taxes
  1. Step 1: Distribute labor income taxes between five labor occupations
  2. Step 2: Allocate corporate income and property taxes to natural resources and capital
  3. step 3: calculate sector-specific total income and factor taxes
- Stage 9: construction of trade and transport margins and import duties matrices
  1. Step 1: Convert the trade and transport margins vectors into trade and transport margins matrices
  2. Step 2: Convert the import duties vector into import duties matrix.
- Stage 10: trade-link international trade
  1. Step 1: Split-up of the import use table into bilateral use tables
  2. step 2: Split-up of the export column into bilateral export columns

4 Data Sources for the Afghanistan Database

The building blocks for creating a database for a CGE model are official statistics from an IOT, or from a SUT, or from a SAM. Often the structure of the published data is not in the required format of CGE database, and so a major task is to transform the official data into a form required by a CGE database. The first step in this task is typically a review of the primary source of data. Before creating the CGE database, it is important to review and understand the valuation, structure, and unique features of the published data, as these dictate what data manipulating steps are required.

The 2008 SNA recommends three main valuation concepts of the flows of goods and services: basic prices, producers' prices, and purchasers' prices. The basic price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output, minus any tax payable (i.e. VAT and excise duties), and plus any subsidy receivable on that unit as a consequence of its production or sale. basic prices exclude any transport charges involved separately by the producer. The producers' price is the amount receivable by the producers from the purchaser for a unit of a good or service produced as output minus VAT, or similar deductible tax, invoiced to the producer. it excluded any transport charges invoiced separately by the producer. Finally, the purchasers' prices are those prices payable by the purchasers and include transport cost, trade margins, and taxes and exclude any deductible VAT or similar deductible tax (Mahajan et al., 2018).

4.1 Basic structure of the Supply Use Tables for Afghanistan

In this subsection, we briefly describe the basic structure of the Afghanistan SUT, available for 2017, where the supply table is valued at the basic price, and the Use table is valued at the purchasers' price. This will be our starting point in creating CGE database. The supply table contains information on the commodity-specific supply from domestic and imported sources and includes columns indicating margins, whereas the Use table shows the final users of these commodities.

Table (3) is a simplified illustration of the Supply table. The supply table consists of 267 commodities in rows, and various sources of supply, trade and transport margins, import duties, and total supply in columns. The column output shows the supply of domestic production at basic price, and the import column shows goods and services at cost, insurance, and freight (CIF) prices. The columns of the valuation matrix refer to trade margins, transport margins and import duties.

Table 2: The format of the supply table

		Output	Import	Valuation Matrices			Total Supply
		Basic prices	CIF prices	Trade Margins	Transport Margins	Import Duties	
Products	1						
	2						
	3						
	.						
	267						

The supply valued at the basic price can be calculated by adding the domestically produced commodities (output column) to the imported commodities. Supply at basic prices is converted to supply at purchasers' prices by adding trade and transport margins and import duties columns. The final column of Table (3) shows the total supply of goods and services at purchasers' prices.

The Use table, valued at purchasers' prices, is illustrated in the table (4). This table contains information on the value of commodities purchased by different users. The Use table includes a matrix of intermediate consumption of domestic and imported goods and services by 267 commodities and 22 industries. The final consumption matrix contains columns of final consumption of households, Government, and Non-profit Institution Supporting Households (NPISHs). The matrix of Gross capital formation contains column vectors of GFCF government, FGCG non-government, and changes in inventories. The last two columns of the Use table contain export in Fright-On-Board (FOB) and total use. The total use is valued at purchasers' prices and is the sum over all users for each product. The values in the total use column is equal to the commodity supply valued at purchasers' prices.

The last three rows of the Use table contain total intermediate consumption, gross value added (residually calculated), and output (import duties included). Table 1 shows the simplified Use table provided by NSIA for 2017.

Table 3: The format of the Use table

		Intermediate Consumption (IC)				Total IC	final consumption			Gross Capital Formation			Export	Total use
		Agri. (1)	Manu. (2)	...	22		Househ.	GOV.	NPISH	GFCF gov	GFCF no-gov.	changes inv.		
Products	1													
	2													
	3													
	.													
	267													
IC														
GVA														
Output														

4.2 Other Data Sources

We converted the available SUT into the required database format in 10 stages. The data from our primary sources is not sufficient for constructing a CGE database, and therefore, there is a need for supporting information. We managed to retrieve some missing data from other national and international organizations, and also sometimes reasonably estimate them. The manipulation is applied to data obtained from supporting resources to make them consistent with each other.

The compensation of value added includes compensation to labor distinguished by five gtap occupations, capital, land, and other natural resources. To determine labor compensation, we use employment and wages data from the International Labour Organization (ILO). To calculate labor compensation for 65 GTAP sectors and 5 occupations, we employed several data sources from the ILO. We use Employment by Economic Activity and occupation (thousand)-annual data (ILO, 2017a), Employment by Sex and Occupation data (ILO, 2017b), and Mean Nominal monthly earning of employees by Sex and occupation data for the year 2014 (ILO, 2014), and for the year 2020 (ILO, 2020). Data on the compensation to land and natural resources are not available. Therefore we rely on the procedure applied by (Hertel et al., 2020) to estimate the share of return to the land and natural resources. There are several kinds of taxes included in GTAP Data Base such as trade taxes, import sales taxes, domestic sales taxes, factor taxes, production taxes, and direct taxes. Our main data source on the different types of taxes is the International Monetary Found's Government Finance Statistics (IMF, 2017).

To project the IOT for the year 2017 backward, we utilized data from various sources, and during the balancing process, this statistical information is used as external constraints. NSIA provides data on the amount of value-added generated by each sector for all the GTAP years (2004, 2007, 2011, 2014). The original data source includes fewer sectors in comparison to the GTAP sectoral classifications. Therefore, one of the main tasks is to utilize these additional data sources to split the original sectors into the GTAP sectoral Classification. The service sector is the largest sector of Afghanistan and is more disaggregate in comparison to the agriculture and industry sectors. The Agriculture sector includes the Cereal production sector, livestock sector, and other sectors. The industry sector contains the mining and quarrying sector, manufacturing sector, energy sector, and construction sector. Therefore based on available information, and computation methods, various assumptions were necessary to split the agriculture and industry sectors. Data sources, methods of computations, and imputations, as well as assumptions, are documented and are discussed in more detail in section six.

The statistical yearbooks are the primary data sources to compute the output values of each agriculture, industry sub-sectors for the GTAP years. The data and statistical information in the statistical yearbooks are collected from ministries, government organizations, and private sectors. The statistical yearbooks depicts the socio-economic condition of the country and also provide easy access to rich source of statistical information and data on population, educational attainment, the total number of violence, the number of crime, public health indicators, consumer price index, agricultural production, mining and manufacturing production, electricity production and consumption, foreign trade, and services sectors. NSIA publishes the statical yearbooks since 2002 annually, however, they are only publicly available since 2010. Their early versions were only available to international organizations such as World Bank and IMF, and they were published by (CSO). We utilize publicly available Statistical yearbooks (NSIA, 2011), and (NSIA, 2014) to map sectors in the original data source to the GTAP sectoral classifications for the GTAP years 2014, and 2011, and for the year 2007 and 2004 IMF report (Symansky et al., 2006) and the World Bank country economic updates reports are the primary sources of information.

To calculate the gross output value of agricultural products, detailed information on the output of crop production (Q) and prices (P) is obtained from the Ministry of Agriculture, Irrigation, and Livestock (MAIL). The Gross output of each crop production is calculated as quantity multiplied by Prices (Q x P). Additional information sources provide statistics on the production and consumption of specific commodities. (Fareed, 2014) and (Bonneir, 2007) provide data on milk production, dairy production, and processing. (Jilani et al., 2013) present information on wheat and maize production, and (Walters et al., 2012) on vegetable production. (Kakar et al., 2019) report information on arable, irrigated, and rainfed land and rice cultivation and production. Afghanistan Womens' Chamber of Commerce and Industries (AWCCI, 2015) report information on silkworm see production. Complementary information on the production and prices of different types of crops and livestock censuses were obtained from the Food and Agricultural Organization of the United Nation (FAO). FAO Afghanistan (FAOAFG) report on the status and perspectives of the animal genetic resources development, sedentary farming system, milk production, and other animal product(Zafar, 2005), report also contains information on agriculture land and forest area.

Ministry of Commerce and Industries of Afghanistan (MOCI) provides additional information on food products and beverages output (Siddiqui & Naeem, 2015), (Shams & Adela, 2009) reports data on sugar production. (Ahmadzai, 2014) provide information on textiles, wearing apparel, leather, and wood products. (Mossotti, 2014) provide data on the manufacture of other non-metallic mineral products.(Nasrat et al., 2016) describe the carpet industry and provide information on the carpet production and production, they show the data on the value of exports in million USD Since 2001. (Rassin, 2012) provides an overview of the marble industry and data on domestic production from 2004 till 2012. Ministry of Energy and Water (MEW), Da Afghanistan Brishna Shirkat (DABS), and Ministry of Mines, and Petroleum (MOMP) are the main data sources for domestic and international agencies. The data on the energy, electricity, and mining sector can be mainly accessed from the reports published by NSIA, World Bank, IMF, Asian Development Bank (ADB), and other publications. (Rostami et al., 2017) provide data on annual domestic energy production and imports. Annual production distinguishes by the type of energy production source, and imported electricity is reported by country of origin, and the data is available for six years starting from 2006. (Burns, 2011) provide data on annual solar electricity generation. (Malik, 2009) report information on the production of electricity, natural gas, crude oil, petroleum products, coal and the different type of use of coal, and wind potential.

World Bank investigates different aspects of the Afghan economy and publishes data and reports regularly. In order to make the mapping between original data and GTAP sectoral classification more accurate and to calculate missing values, we retrieved a number of reports from the World Bank website. (Leao et al., 2018b) provide information on agricultural employment, particularly the book presents information on the patterns of earnings from rural activities(Leao et al., 2018a), the book also contains information on employment, skill, and human capital. (Hogg et al., 2013) explains in detail the economic structure of Afghanistan and mainly assess the economic effects of transition, and provides data on sectoral (agriculture, opium, mining, industry, and services) GDP growth, employment, aid, and other main economic indicators from 2003 till 2011. Several country economic updates report (Srinivasan & Ishihara, 2009),(Nassif, 2012), (World Bank, 2013), (Joya & Khan, 2014) (Group, 2016) provide data on cereal production, food, and non-food prices, export, imports, and other selected economic indicators. All these reports provide information from the year 2002 their main data source are NSIA, DAB, and other local agencies.

Afghanistan Living Condition Survey (ALCS) (CSO, 2016) is conducted by the NSIA (CSO) and with technical assistance from ICON-institute and financial support of the European Commission. ALCS is the most comprehensive survey report, covering detailed information on population and household, labor market, agriculture, health, education, housing, and gender. The report provides detailed information on the labor market, labor force participation, labor force characteristics, labor force composition, and unemployment. The report is based on two survey rounds of the National Risk and Vulnerability Assessment (NRVA) in 2003 and 2005. ILO Asia pacific working paper series (Dasgupta et al., 2019) shows data on employment scenarios in Afghanistan from 2007-2008 to 2013-2014. The paper provides detailed information on the structure of employment, it also presents data on labor force participation rate by age, gender, educational level, unemployment, unemployment rate by age, gender and educational level.

4.3 Issues With the Data

It should be noted that the following discussion is based on data after the SUT commodities and industries are aggregated to the dimensions of the GTAP database. The aggregation, disaggregation, and mapping of commodities and industries are described in stages 1 and 2 of section 5.

Although The Afghanistan SUT contains a supply table and detailed use data of 267 commodities and 22 industries, a number of differences with the GTAP database are as follows:

- Firstly, The use table (3) contains a matrix representing the flow of commodities to intermediate and final users valued at purchasers' prices. The model requires these flows to be split up into (i) flows of commodities to intermediate and final use at basic prices; (ii) commodity, users, and margins specific matrices, and (iii) commodity and user specific import duty matrix.

- The import duty column in the supply table (2) records commodity specific import duties paid on imported goods. Similarly, the trade and transport margins columns record commodity specific margins on commodities. However, there is no information on the user specific import duties and margins on commodities. Instead, the import duties and margins are included in the purchasers' values of the commodity flows in the use table. This import duty column and trade and transportation margins columns need to be split into import duties, trade, and transportation margins matrices.

- In the use table (4), the distinction between domestic and import uses is missing. The import column in the supply table (3) records imports of commodities. We use this column to disaggregate the use table valued at purchasers' prices into two source dimensions, namely, the domestic use table and the imported use table.

- In the use table (4), the total compensation to primary factors is presented as gross value added. There is no data on the compensation to labor, land and natural resources, and capital. We use external data sources mentioned above to split the value added row to compensation to labor distinguished by five skill level, land and natural resources and capital.

- The Supply table provides no data on the product taxes. The CGE Model database requires the creation of commodities by users specific tax matrices. This implies that we obtain taxes values and distribute them over commodities and users.

- The import column in the supply table (3) and the export column in the Use table (4) are aggregated over all trading partners. The SUT is not supplemented by trade data in order to link the import and export columns through bilateral trade flows. We use international statistics to trade link the import and export columns.

5 The CGE Database: A Social Accounting Matrix creating process

This chapter describes the methodology developed to produce SAM for Afghanistan for the GTAP reference year 2017 in compliance with GTAP submission requirements. Such a methodology allows the conversion of the Afghan SUTs from NSIA's classification into the GTAP sectorial classification and creates additional matrices to produce SAM by means of several steps grouped into ten stages. In subsection one, we start with the conversion of supply and use table from the old product and industry classification into the new classification. The second subsection decomposes the gross value added, subsection three creates valuation matrices, and subsection four trade-link the import use table and export column.

5.1 SUT conversion method

The conversion method for SUT consist of eight steps grouped into three stages, i.e (1) conversion of use table, (2) conversion of supply table, (3) compilation of IO table and distinction between domestic use and import use tables. At first and second stage we develop a conversion method for the classification conversion, and in the last stage we compile the IO table and split the use matrix into domestic use and import use matrices.

5.1.1 Stage 1: Conversion Use table

The Use table(4) is valued in purchasers' prices and includes a matrix of intermediate consumption of domestic and imported goods and services by 267 commodities and 22 industries and the final consumption matrix. In the Use table, industries or columns are recorded according to the NSIA classification, which is much more aggregated than the GTAP required for the compilation of Input-output tables. In addressing this issue, we introduce a conversion method to disaggregate the columns using bridge matrices or conversion factors. Conversions deal with those situations where the correspondence between Columns in the NSIA's classification (old classification) and GTAP classification (new classification) implies one-to-one cases (direct matching), many-to-one cases (aggregation), and one-to-many cases (disaggregation). In direct matching, one single sector in the old classification fits perfectly with another single sector in the new classification. In aggregation, various sectors in the old classification are aggregated into one single sector in the new classification. Finally, in one-to-many cases, one sector in the old classification is broken down into various sectors in the new classification.

Matrix **G** is the target matrix with different dimensions and the new classification. The conversion method transforms the intermediate use matrix **A** from the old classification and old dimension (267*22) into a new classification and dimensions (65 *65) in four steps. In the first step, industries or columns are transformed from the old classification into the new classification. In the second step the conversion coefficient matrix is adjusted. In the third step, the product classifications or rows are converted from the old classification into the new classification. The last step includes the conversion of the final demand matrix.

Let **C** be a bridge matrix of order 22 * 65, where 22 is the number of industries in the old classification, and 65 is the number of industries in the new classification. Matrix **C** converts the columns of matrix **A** from the old industry classification into the new industry classification. Matrix **C** is populated with conversion coefficients. Conversion coefficients are defined as the share of one specific industry reallocated to another in a different classification. The conversion coefficient is based on the proportionality assumption. Every GTAP sector gets input as to their share in output, or the distribution of input is only a function of the level of output. The matrix **C** is adjusted in the next step to assure their rows and columns sum in the new classification equal the values by rows and columns in the old classification.

$$\underset{(267\times22)}{\mathbf{A}} \times \underset{(22\times65)}{\mathbf{C}} = \underset{(267\times65)}{\mathbf{AC}} \tag{1}$$

Equation (1) converts matrix **A's**columns. Basically, the resulting matrix **AC** has products (in rows) in the old classification and industries (in columns) in the new classification. Industries have been changed from NSIA's classification to GTAP classification, while the product classification remained unchanged.

The resulting row vectors of the intermediate consumption matrix in new classification **AC** are unlikely to match total product output in one-to-many mapping. In the second step, we use **AC** matrix and rescale its rows and columns from one-to-many disaggregation cases to match the output by product and industry in the old classification. This adjustment relies exclusively on matrix **C**. The adjusted matrix C^{adj} contains the recalculated conversion coefficient. We use the adjust conversion coefficient matrix C^{adj} and repeat the multiplication again. As a result we obtained balanced matrix, AC^{adj} with product in rows in old classification and industries in columns in the new classification. And importantly, it is assured that their rows and columns sum in the new classification equal the value by rows and columns in the old classification. In the next stages we use the C^{adj} matrix to convert the domestic output, import, trade and transport margins and import duties columns into matrices.

The starting point for third step is the semi-transformed intermediate consumption matrix AC^{adj}, obtained and adjusted in in first and second step. In third step the rows are converted from the old classification into the new classification. The AC^{adj} is pre-multiplied by the bridge table **R**.

$$\underset{(65\times267)}{\mathbf{R}} \times \underset{(267\times65)}{AC^{adj}} = \underset{(65\times65)}{\mathbf{G}} \tag{3}$$

The bridge table **R** maps products from the old classification into the new classification. Matrix R is of order 65*267. Where 65 is the number of products in the new classification and 267 is the number of products in the old classification. The Bridge matrix R provides a generic correspondence between CPA/ISIC rev.4. and GTAP sectors and is used to convert the rows of Matrix **A** from the old product classification into the new product classification. The resulting matrix **G** has the product (in rows) in the new classification and industries (in columns) in the new classification.

The final step of the first stage is the conversion of the final demand matrix from the old classification into the new classification. There is an exact match between the columns of the final demand matrix in the old classification and the new classification. Therefore, the conversion process is done with very highly disaggregated data in the rows. At the most detailed level, all reclassifications are many-to-one cases, due to the high disaggregation of the commodities, at such detail levels, the conversion is mostly mapping, or the transformation is nothing else than just a simple aggregation. The first stage provides an intermediate consumption matrix at purchasers' prices and the final demand matrix at purchasers' prices with seven categories, namely, household consumption, Government and Non-profit Institution Supporting Households (NPISHs) consumption, gross capital formation government and non-government, changes in inventories, and export in Fright-On-Board (FOB).

5.1.2 Stage 2: Conversion Supply table

The supply table consists of 267 commodities in rows and various sources of supply, trade and transport margins, import duties, and total supply in columns. The final column of Table (3) shows the total supply of goods and services at purchasers' prices. The initial vectors of domestic production, import, and margins are recoded according to the CPA/ISIC.rev.4. classifications, which are much more disaggregated than GTAP required for the compilation of IOTs. In the first step, commodities are mapped from the old classification into the new classification. In the second step, domestic production column is converted into production matrix (transposed make matrix).

In the first step we convert the columns in the supply table from the old commodity classifications into the new product classification. The conversion process with very highly disaggregated data is done by just re-classification. The advantage of this option is that correspondence between new and old classifications ends up being many-to-one for all groups of product. This correspondence is based on a mapping between CPA/ISIC.rev.4. and GTAP classification. Therefore, the conversion becomes nothing more than a pure reallocation of values to a new classification.

The first step of the second stage conversion provided column vectors of domestic production, imports, and margins, all in the GTAP classification.

In the second step, we transform the domestic output column into the production matrix. A production matrix only includes information on the domestic output of industries by product. The production matrix reflects the primary and secondary production activities of industries. The principal activity of an industry is reported on the diagonal of the matrix, while the secondary activities of an industry are listed off the diagonal (Eurostat, 2008). The initial column vector in the supply table implies that each industry produces one commodity, and each commodity is produced by one industry. Using a simple matrix operation, we convert the column vector of domestic output into a diagonal production matrix. Make matrix is obtained by transposing the production matrix (Eurostat, 2008). The make matrix shows the domestic production of 65 GTAP commodities by 65 GTAP industries at the basic price.

5.1.3 Stage three: Compilation of input-output table and import and domestic use tables

The first step of the third stage involves the conversion of SUT in the GTAP classification we obtained in the last steps to a symmetric input-output table. A transformation of the supply and use table to symmetric input-output tables is not necessary if no secondary outputs are observed. In this case, the intermediate consumption requirements are fully determined by the primary activity. In such a case, the make matrix (transpose production matrix) of the supply table we obtained in the second stage has only data entries on the main diagonal, and the Use table we obtained in the first stage is equivalent with an IO table (Eurostat, 2008). Also, we implemented the final check to ensure that the accounting identities and non-negativities hold and that the product uses and industry output in the new classification match figures in the old classification.

In the last step, we obtained a symmetric, balanced IOT, which has the GTAP format, and the product breakdown matches the GTAP sectoral classification. However, the IOTs to be delivered to GTAP are required to include matrices of domestic and import flows distinguishing between intermediate and final uses by activities. Therefore, the second step splits the use matrix into domestic and imported use matrices. In the initial SUT, NSIA allocates the values in the total supply column with a certain percentage across 22 producing industries and final demand categories. To obtain the domestic use matrix, we use the same allocation share and map the domestic production column into 22 intermediate industries and final use categories. Then we use the adjusted conversion coefficient matrix C^{adj} to map the 22 industries into 65 GTAP sectors. To obtain the import use matrix, we followed the same procedure we applied to construct the domestic use table, with one adjustment to the final demand matrix. In the GTAP database, no imported commodity is exported without being processed in a domestic industry (Rueda-Cantuche et al., 2016). Therefore we set the export column in the final demand matrix equal to zero and map the import column vector into 22 intermediate industries and final demand categories. Then, we use the adjusted conversion coefficient matrix C^{adj} to convert the 22 intermediate industries into 65 GTAP sectors. As a result, we obtained a symmetric input-output table with a proper distinction between domestic and import uses.

5.2 The decomposition of gross value added

We continue to split gross value added according to compensation of labor, distinguished by skill type, land, and other natural resources. The disaggregation method consists of nine steps grouped into three stages. i.e., (1) Construction of labor employment and compensation matrices, (2) estimation of compensation to land and natural resources, (3) calculation of compensation to capital. In the first stage, we obtain an initial split of total labor compensation to five different GTAP skill levels. In the second stage, we construct the first estimates of the compensation to land and natural resources based on the method developed by GTAP (Hertel et al., 2020). In the third stage, we compute capital compensation residually as the difference between the total value-added and labor compensation and land and natural compensation.

5.2.1 Stage four: Construction of employment and compensation matrices

In this subsection, we calculate labor compensation across 65 GTAP sectors, split into five occupation levels[5]. In the first step, we impute missing wages by occupations (sub-major groups) for the year 2017. In the second step, We map the data on employment by occupations (sub-major groups) and economic activity to the GTAP sectors. In the third step, we calculate the labor compensation matrix and map that to the GTAP occupation level, and finally re-scale the labour compensation matrix.

In The first step we estimate the missing wages. We need data on employment and wages to derive the labor split. Since statistical information on the nominal monthly wages for the year 2017 is not available, we use the Compound Annual Growth Rate (CAGR) formula and available data on the wages from the other years to calculate and impute the missing wages. We obtain the vectors of annual growth rate and missing wages by applying the CAGR formula to the data on the mean nominal monthly wages by major occupations for the years 2014 (W_{Mocc}^{2014}), and 2020 (W_{Mocc}^{2020}).

$$CAGR = \left(\frac{V_{final}}{V_{begin}}\right)^{\frac{1}{n}} - 1 \tag{2}$$

Where V_{begin} is the beginning value, V_{final} is final value, and n is the number of years. To calculate the WAGR, we rewrite the equation above as:

$$WAGR = \left(\frac{W_{Mocc}^{2020}}{W_{Mocc}^{2014}}\right)^{\frac{1}{n}} - 1 \tag{3}$$

Once we have the WAGR, we can go backward in time and calculate the vector of wages by Major occupation (W_{Mocc}^{2017}) for the year 2017 as follow:

$$\begin{aligned} WAGR, &= \left(\frac{W_{Mocc}^{2017}}{W_{Mocc}^{2014}}\right)^{\frac{1}{n}} - 1 \\ \left(WAGR, +1\right)^{n} &= \left(\frac{W_{Mocc}^{2017}}{W_{Mocc}^{2014}}\right)^{\frac{1}{n}n} \\ W_{Mocc}^{2017} &= \left(WAGR, +1\right)^{n} * W_{Mocc}^{2014} \end{aligned} \tag{4}$$

[5]GTAP disaggregated labor into five occupations: official and managers, technicians, clerks and associate professionals, service and shop workers, and agricultural and unskilled

Equation (6) gives us the vector of monthly wages by major group occupation for the year 2017. The employment data is reported annually in the ILO. Therefore, to obtain annual wages, we multiply the monthly nominal wages by 12. The last multiplication gives us the vector of annual wages by major group occupations (W^{2017}_{Mocc}) for the year 2017.

In the second step, we generate the employment matrix $[EMP_{Socc,GTAPsec}]$, with the ILO occupations (sub-major-groups) in rows and GTAP sectors in columns. ILO provides the data on the number of workers by major groups occupations and industry $[Emp_{Mocc,Ind}]$. To construct the employment matrix by sub-major group occupations level and industries, we map the major groups occupations to the sub-major groups occupations following the concordance between major groups and sub-major group occupations provided in Appendix 2. Employment matrix $[EMP_{Socc,Ind}]$ is of order 34 x 17, with the ILO sub-major groups occupations in rows and industries in columns.

The ILO industries conversion to the GTAP sectors starts with the multiplication of the employment matrix $[EMP_{SOCC,Ind}]$ by a Transformation table. Let **T** be a transformation matrix that map ILO industries into the GTAP sectors. Matrix **T** is of order 17 x 65, where 17 is the number of industries in ILO classification and 65 is the number of sectors in GTAP classification. Matrix **T** contains concordance between ILO industries and GTAP sectors. The concordance between ILO industries and GTAP sectors is provided by (Walmsley & Carrico, 2016).

$$\underset{(34\times17)}{[EMP_{Socc,Ind}]} \times \underset{(17\times65)}{T} = \underset{(34\times65)}{[EMP_{Socc,GTAPsec}]} \tag{7}$$

Equation (7), basically convert the columns of Matrix $[EMP_{Socc,Ind}]$. The resulting matrix $[EMP_{Socc,GTAPsec}]$ has the ILO occupations in rows and GTAP sectors in columns.

In the third step, we obtain labor compensation matrix $[Comp_{GTAPocc,GTAPsec}]$, with GTAP occupations in rows and sectors in columns. To do so, we convert the occupation level of the wages vector we estimated in the first step from the major group occupations to the sub-major group occupations. Then the wages vector by sub-major group occupation(W^{2017}_{Mocc}) is applied to the employment matrix by sub-major group occupations and GTAP sector matrix $[EMP_{Socc,GTAPsec}]$. As a result, a new matrix of labor compensation $[Comp_{Socc,GTAPsec}]$, is calculated. The resulting labour compensation matrix has sub-major occupations in ILO classification in rows and GTAP sector in columns and is of order 34 x 65.

The occupation conversion to the GTAP occupations starts with the pre-multiplication of labor compensation matrix $[Comp_{Socc,GTAPsec}]$ by the bridge table. Let **S** be a conversion matrix, that transform ILO sub-major group occupation into the GTAP occupation level. Matrix **S** is of order 5 x 34, where 5 is the number of occupations in GTAP classification and 34 is the number of occupations in ILO classification. Matrix **S** contains concordance between ILO occupation levels and GTAP occupations level. [6]

$$\underset{(5\times34)}{S} \times \underset{(34\times65)}{[Comp_{Socc,GTAPsec}]} = \underset{(5\times65)}{[Comp_{GTAPocc,GTAPsec}]} \tag{8}$$

[6] The concordance can be found in Appendix 2

Equation (8), basically transforms the rows of matrix $[Comp_{Socc,GTAPsec}]$ from the old occupations level into the new occupations level. The resulting matrix $[Comp_{GTAPocc,GTAPsec}]$ has the GTAP occupations level in rows and GTAP sectors in columns. However, the total labor compensation obtained in the last step does not match the value of total labor compensation available from NSIA. Therefore in the final step, we re-scale the labor occupation matrix to match the exogenous total labor compensation.

5.2.2 Stage five: Compensation for land and natural resources

Here we describe the construction of first estimates for the expenditures by firms and sectors on land and natural resources as components of total sector value added. This is done for a subset of sectors only for which those items account for a non-trivial share of total expenditures on capital. Specifically, in the GTAP database, land is used used by the gricultural sectors. Other natural resources such as timber, stock of fish, or fossil fuels and mineral deposits are important in the sectors forestry (*frs*), fishing (*fsh*), the fossil fuel (*coa, oil, gas*) and other mining (*oxt*). Data on these types of expenditures are scarce, however, and not available for Afghanistan. Thus, in order to construct them, we rely on the procedure applied by Hertel et al. (2020) to calculate the share of sector value added going to the compensation of natural resources in the GTAP database and extended it to the derivation of the VA share of land.[7] Once we obtain the VA share of those items, we multiply it by the total sector value-added.

Hertel et al. (2020) rely as much as possible on the data and parameters available from the GTAP database itself. First, they calculate the the own Allan-Uzawa elasticity of substitution of the fixed natural resource r, σ_r, as

$$\sigma_r = -\sigma_{VA}(\theta_r^{-1} - \theta_{VA}^{-1}) - \sigma_T(\theta_{VA}^{-1} - 1), \tag{8}$$

where σ_{VA} and σ_T are the elasticities of substitution among the different VA components and between those components and intermediate inputs, respectively. We obtain both from the GTAP database where the σ_T is equal to zero. The share of value added in total cost is denoted as θ_{VA} and obtained from Afghanistan's IO tables. Our main interest here lies with the share of natural resource r in total cost, denoted as θ_r, which can then be calculated as

$$\theta_r = \left(\theta_{VA}^{-1} - \frac{\sigma_r}{\sigma_{va}}\right)^{-1}. \tag{9}$$

Next, and as in Hertel et al. (2020), we exploit that in a partial equilibrium setting and the presence of a fixed sector specific factor, such as land, and natural resources, a price increase of sector output is reflected in higher rents associated to that resource. In such a setting the supply elasticity of sector j, i.e. η_j, is equal to the negative of the own Allan-Uzawa elasticity of substitution of the fixed natural resource r, i.e. $\eta_j = -\sigma_r$. Thus, θ_r can finally be calculated as

$$\theta_r = \left(\theta_{VA}^{-1} + \frac{\eta_r}{\sigma_{va}}\right)^{-1}. \tag{10}$$

We obtain supply elasticities in agriculture, i.e. η_j, from Johnson & Vollrath (2020) and for the remaining natural resources from Hertel et al. (2020). Then, we apply them, together with

[7] In the GTAP database the share of land share of total VA is derived from a survey of the literature. For the "Rest of South Asia" region, which includes Afghanistan in GTAP, however, the literature does not provide such values. As a result Hertel et al. (2020) applied the land share of India to this region.

σ_{VA} from GTAP and θ_{VA} from Afghanistan's IO tables, to Equation (10). We obtained the resulting shares for land and natural resources and compare them with the ones GTAP used for the composite "Rest of South Asia" region. We apply the share of land to all agricultural sectors as it is done in the GTAP database.

5.2.3 Stage six: Estimation of Compensation to capital

This section describes the adjustment of labor income share and compensation to capital. The labor income share is calculated as compensation to labor relative to gross value added (gross labor share). Labor compensation relative to net value-added is called the net labor share. Fixed capital depreciation is the link between gross value-added and net value-added. Depreciation is typically referred to as the consumption of fixed capital in the national accounts, and it is the implicit income that is consumed by the use of fixed capital and, therefore, its included in GDP (Karabarbounis & Neiman, 2014).

In the first step, we calculate fixed capital consumption and adjust the labor income share. The labor share of income is conventionally computed by dividing the total compensation paid to employees by the national income (GDP). One adjustment is required for the computation of its denominator. Labor income share needs to be calculated net of capital consumption by subtracting the amount of fixed capital consumption from the GDP. To adjust the denominator, we need to obtain the amount of fixed capital consumption. To do so, we use the data on fixed capital consumption and GDP provided by World Development Indicator (WDI) and calculate the capital depreciation rate, which is the ratio of fixed capital consumption to the GDP. Then, to calculate fixed capital depreciation, we multiply the depreciation rate by the initial GDP value and obtain the fixed capital consumption. We use the normalized fixed capital depreciation to adjust the GDP and consequently adjust the labor share.

In the second step, we allocate the fixed capital consumption amount calculated in the last step across the GTAP producing sectors. As the value added is intended to measure the value created by a process of production, and the consumption of fixed capital is a cost of production (McCulla et al., 2015). Therefore, we assume that the cost of production is equal across all sectors and therefore distribute the fixed capital consumption evenly across the producing sectors. The Value added represents the contribution of labor, capital, land, and natural resources. Some part of the value added should therefore be regarded as fixed capital consumption (McCulla et al., 2015). For this reason, we add the row vector of fixed capital deprecation to the value added matrix. As a result of this adjustment, the value added is split up into compensations to labor, land and natural resources, and fixed capital consumption. However, the sum of each column of the value added matrix does not comply with the targeted value added from the national statistics. Therefore, we normalize the sector specific compensation to labor, land and natural resources, and fixed capital consumption. as a result, we decomposed value added into three components, and the sum of each column corresponds to the targeted value.

In the third step, we obtain the compensation to capital. To do so, we convert compensation to labor, land, and natural resources and fixed capital consumption into the percentage share of Gross Value-added. We add together all the percentage shares and get one of the two possible outcomes. Either the sum of the added share is either less than 100 percent, or it is more. If the sum is less than 100 percent, then the residual is the compensation to capital. In the second case, where the sum is more than 100 percent, we normalize the share of compensation to labor, land, and natural resources and capital depreciation to equal 100 percent. We assume that the adjusted capital depreciation we obtained in the last step is the capital compensation share. As a result of this procedure, we calculated the compensation to capital for all the Sectors, and most importantly, it varies across sectors.

In the fourth step, we re-scale the compensation to labor, and re-adjust non-labor compensation accordingly. The previous steps provided us with the value added matrix decomposed into compensation to primary factors. However, the total value of the resulting vector of compensation to labour does not match the total value of gross labor share. Therefore, we normalize the compensation to labor such that the total is equal to the gross labor share. After the adjustment to the labor compensation, eventually, non-labor compensation is calculated residually as a difference between the gross value added and labor compensation. The non-labour compensation is split up proportionally into compensation to land and natural resources and compensation to capital. Our final task is to ensure that total factor payment is scaled to the official aggregate value for factor payment as it appears in the SUT.

5.3 Valuation matrices

The input-output table we obtained in the first step of the third stage is in the purchasers' prices. It is necessary to produce different valuation layers of the table, which covers the transformation of data from the concept of purchasers' price to the concept of basic price and vice-versa (Mahajan et al., 2018). The IOT at purchasers' prices is eventually transformed into IOTs at basic prices with a distinction between domestic and import use matrices (obtained in the third stage) and additional matrices for the trade and transportation margins and import duties. In this section, we construct the valuation matrices for the taxes of products and trade and transport margins in three stages, i.e., (1) estimation of taxes on product matrix, (2) construction of income and factor taxes matrix, (3) compilation of trade and transport margins and import duties matrices. In the first and second stages, we estimate matrices for product, income, and factors taxes, and in the third stage, we transform the trade and transport margins and import duties vectors into similar dimensions as intermediate and final use tables.

5.3.1 Stage seven: Taxes on products

In the first step, we assign taxes on products to the taxable use categories. Taxes on products include general taxes on goods and services and excise taxes. To generate the valuation matrix for the taxes on products, we rely on the data provided by the IMF Government Financial Statistic (GFS). In relation to the general taxes and excise taxes, we adopted a simplified approach. After, we determine taxable and exempted items, (of Finance of Afghanistan, 2009)[8]. We proportionally allocate general taxes to the relevant entries in intermediate and final use matrices and excise tax to the final use categories, explicitly to private households and capital formation. In order to obtain a valuation matrix for taxes on products, we add together the general taxes on goods and service matrix and the excise tax matrices. The tax matrix we obtained has the same dimension as the intermediate and final use tables.

In the second step, we adjust the intermediate and final use matrices to the value of product taxes. Columns-wise summation of the valuation matrix we obtained in the last step gives us

[8]The national Tax administration specifically exempts health services, educational services, insurance services, other social services, public administration, and defenced services and exports.

the row vector of net taxes on products paid by each intermediate use (production sectors) and final uses categories. In order to add the vector of the net taxes on products into IOTs we perform two adjustments. We start with the adjustments of value-added components. We re-scale the columns of the value-added matrix by the amount of taxes paid by each sector. Next, we proportionally adjust the intermediate use and final use table by the size of net taxes on products consumed by final use categories.

5.3.2 Stage eight: Income and Factor Taxes

To distribute income and factor taxes, we follow the methodology proposed by GTAP. Income and factor taxes denote taxes on income, profit and capital gain, taxes on payroll and workforce, social security, taxes on property, and other taxes. We assign all social security contributions to labor and distribute them proportionally between skilled and unskilled labor and distribute all the factor employment taxes equally on all factors. Additionally, we map taxes on payroll and workforce to labor and property taxes to the non-labor factor. For income taxes, we assign personal income tax to the labor and corporate income taxes to other factors.

In the first step, we assign all social security contributions, taxes on payroll, and personal income taxes to labor. To distribute labor income taxes among five labor occupations, we construct a transformation matrix by dividing each element of disaggregated labor value-added matrix by total labor value-added. Moreover, we multiply the social security contributions, taxes on payroll, and personal income taxes by the transformation matrix. As a result, we converted the values of labor taxes into matrices.

In the second step, we map non-labor taxes. We distribute property taxes and corporate income taxes to the non-labor factors. To do so, we create a coefficient matrix by dividing each cell of the non-labor value added matrix by the total non-labor value added and then multiply the coefficient matrix by the non-labor taxes to convert them to matrices. In the third step, we allocate all other factor employment taxes. We assume that all other factor employment taxes to bear equally on all factors, therefore we distribute them *pro rata* across all eight GTAP primary factors (the five kinds of labor, capital, agricultural land, and natural resources).

In the third step, we aggregate all the income taxes into a single income taxation matrix and all the factor taxes into a single factor taxation matrix. Column-wise summation of these two matrices gives us sector-specific total income and factor taxes, and then we add these two-row vectors as income and factor taxes to the components of value-added

5.3.3 Stage nine: Trade and Transport margins and import duties

In this stage, we convert the trade and transport margins and import duties vectors into matrices in two steps. For all non-service commodities listed in the Afghanistan SUT, margins are given as Trade and transportation margins. Some features that we noted are. Firstly, there are not margins for services provided because services are delivered directly from producers to consumers and hence do not require margins. Secondly, there are not margins on inventories. Thirdly, Trade margins are usually produced domestically but apply to goods produced domestically and imported. Transport margins may be provided by resident and non-resident (Moulton, 2004). Finally, the margins columns show a positive value for each commodity where margins apply, with an offsetting negative value for each of the margin commodities. The values of trade and transport services, reflected in the use table, show only those that are consumed directly and do not include any margins. Instead, margins are included in the value of the goods at purchasers' prices, shown in the rest of the use table.

In the first step, we convert the trade and transportation margin vectors into matrices. To obtain the trade and transportation margin matrices, we follow the same procedure we applied in stage three to generate the domestic use matrix with one adjustment to the final demand matrix. There are flows that do not require any margins, this is mainly for inventories. Therefore, we set the values in the inventory column in the final demand matrix equal to zero, and map the trade and transportation margin vectors into 22 intermediate consumption and final demand matrices. Then, we use the adjusted conversion coefficient matrix C^{adj} to convert the 22 intermediate industries into 65 GTAP sectors. This step gives us two additional matrices for the trade and transport margins, all in the GTAP classification.

In the second step we convert the import duties vector into import duties matrix. To obtain the import duties matrix we use the same procedure we applied in the third stage to convert the import vector into import use matrix. As a result we obtain the import the import duties matrix.

5.4 Stage ten: International trade

In the third stage, we obtained domestic and import use tables. However, the import use table is still aggregated over all countries of origin. The import use table is supplemented by trade data in order to link the import use table with other trading partners via bilateral trade flows. Using international import, statistics, we disaggregate the import use table into bilateral import use tables. Also, the final use table contains the export column, which indicates the supply to all foreign countries. Similarly, we use international statistics to split the export column vector into bilateral export vectors.

In the first step, we trade link the import use matrix. To trade link import use table, information on the country of origin of the product is needed to disaggregate the import use table. This information can be obtained from international trade statistics. However, applying the trade data to disaggregate the import use table, introduce inconsistencies. Therefore, prior to splitting the import use table, we regain the consistencies. We use the KRAS method to balance the matrix of imports by trading partners, and the import column from the SUT as a column constraint.

To disaggregate the import use table, we follow the methodology proposed by (Bouwmeester & Oosterhaven, 2008) . According to their methodology, the import use table is disaggregated using the import ratios. Prior to disaggregating the import use table, if any duties and import commodity taxes levied in the destination country are included in the import use table, these are to be removed. In the import use table, we complied in the third stage, import duties are already removed. Therefore, we start by applying the import ratios to disaggregate the import use matrix. To disaggregate the import use table, we calculate the import ratios. For each trading partner, there is one vector, which contains the import ratios. These vectors are based on the GTAP classifications. The bilateral import use matrices are calculated by applying the import ratios to the rows of the import use table. The proportionality assumption made here is that each GTAP sector and each final demand category imports the same share of product **i** from the source country. The import use table of the rest of the world is obtained by deducting all bilateral import use tables from the aggregated import use table.

In the second step, we trade link the export column. To trade link the export column, we construct the export matrix whit the GTAP classification in rows and bilateral export partners in the columns. To construct the export matrix, we obtained information from international trade statistics. Using, trade data obtained from several sources introduce inconsistencies. To balance the export matrix, we apply KRAS method, and use the export vector as a column constraint. The export to the rest of the word is calculated by taking the difference between the original column and the summation of all included country columns.

6 Updating and projecting SAMs

Input-output modeling at both national and regional scales is a topic that has gained much attention in recent decades, given a huge number of potential applications (including SAM and CGE) for economic researchers and policy-makers. The well-known problem is that the compilation of the information required to build a survey-based SUTs, Input-output table, and SAM is expensive and time-consuming for statistical agencies, causing a lag between the compilation of the information in the survey and the publication of the table. Reducing the timeliness of the publication of these tables is difficult due to the considerable economic, technical, and human resources required to collect and elaborate the appropriate data. Therefore the use of projection and updating methods to adjust and updated SUTs, input-output tables, and SAM has become increasingly popular over the past 50 years (Mahajan et al., 2018).

Besides the timeliness, there are other reasons leading to the use of non-survey methods such as (a) the need to balance and treat additional and conflicting information. There are cases where data for specific cells, or groups of cells, in the tables are well known or there is reliable information on certain columns or row total. At the same time, there could be cases where data from different data sources are conflicting. In all these situations, the use of the non-survey method is fully justified; (b) the need to revise past published tables in order to adapt them to a new system of national accounts or a new classification of products or industries; (c) the need for regionalization, the construction of multiregional or multi-country tables starting from an available national table and exogenous statistical information for the region constitute another filed where some of these projection methods are applied

6.1 General approaches to projection from a historical perspective

As mentioned, the general balancing and projection approaches basically relies on having available single base tables and at least the row and column total for the target table. The literature on updating, projecting, estimating, and balancing SUTs, input-output tables, and SAMs is very extensive by now and is still growing. In fact in general, it is impossible to consider all updating methods because their number is infinite. In this subsection, we provide a brief description of the methods that were shown to be performing well in the construction of SUTs, input-output tables, and SAM.

The RAS algorithm works by alternately scaling the rows and columns of a matrix. Thus, each row is multiplied by a positive constant, forcing the sum of each row to equal the known sum of that row. Then the same operation is performed on the columns (Alderman, n.d.). Adjusting the columns changes the rows and similarly, scaling the rows changes the column sums. The algorithm iterates between rows and column scaling until the matrix is balanced (Schneider &

Zenios, 1990).

The RAS algorithm is an old method that has been independently discovered and analyzed by researchers working in different areas and in different countries. (Kruithof, 1937) proposed the RAS algorithm, as a procedure to predict telephone communication traffic flows between exchanges in a telephone service network. According to (Deming & Stephan, 1940) there are situations in sampling wherein the data furnished by the sample must be adjusted for consistency. They used the RAS algorithm, to find an approximate solution to the least squares problem for estimating the cell frequencies of a contingency table with known marginal tables. And with their paper, the RAS approach became accessible in the English language as well to social scientists. Since then, an abundance of applications had emerged. They include migration flows(Chilton & Poet, 1973) and (Schoen & Jonsson, 2003), estimation of birth and deaths rates (Sekar & Deming, 1949), international and interregional trade (Bénard, 1963) and (Canning & Wang, 2004) (Furness, 1965) transportation flows, transition probabilities (Theil & Rey, 1966); (Moffitt, 1993); and (Kendall & Nichols, 2002), and voting patterns (Johnston et al., 1982) and (Balinski & González, 1997).

(M. Lahr & De Mesnard, 2004) this paper discusses the RAS algorithm and the various formal formulation of other biproportional approaches in the development of input-output tables and explains what defines an algorithm as biproportional. According to (M. Lahr & De Mesnard, 2004) it was none other than the founder of input-output analysis who first used biproportional technique within the context of input-output analysis with the aim to identify the sources of intertemporal changes in the elements of a given nation's input-output tables. Nevertheless, it was Sir Richard Stone (Stone et al., 1942) (Stone, 1961), (Stone, 1962), and (of Cambridge. Department of Applied Economics & Brown, 1962) who developed a particular biproportional procedure that has become known as RAS method, and a waved the flag on behalf of it within the field of input-output analysis.

The interest of (Bacharach, 1970) in the RAS model stemmed from the work of Sir Richard Stone. The main aim of his work is to investigate the properties of the RAS model designed to estimate the behavior of input-output relations through time and to strengthen the theoretical basis of the biproportional input-output estimation model by introducing stochastic elements. With only row and column total available (Bacharach, 1970) extensively used the RAS method to update old input-output tables to a more recent or even future period of time. (Hewings, 1969) applied the biproportional method to the problem of regionalizing national input-output tables. (Robison & Miller, 1988), (Robison & Miller, 1991) and (Robison, 1997) are examples of regional input-output tables modeling at a very small spatial scale. (Oosterhaven et al., 1986) also sued the biproportional methods to solve the problem of updating interregional input-output tables.

According to (Jackson & Murray, 2004) and (M. Lahr & De Mesnard, 2004) RAS has minimum data requirements, and the iterative solution to the RAS method is simple to understand and straightforward to programs and apply, and its solution ensures minimum information loss. Scaling factor r and s are not identified, and it is not possible to give them a straightforward interpretation to them in terms of absolute values. The meaningful interpretation of the RAS-type scaling factors is only possible if transformed into relative values (M. Lahr & De Mesnard, 2004). RAS is a sign preserving and does not allow the conversion of zero elements from the original matrix into non-zero elements in the target table and does not yield negative values (Mahajan et al., 2018).

The RAS method also has a number of drawbacks. RAS can handle only non-negative matrices, but in many cases, one needs to estimate a new matrix that may have negative entries as well. The RAS method requires row and column totals to be known, and sometimes there are missing and have to be estimated. The method cannot handle conflicting external data and cannot incorporate constraints on the row or column total or any set of interior elements. The RAS method does not allow the use of relative reliabilities on the initial tables and on external which would be advisable for the computation of interval estimates rather than point estimate (Mahajan et al., 2018).

Different variants of the RAS method have been used with the aim of circumventing the limitation presented above. The generalization of estimating a matrix that contains both positive and negative entries was originally proposed by (Günlük-Şenesen & Bates, 1988), which was rediscovered and further formalized mathematically by (Junius & Oosterhaven, 2003), and labeled as a Generalized RAS (GRAS) approach. In fact, (Günlük-Şenesen & Bates, 1988) named the method as a *corrected* RAS method (Temurshoev et al., 2011). The GRAS method allows for positive and negative values in the initial tables and is sign-preserving, like the RAS method. The RAS method can be considered a special case of the GRAS method. However, the objective function of the GRAS method does not represent the minimum information loss principle (Mahajan et al., 2018).

(Lenzen et al., 2007) believed that there are some problems in (Junius & Oosterhaven, 2003), therefore, they revised the method, and corrected its biased objective function. However, their correction does not apply to the work of (Günlük-Şenesen & Bates, 1988), and the reason is that they set the underlying minimization problem such that it accounts for the bias in the RAS objective function (Temurshoev et al., 2011). In their work (Junius & Oosterhaven, 2003) assumes that every row and every column of a matrix to be balanced hat at least one positive element, according to (Temurshoev et al., 2013) this might not be necessarily true in practice, and therefore relax this assumption. Moreover, they present GRAS analytical solution that does not need any high-performance, non-linear equation solver (e.g. GAMS) to derive the GRAS result. Another advantage of the GRAS analytical solution proposed by (Temurshoev et al., 2013) is that ensures control of the convergence process by setting the desired threshold level, which is not straightforward when using solvers (Mahajan et al., 2018).

Similar to the GRAS method, however, the GRAS method needs to have known row and column totals, a precondition that is sometimes unrealistic if the projections are extended to SUTs rather than relating just to IOTs. Indeed, the total product outputs are not usually known and, consequently, row totals are not known (Mahajan et al., 2018). To solve this problem (Temurshoev & Timmer, 2011) applied the RAS updating idea for the joint estimation of supply and use tables. The algorithm is a biproportional and theory-basaed, and has an additional number of advantages compared with GRAS method. In contrast to RAS method and GRAS method, their approach does not require the availability of total outputs by-product for the projection years. The algorithm, called the SUT-RAS method, jointly estimates SUTs that are immediately consistent, and thus, unlike the Euro method (Eurostat, 2008) and EUKLEMS approach (“EUKLEMS road map WP1”, 2005), no additional assumptions are needed to make them consistent. It is applicable to different settings, such as the frameworks with basic prices, purchasers’ prices and with a distinction between domestic and import use, while the GRAS method is envisaged to be applied only to single price valuation at a time (Temurshoev & Timmer, 2011).

None of the above methods uses any additional information or external additional constraints other than a row or column totals of the target table. The introduction of additional information which is different from those of the column and row totals can improve the outcomes of the RAS-type projection. The RAS method can thus be used to cover the case that additional information is available. The availability of extra information on a subset of elements and also on additional external constraints transform a projection problem into an estimation problem. Furthermore, the estimation problem can also be transformed into a compilation problem. As explained by (Lenzen et al., 2009) the RAS-type method cannot handle the conflicting external information, and this might be a routine situation faced in the compilation of SUTS and input-output tables (Mahajan et al., 2018).

(Israilevich, 1986) developed a method called ERAS. In his Ph.D. dissertation entitled *Biproportional forecasting of input-output tables* he developed a RAS-based approach that fixes interior cell values of the forecasted matrix to known values. This approach helped (Szyrmer, 1989) to develop an interesting piece that showed that the introduction of more know information improves the outcomes of the RAS-type projection. (M. L. Lahr & Dietzenbacher, 2001) supported this notion as well, by measuring the gain in accuracy when adding selected perfect information to a non-survey table. The data added in Lahr's work were based on an algorithm that identified sectors that had the greatest linkage power and then the element within that sector to which the Leontief inverse was most sensitive.

(Gilchrist & St Louis, 1999) described an algorithm called TRAS (three-stages RAS). The TRAS extends RAS by including additional information other than the row and column total of the target table. The object of their then is to fill in the detailed matrix's censored data using information from its more aggregated but uncensored equivalent. The third stage of TRAS is one adjusting for the difference in sectoral detail between the two matrices. Using a Monte Carlo experiment for all Canadian provinces, the author showed that being informed by the more aggregated tables improved the accuracy of the detailed tables substantially compared to a standard RAS method. They also opt for a stronger test of the marginal value of TRAS over RAS. They limited themselves to the construction of a relatively detailed for Alberta only and used the results of the RAS adjustments as the initial coefficients in subsequent TRAS adjustments. They then measured the marginal gain of TRAS over RAS, by regressing the results from the RAS and the incremental gain from TRAS against the actual coefficients for five tables the make coefficients, use coefficients, market share, direct coefficient, and Leontief inverse matrices. The incremental gain from TRAS is shown to be statistically significantly different from the information obtained via RAS in all but the market share matrix.

Earlier work in the 1960s took the form of a modified RAS described by (Paelinck & Waelbroeck, 1963). According to their method, one can incorporate known interior information matrix information in RAS setting. When projecting to a desired table, one can account for the values of known interior cells of such a table. The particular known cell values were set at zero and subtract the known values from the row and column total. The RAS method was then applied to the remaining cell, and the known cells were placed back into their cells in the projected table when the algorithm is terminated. In this way, rather than adding to constraint, which would obviate the possibility of biproportional techniques and often was a reason why mathematical programs were used, this operation basically requires a mere realigning of them. This solution, however, creates too many zeros in the modified initial table. This can possibly pose a problem since zero cells serve to block the ability of the RAS procedure to distribute excess value from one sector to another.

(Lenzen et al., 2009) developed a generalized iterative scaling method (KRAS) that is able to reconcile input-output tables and SAMs under conflicting information. (Lenzen et al., 2009) term their method KRAS from konfliktfreies (conflict free) RAS. Like the early RAS variant, KRAS can handle constraint on arbitrary sized and shaped subset of matrix elements and conflicting external data and inconsistent constraints, and Allow for relative reliability of the initial estimate and the external constraint. It is a kind of RAS-type iterative procedure that can deal with all the four desirable properties identified above. In the first step, it minimizes a GRAS-type objective function as stated in (Lenzen et al., 2007). The second step adjusts conflicting constraints simultaneously with the transaction matrix, whenever the first step fails to match them. The adjustment to constraints constants are regulated according to their degree of uncertainty as described by (Lemelin, 2009). Applying KRAS in four case studies, they found that, as with constraint optimization, KRAS is able to find a compromise solution between inconsistent constraints. This feature does not exist in conventional RAS variants such as GRAS. KRAS can constitute a major advantage for the practice of balancing input-output tables and social accounting matrix, in that it deals with the manual removal of inconsistencies in the constraint system in a systematic and automated way. This quality does not come at the expense of substantial programming and computational requirements.

There are other types of linear or non-linear constraint optimization methods characterized by minimizing some measure of distance between all the elements of the prior and estimated tables (Mahajan et al., 2018). Non-biproportional methods such as those that take weighted or unweighted squared differences between the target and original matrix as objective functions can deal with negative entries, but it is difficult to guarantee the signs of entries. The non-biproportional family includes methods that use the most commonly applied objective function such as the Normalized Squared Difference (Friedlander, 1961), or Squared difference (Almon, 1968). However, the solutions of this class of methods cannot preserve the signs. Some enhanced approaches have been developed by (Jackson & Murray, 2004) which can preserve sign, however, these methods need non-linear programming solvers (M. Lahr & De Mesnard, 2004).

In their paper (M. L. Lahr & Dietzenbacher, 2001) argue that the most effective means for targeting portions of a regional input-output model for superior data is to compare the sensitivity of the regions' Leontief inverse to proportional changes in sector technology. In a search for an approach that recognizes critical points of input-output models ripe for superior data in a manner more compatible with survey work, he combines the findings of other measures that identify sectors that are more critical to the accuracy of the Leontief inverse with other literature to develop a quasi-complete superior-data search strategy for producing hybrid regional input-output tables. This method uses weighted square differences as an objective function. This function gives equal weights to the absolute differences by the prior year coefficient value, irrespective of coefficient size. (M. Lahr & De Mesnard, 2004) use the absolute difference as an objective function for updating and estimating input-output matrices. (Friedlander, 1961) proposed to use the normalized squared differences as an objective function in order to estimate a matrix with given row and column totals. An alternative apparently similar technique was proposed by (Stephan, 1942) with the only difference that the method proposed by (Friedlander, 1961) dealing directly with approximation, instead of increments. (Matuszewski et al., 1964) develop a procedure for estimating changes in the coefficient of an inter-industry input-output matrix. Their method does not call for large quantities of supplementary data. The objective function of this method is a normalized version of the absolute difference method. Another often used objective function for updating input-output matrices is the function of squared difference presented in (Almon, 1968). In this formulation, there is no explicit differential weighting according to coefficient size.

6.2 Methodology for projecting and updating SAM

The RAS method has enjoyed higher popularity, however, the use of RAS in statistical agencies requires the manual and therefore often tedious removal of inconsistencies in the constraint system, therefore it is desirable to have a RAS technique that deals with such common occurrences in a systematic and automated way. Such a variant of RAS is described by (Lenzen et al., 2009). They base their derivation strongly on the GRAS method of (Junius & Oosterhaven, 2003). Their exposition proceeds in three steps. First, GRAS is generalized to constraints on an arbitrary subset of matrix elements. Second, the restriction of GRAS for constraint coefficients to be either 1 or -1 is relaxed and it's allowed to be any real number. Third, the reliability and conflict of external data are incorporated.

To fully understand the nature of the KRAS updating and projecting method, its mathematical formulation has to be first presented. Let A_0 be an $m\ x\ n$ unbalanced matrix with an m-vector of row sums u_0 and, n-vector of column sums v_0. A_0 consist of entries $a_{ij} \geq \boldsymbol{0}$ and entries $a_{ij} < \boldsymbol{0}$. **u** is given m-vector of row sums, and textbfv is given n-vector of column sums. The problem is to find a new $m\ x\ n$ matrix **A** using **A**'s known row and column sums that deviate leas from given matrix A_0.

(Bacharach, 1970) showed that the RAS algorithm can be derived from minimizing the difference between two probability distribution functions **A** and A_0.

$$f(\mathbf{A}, \mathbf{A_0}) = \sum_{i,j} a_{ij} \ln \frac{\mathrm{a_{ij}}}{\mathrm{e\ a_{0ij}}} \tag{11}$$

subject to constraint **u** and **v** on know row and column totals.

$$\sum_j a_{ij} = u_j \text{ and } \sum_i a_{ij} = v_j \tag{12}$$

The term on the right-hand side of the equation is called the Kullback-Leibler divergence or relative entropy which measures the difference between two probabilities. The RAS method is appropriate for positive elements but needs to be inversed for the negative elements. The GRAS method of (Junius & Oosterhaven, 2003) is derived in the same way. However the

$$r_i^{(n)} = \frac{u_i + \sqrt{u_i^2 + 4 \sum\limits_j p_{ij}^{(n)} \sum\limits_j n_{ij}^{(n)}}}{2 \sum\limits_j p_{ij}^{(n)}} \tag{13}$$

where

$$p_{ij}^{(n)} = p_{ij}^{(n-1)} s_j^{(n-1)}$$
$$n_{ij}^{(n)} = n_{ij}^{(n-1)} [s_j^{(n-1)}]^{-1}$$
$$s_j^{(n-1)} = \frac{v_j + \sqrt{v_j^2 + 4 \sum\limits_i p_{ij}^{(n-1)} \sum\limits_i n_{ij}^{(n-1)}}}{2 \sum\limits_i p_{ij}^{(n-1)}}$$

The algorithm converges if:

$$\left\|(\mathbf{\hat{r}P\hat{s}} - \mathbf{\hat{r}^{-1}N\hat{s}^{-1}})\mathbf{i} - \mathbf{u}\right\| < \delta \left\|\mathbf{u}\right\|$$

and

$$\left\|\mathbf{i}(\mathbf{\hat{r}P\hat{s}} - \mathbf{\hat{r}^{-1}N\hat{s}^{-1}})\mathbf{i} - \mathbf{v}\right\| < \delta \left\|\mathbf{v}\right\|$$

for a sufficiently small δ.

To incorporate constraints on arbitrary subsets of matrix elements (Lenzen et al., 2009) generalized the formulation of constraints as $\mathbf{Ga} = \mathbf{c}$, where $\mathbf{a}$ is the vectorization of $\mathbf{A}$ above. Vector $\mathbf{c}$ contains all the imposed constraints. $\mathbf{G}$ is simply a spares binary matrix showing the existence or non-existence of relation between $\mathbf{c}$ and $\mathbf{a}$. Such formulation includes constrained row and column sums, constrained single elements, constrained subsets, and negative elements as special cases. The (Junius & Oosterhaven, 2003) minimisation problem then becomes

$$\text{Minimise} f(\mathbf{a}, \mathbf{a_0}) = \sum_{i,j} a_{ij} \ln \frac{\mathrm{a_{ij}}}{\mathrm{e\ a_{0ij}}} \quad \text{subjectto} \quad \mathbf{Ga} = \mathbf{C} \tag{14}$$

Constraint implies how much all realizations ($\mathbf{Ga}$) are away from the imposed constraint $(\mathbf{c})$. Let there be n_c constraints, the above equation can be generalized to

$$r^{(n)} = \frac{c_i + \sqrt{c_i^2 + 4\Sigma_{j,a_j^{(n-1)}g_{ij}>0} g_{ij} a_j^{(n-1)} \Sigma_{j,a_j^{(n-1)}g_{ij}<0} g_{ij} a_j^{(n-1)}}}{2\Sigma_{j,a_j(n-1)g_{ij}>0} g_{ij} a_j^{(n-1)}} \qquad \text{and} \tag{15}$$

$$a_j^{(n)} = a_j^{(n-1)} [r^{(n)}]^{Sgn\left(a_j^{(n-1)g_{ij}}\right.}, \quad \text{with} \;\; i = n \mod n_c$$

In Equation (), the negative elements in Equation () have been replaced with negative coefficients on positive elements, but otherwise, the formation is exactly the same. There is only one scalar r_i for each constrain i, and these scalars are applied consecutively for all $i = 1, ..., n_c$.

The algorithm converges if

$$||\mathbf{Ga} - \mathbf{c}|| < \delta ||\mathbf{c}|| \tag{16}$$

for a sufficiently small δ.

The extension of the GRAS method proposed by (Lenzen et al., 2009) has the following features:

- The KRAS method necessarily implies the inclusion of additional aggregation constraints. Very often the required available information may take the form of aggregates (sum) of certain entries of the matrix. The case of updating or projecting SAM or input-output table that necessarily has to be consistent with available national data can be considered as an example of incorporating knowing information on aggregates of sub-matrices of a larger matrix to be estimated. Therefore the KRAS method finds a compromise solution between conflicting external information and inconsistent constraints.

- The method allows for updating and projecting SAM and input-output tables both with positive and negative entries. The inclusion of negative entries into the matrix updating framework is clearly an important advantage. Therefore the KRAS method is sign-preserving, thus positive and negative elements in the benchmark matrix keep their signs after the projection procedure.

- The authors derived the complete analytical solution of the method and provide an easy and simple iterative algorithm for its computation. The existence of a closed-form solution makes KRASing a rather simple method to apply in practice. The method moreover does not need advanced knowledge of the more complex numerical optimization and programming methods. And consequently, no necessity of having access to a high-performance solver, since the iterative approach can be easily programmed with R.
- The convergence process of the method is easier to control. In particular, in the case of non-convergence one could derive the approximate solution simply by increasing only the threshold δ. level in the iterative approach.
- The procedure is also zero-preserving, therefore the zero entries in the base year matrix remain zero in the updated matrix.

6.3 Available Data

The task is projecting SAMs for four GTAP reference year (2014, 2011, 2007, 2004). The key to having a reasonably informed model is having reasonable data input. The following data are externally available and are exogenously imposed on the projected SAMs, which for convenience we call external constraints.

1. Gross value-added disaggregated by 65 GTAP sectors, and 4 projection years. The data on gross value added is available according to a domestic classification that is more aggregated or has fewer manufacturing sectors. Therefore, before being used as an additional constraint, the data is mapped to the 65 GTAP sectors.
2. Aggregate private consumption figures for all four projection years.
3. Aggregate Government consumption figures for all four projection years.
4. Gross domestic capital formation figures for all four projection years split into construction and durable capital goods.
5. Gross fixed capital formation (GCF) figures for all four projection years. The GCF is split into GCF general government and GCF non-government.
6. Export of goods and services for all four projection years, disaggregated by sectors, and distinguished by origin and destination
7. Import of goods and services for all four projection years, disaggregated by sectors, and distinguished by origin and destination
8. Changes in inventories,
9. Taxes on products, income, and factor taxes. Taxes on products include general taxes on goods and services and excise taxes. The data on all items of taxes is provided by IMF government financial statistics.
10. Labor income share

6.4 Overview of processes:

In this section, we combine The Compound Growth Formula with KRAS balancing method to backward project the SAMs. Starting from the benchmark SAMs for the years 2016 and 2019 the following process is used in order to project SAMs for four GTAP reference years. In the first stage, an initial SAM is estimated using available SAMs. In the second stage, we imposed the available data as an external constraint, and in the third stage, KRAS balancing of the initial estimate is performed using the exogenous data as an external constraint.

First Stage: Creation of initial estimate: For the GTAP reference years with no SAM, Compound Annual Growth Rate formula and the SAMs for the benchmark years are used to arrive at the initial unbalanced SAMs. The Problem with the missing data and to capture structural changes in the economy over time therefore the best possible way to capture all these changes is to capture the growth rate of the economy. The reason for such a procedure is that structural change can be, at least partially taken into account by studying the growth rate of input-output coefficients. The input-output coefficient is a measure of the relationship between the amount of input used and the amount of output produced in an economic system. A SAM coefficient matrix is constructed by diving the cells in each column by the column sums. The matrix of coefficients provides a raw material for much economic analysis and modeling. For example, the coefficient computed from the use matrix (intermediate-input coefficients) is Leontief input-output coefficients. The coefficient for primary factors are value-added coefficients and give the distribution of factor income. Column coefficients for the commodity accounts represent domestic and import shares, while those for the various final demands provide expenditure shares.

There is a long tradition of work that starts from the assumption that these various coefficients are fixed, or they rely on the assumption that the economic structure will not change significantly during the interpolation period. However, this assumption may not always hold, particularly for countries experiencing rapid development. The input-output coefficient can provide valuable insight into the structural changes that are occurring in an economy. The compound growth formula can be used to study the growth rate of the input-output coefficients over time. By calculating the compound growth rate of the input-output coefficient over a period of time, we determine the average annual rate at which the coefficient has changed, and can gain insight into the changes in the production structure and interdependence of different sectors of the economy.

With respect to the remaining four years, we projected the SAMs from 2016 and 2019 backward using the compound annual growth rate. The assumption is based on the Compound Annual growth rate (CAGR). CAGR assesses the pace and direction of the evolution of an indicator. this formula uses the data from the first and last year of the analyzed times span and is used to calculate the average annual rate of change of the indicator between these two data points. To calculate the CAGR we need to determine the beginning value, the final value, and the number of years.

$$CAGR = \left(\frac{V_{final}}{V_{begin}}\right)^{\frac{1}{n}} - 1 \tag{17}$$

Where V_{begin} is the beginning value, V_{final} is the final value, and n is the number of years. To calculate the CAGR of the technical coefficient we rewrite the equation above as:

$$CAGR_{ij} = \left(\frac{a_{ij}^{final}}{a_{ij}^{begin}}\right)^{\frac{1}{n}} - 1 \tag{18}$$

where a_{ij}^{final} is the value of the technical coefficient in the final year, and a_{ij}^{begin} is the value of the technical coefficient in the beginning year, and n is the number of years.

Once we have the $CAGR_{ij}$ we can go back in time and calculate the technical coefficients for the years 2014, 2011, 2007, and 2004. The technical coefficients $a_{ij}^{begin_new}$can be calculated as follow

$$\begin{aligned}
CAGR_{ij} &= \left(\frac{a_{ij}^{final}}{a_{ij}^{begin}}\right)^{\frac{1}{n}} - 1 \\
CAGR_{ij} + 1 &= \left(\frac{a_{ij}^{final}}{a_{ij}^{begin_new}}\right)^{\frac{1}{n}} \\
\left(CAGR_{ij} + 1\right)^{n} &= \left(\frac{a_{ij}^{final}}{a_{ij}^{begin_new}}\right)^{\frac{1}{n}n} \\
\left(CAGR_{ij} + 1\right)^{n} &= \left(\frac{a_{ij}^{final}}{a_{ij}^{begin_new}}\right) \\
a_{ij}^{begin_new} &= \frac{a_{ij}^{final}}{\left(CAGR_{ij} + 1\right)^{n}}
\end{aligned} \tag{19}$$

Once we have the technical coefficients matrix for the new beginning year($a_{ij}^{begin_new}$), we can calculate the amount of commodity i used by sector j (u_{ij})

$$u_{ij}^{begin\_new} = u_{ij}^{begin} * a_{ij}^{begin\_new} \tag{20}$$

where $a_{ij}^{begin\_new}$ is the new estimated coefficient. As an example and to make the procedure clear we calculate the coefficient for the year 2014 as follows: To calculate the CAGR of technical coefficients we rewrite the equation above as:

$$CAGR_{ij} = \left(\frac{a_{ij}^{2019}}{a_{ij}^{2016}}\right)^{\frac{1}{3}} - 1 \tag{21}$$

where a_{ij}^{2019} is the value of technical coefficients in the year 2019, and a_{ij}^{2019} is the value of the technical coefficient in the year 2016, and 3 is the number of years.

Once we have the $CAGR_{ij}$ we can go back in time and calculate the technical coefficients for the years 2014, 2011, 2007, and 2004. The technical coefficients for the year 2014 a_{ij}^{2014}can be calculated as follow

$$
\begin{aligned}
CAGR_{ij} &= \left(\frac{a_{ij}^{2016}}{a_{ij}^{2014}}\right)^{\frac{1}{2}} - 1 \\
CAGR_{ij} + 1 &= \left(\frac{a_{ij}^{2016}}{a_{ij}^{2014}}\right)^{\frac{1}{2}} \\
\left(CAGR_{ij} + 1\right)^2 &= \left(\frac{a_{ij}^{2016}}{a_{ij}^{2014}}\right)^{\frac{1}{2}2} \\
\left(CAGR_{ij} + 1\right)^2 &= \left(\frac{a_{ij}^{2016}}{a_{ij}^{2014}}\right) \\
a_{ij}^{2014} &= \frac{a_{ij}^{2016}}{\left(CAGR_{ij} + 1\right)^2}
\end{aligned}
\tag{22}
$$

Once we have the technical coefficients matrix for the year $2014(a_{ij}^{2014})$, we can calculate the amount of commodity i used by sector j (u_{ij})

$$
u_{ij}^{2014} = u_{ij}^{2017} * a_{ij}^{2014} \tag{23}
$$

Since we do not have data on the output of each sector for the reaming years, therefore we can also estimate per-sector output using the above algorithm. In the first step, we calculate the growth rate of input-output share for each sector in each year. Once we have the growth rate the share of input-output for each sector is calculated. In the last step, we use the share of input-output for each sector to calculate the output per sector.

Stage two: Imposing Constraints: Once the initial SAM is estimated, additional data is imposed as external constraints. Constraints are hence constructed from all available data. These (10 (write the correct number)) subsets of constraints make up the full list of constraints. Constraints **c** is constructed for each GTAP reference year. The main idea of the approach taken here is to leave fewer data to be estimated mathematically by including all applicable data in the balancing process. Each constraint requires its own vector of the length of **a**, where the elements involved in the constraints are set to one, and the rest is zero. Placing exogenous data as an external constraint, there we have a number of different types of constraints such as:

- Row and column constraint: The data on the total demand and total supply is not available for any of the mentioned reference years, therefore, we use the growth formula explained above to calculate the columns or industries output, and rows or product output, and place them as columns and row constraints. Row and column constraints are included to ensure the balance between the expenditure and income approaches to GDP.
- Very often the required available information may take the form of aggregates (sum) of certain entries of the matrix, such as aggregate private consumption, aggregate private consumption, gross-value added, and other types of information mentioned above. The constraints on certain entries of the matrix take the following forms:
  1. constraints on an arbitrary subset of matrix elements = Constraints on the aggregates of the cells (sub-matrix). In this case available additional information takes the form

of an aggregate value of certain rows or columns, and we place that as external constraints. Constraints are placed such that the sum of certain cells equals the known aggregate value. Aggregation constraints are imposed on private consumption, government consumption, and imports, where the value of consumption and import by sector are adjusted to the known aggregate value.

2. Constraints on a specific cell. In this case, known information is placed as a constraint on particulate cells. For example, the National Accounts provide data on value-added, and export by industry, therefore this known information is placed as constraints on each specific cell. When available information is used as cell constraints, these are not projected within the KRAS framework, rather the original values are preserved during the balancing procedure.

- Zero constraint: Zero constraint implies the structural changes in the economy. To Capture the structure changes in the economy, we use zero value as a constraint to show that some of the industries or products were not active. As we go back in time there are cases, where a certain number of food and manufacturing industries were not active.

Stage three: Performing the balancing: Once we imposed all the above mentioned constraints, the KRAS balancing is performed. The balancing run consists of the two steps: First step, calculate the scaling factor r: As mentioned above there is only one scalar r_i for each constraint j. Then we use the scaling factors to update the elements in the vectorized form of the initial matrix. Then, the algorithm checks the constraint and if they are fulfilled calculates the information loss and breaks the loop. We calculate the information loss according to the objective function in equation(3) of (Junius & Oosterhaven, 2003). In the second step, if the constraints are not fulfilled, the procedure is run until $\mathbf{Ga}$ stops converging toward $\mathbf{c}$, which occurs when adjustment cannot continue with the given conflicting constraint values. Convergence is assumed when the maximum deviation of any $\mathbf{Ga}_i$ from c_i is less than the specified threshold. This implies, that the maximum number of iterations is reached, and there is no solution. Once KRAS terminates in oscillations without reaching convergence, the original external constraints c_i can clearly not all be satisfied simultaneously, and either some of them or all of them must be erroneous. Many of the constraints come from the data which contain errors, and that makes them conflicting. Therefore, c_i must be modified toward their realization $\mathbf{Ga}_i$ in order to achieve convergence. With the KRAS, the convergence process of the method is easier to control. In particular, in the case of non-convergence one could derive the approximate solution simply by increasing only the threshold δ. level in the iterative approach.

Finally: after the final estimation, will explain the result of each year. And will include information about the: number of external constraints, second, the exact number of iterations, third, the run time

7 Merging the Afghan region into the GTAP database

8 Conclusion

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9 Appendix

9.1 Concordance between GTAP 65 sectors and Afghan sectors

Table 4: Concordance between GTAP 65 sectors and Afghan sectors

Number	GTAP 65 Sector	Afghan sectors
1	pdr	Paddy rice
2	wht	wheat
3	gro	Cereal Cereal grains nec
4	v_f	vegetables, fruit, and nuts
5	osd	sesame, common flex and cotton seed, mustard
6	c_b	sugar beet, and sugar cane
7	pfb	cotton
8	ocr	plants used in pharmacy
9	ctl	bovine cattle, sheep, goats, horses, asses, mules
10	oap	poultry
11	rmk	raw milk
12	wol	wool, and silk
13	frs	Information not available
14	fsh	not active
15	coa	mining of hard coal
16	oil	not active
17	gas	Extraction of natural gas
18	oxt	stucco, condensate, marble, iron and other minerals
19	cmt	meat of bovine, sheep and goat
20	omt	not active
21	vol	sunflower, vegetable oil
22	mil	dairy product
23	pcr	not active
24	sgr	sugar
25	ofd	prepared fruit,bakery and food product, sugar confectionery
26	b_t	non-alcoholic beverages
27	tex	textile
28	wap	manufacturing of wearing apparel
29	lea	tanning and dressing of leather and leather product
30	lum	manufacture of wood product
31	ppp	paper product and publications
32	p_c	manufacture of coke oven product
33	chm	Chemical products
34	bph	Basic pharmaceutical products
35	rbb	Rubber and plastic products
36	nmm	Mineral products nec
37	i_s	manufacture of basic iron

Continued on next page

Table 4 – *Continued from previous page*

Number	GTAP 65 Sector	Afghan sectors
38	nfm	manufacture of basic precious and non-ferrous metal
39	fmp	fabricated metal product
40	ele	Computer, electronic and optical products
41	eeq	electronic equipment
42	ome	Machinery and equipment nec
43	mvh	not active
44	otn	motorcycle assembly
45	omf	not active
46	ely	production, collection and distribution of electricity
47	gdt	manufacturing of gas
48	wtr	collection, purification and distribution of water
49	cns	constructions
50	trd	wholesale and retails trade
51	afs	Accommodation, Food and service activities
52	otp	land transport
53	wtp	not active
54	atp	air transport
55	whs	warehousing and support activites
56	cmn	post and telecommunications
57	ofi	financial intermediation
58	isr	insurance and pension funding
59	rsa	Real estate activities
60	obs	real estate, renting and business activities
61	ros	other service activities
62	osg	public adminsitration, and defence
63	edu	Human health and social work activities
64	hht	Education
65	edw	Dwellings

9.2 Data sources: Explanation

9.2.1 Agriculture

The agriculture sector in Afghanistan supports the livelihood of nearly three-quarters of the total population, thus, agriculture growth is vital for driving the country's economy and for ensuring national food security.

The main source of data utilised for the calculation of various crops, livestock, and food processing for Afghanistan is the National Statistics, and Information Authority (NSIA), Ministry of Agriculture, Irrigation and Livestock (MAIL), Food and Agriculture Organization of the United Nations (FAO).

Crop Production National Statistics and Information Authority (NSIA), Ministry of Agriculture provide direct data on the cultivated land area, yield per hectare, and total production of paddy rice, wheat, maize, barley, vegetables, fruits, nuts, oilseeds, sugar beet, sugar cane, cotton, and other crops, National Statistics and Information Authority (2004-2014). Since these data are not sufficient to calculate the total value of output for all agriculture sub-sectors, it was necessary to obtain some additional information. Particularly prices for crops, vegetables, fruits and nuts. Per unit prices for all agriculture, sub-sectors are provided by the Ministry of Agriculture, Irrigation, and Livestock (MAIL).

9.2.2 Livestock

In terms of data availability and total value calculation, the livestock sectors are divided into five sub-sectors namely:

1. Livestock census
2. Milk and milk product
3. Poultry
4. Other livestock products comprising of various edible and non-edible products other than milk and milk product and poultry.

Livestock Census
The data on the Afghanistan livestock census and its local prices are obtained from the Ministry of Agriculture, Irrigation, and Livestock (MAIL), and the Food and Agriculture Organization of the United Nations (FAO). The data shows that by the year 2014 there are 5.349 million cattle, 13.485 million sheep, 7.059 million goats,1.441 million ass, 0.171 million camel and horses each, and 11.098 million poultry.

Milk & Dairy products
According to the data provided by the District Offices of Ministry of Agriculture and Irrigation, in 2010 total milk production in Afghanistan was estimated at 1.496 million Metric tons. Commodity-wise details on the production of different dairy products are available from the local industrial parks in five main regions of Afghanistan, Fareed (2010).

Wool & Silk
Several surveys conducted in the different regions of Afghanistan, make the data available on the annual production of wool. These data sources exclude wool directly used by rural families for filling cushions and for spinning into yarn for carpet, sock, and other handicraft production. Afghan Women Chamber of commerce (AWCCI) and NSIA present detailed information on the production of silkworm cocoons. It also reports information on labour participation, particularly female labour participation, the cultivation of Mulberry trees, Silkworm seed production, rearing, and reeling, AWCCI (2015).

Bovine Meat Production
Annual data on production and consumption of meat by household are not available, however, the statistical yearbook of Afghanistan provide data on the total consumption of meat by military personnel (NSIA).

Vegetable Oils and fate
On the bases of data availability the vegetable oil and fats can be divided into two sub-sectors namely, sunflower and general vegetable oils. The sub-sector wise details were obtained from the Statistical Yearbook of Afghanistan (NSIA).

Sugar
Baghlan Sugar factory is the only active sugar-producing factory in Afghanistan. According to the information provided by Peace Security Development Network, the factory can produce 15000 tons of sugar annually, however by the year 2014, the factory production was only 570 tonnes of sugar Shams & Adela (2009).

Food product n.e.c
The product covered under the food product Sector are:

- Prepared and preserved fruit
- Bakery product
- Chocolate and sugar confectionery
- Food product n.e.c

Ministry of Commerce and Industries of Afghanistan (MOCI), and the statistical Yearbook of Afghanistan provide the data for the product covered under the food production sector, Ministry of Commerce Industries of Afghanistan (2013).

Beverages & Tobacco Products
Ministry of Commerce and Industries of Afghanistan (MOCI), and the statistical Yearbook of Afghanistan report the total value of non-alcoholic beverages. However, more detailed information on employment, production capacity, and inputs can be obtained from the local producers in Afghanistan (NSIA).

9.2.3 Energy Sector

The energy sector, disaggregated into six sub-sectors. the sub-sectors are, Coal, Oil, Gas, Petroleum, and coal product, Electricity, and Gas manufacturing distribution. The major source of data for the energy sector of Afghanistan is the Ministry of Energy and Water (MEW), Ministry of Mines and Petroleum (MOMP), National Statistics and Information Authority (NISA), and Statistical Yearbook of Afghanistan.

Coal, Oil, Gas, & Petroleum
The data on the total production of coal, gas, and petroleum production is based on the information obtained from the Ministry of Mines, and Petroleum, and the National Statistics and Information Authority, (NSIA. Afghanistan has only a limited reserve of oil, and domestic oil production is insignificant, Malik (2009).

Electricity
The economic activities covered in this sector are the generation, transmission, and distribution of electrical energy. Afghanistan generates its electricity from its several hydroelectric plants as well as using fossil fuel, and solar panels (NSIA). Data on total generation, distribution,

and consumption is based on the information reported by the ministry of energy and water of Afghanistan, and local energy distributor Da Afghanistan Brishan Shirkat (DABS).

Gas Manufacturing & Distribution
Limited amount of gas supplied through a pipeline from the gas fields to the power plant near Mazar-i-Sharif Malik (2009). Its total value is reported by statistical yearbook of Afghanistan (NSIA).

9.2.4 Industry Sectors

Goods and Services sector, comprising of 30 sectors. sectors are grouped according to the source of available data. Table 4 shows the disaggregation of the goods and services sector. Ministry of Commerce and Industries of Afghanistan (MOCI), Ministry of Mines and Petroleum (MOMP), National Statistics and Information Authority (NISA), statistical yearbook of Afghanistan, and Afghanistan Investment Support Agency (AISA) provide data on industry sectors in Afghanistan .

Mining and Quarrying
The mining and quarrying sector include Stucco, condensate, marble, iron, liquid ammonia, and other minerals. The statistical yearbook of Afghanistan provides information on the output of each sub-sector (NSIA). Afghanistan Investment Support Agency provides comprehensive information on the marble industry in Afghanistan, Rassin (2012). Also, the data on the production of iron can be obtained through correspondence from the respective producing mines in the ministry of Mines and Petroleum (MOMP).

Textiles, Wearing Apparel, Leather product, & Wood products
Ministry of Commerce and Industries of Afghanistan (MOCI), provide information on the total output of wearing apparel, leather product, and wood product, Ahmadzai (2014).
Afghanistan Investment Support Agency (AISA) reported data on the total output of textile and leather industries in Afghanistan. AISA further disaggregates the data on the textile and leather sector at the provincial level, and also provides information on employment, sales, and cost of production of the textile and leather industry, Ahmadzai (2013).

Paper product and Publication
Data on paper products and publications can be obtained from many sources. Data on the total amount of output are obtained from the Ministry of Commerce and industries. Also, the Statistical yearbook provides information on the total paper production and the total value of publications. Further detailed data can be obtained from the publication department at different ministries such Ministry of Higher Education, Ministry of Education and Ministry of Information and Culture (NSIA).

Manufacturing of chemical, basic pharmaceutical, rubber & plastic product
Items appearing in the data as the manufacture of the chemical and chemical products are chemical products, basic pharmaceutical products, and rubber and plastic products. Information on the value of these items can be obtained from the National Statistics and Information Authority (NISA), and the Ministry of industry and commerce, (NSIA).

Manufacture of other non-metallic mineral products
The manufacture of other non-metallic mineral products is dealt separately under five groups,

such as salt, cement, marble, ceramic, and lime. Statistical Yearbook of Afghanistan presents data on the manufacturing of other non-metallic minerals products. United States Geological Survey Department provides information on the Cement and dimension stone production in Afghanistan, Mossotti (2014). Afghanistan Investment Support Agency (AISA) provides detailed information on the total value, number of varieties, number of firms, and total employment of the marble sector, **?**. A study by the Ministry of Industry and Commerce present much detailed information on cement producing factories in Afghanistan.

Ferrous Metals, Metals n.e.c, Metal Product Transport equipment n.e.c
The data on the manufacture of basic iron and steel, manufacture of basic precious and non-precious metals, manufacture of fabricated metal products, and manufacture of other transport equipment are obtained from National Statistics and Information Authority (NISA), and United Nations Economic and Social Commission for Asia and the Pacific (ESCAP),Policy (2014).

Water
The economic activities covered in the water sector are collection, purification, and distribution of water, mostly for domestic consumers, excluding the operation of the irrigation system. At the public sector level, the Water supply department in each major city of Afghanistan provides information on water supply. Data at the private sector level can be culled out from the water purification factories. Also, the Statistical Yearbook of Afghanistan presents detailed information on all the economic activities (both public and private) covered under the water sector. (NSIA).

Construction
The value of basic materials such as cement, iron, brick, tiles, timber, and other construction materials used for construction determines the value of the total output of the construction sector. National Statistics and Information Authority (NISA) report the data on the total value of the construction sector (NSIA).

9.2.5 Services Sectors

The main data sources of data for the services sectors in Afghanistan are National Statistics and Information Authority (NISA), statistical yearbook of Afghanistan, The Ariana Afghan Airlines, Ministry of Communications and Information Technology of Afghanistan, and Ministry of Transport and Civil Aviation.

Trade
The main activities that are considered in the trade sector are wholesale, and retail trade in all commodities, and hotels and restaurants. Wholesale covers units which resell without transformation, new and used goods generally to the retailers and industries. Retail trade covers units, which only resell without transformation, new and used goods for household consumption. Ministry of industry and commerce, the National Statistics and Information Authority (NISA), and World Bank report on Afghanistan Economic Update report detailed data on the total value of the trade sector, Joya & Khan (2014).

Accommodation, Food, and Service Activities
This sector consist of services rendered by hotels, restaurants, and other eating and drinking and other lodging places. National Statistics and Information Authority provide data on the total value of this sector (NSIA).

Transport n.e.c Air Transport
Ministry of Transport and Civil Aviation, and the National Statistics and Information Authority (NISA), present data on the total value of land and air transports. Provincial departments of the Ministry of Transport and Civil Aviation report the total number of buses, and trucks both for private and public sectors (NSIA). Further details on Air transport can be obtained separately for public and private sectors. Air aviation department and The Ariana Afghan Airlines provide detailed information on the value of public sector air transport, and Kam-Air provide data on private sector air transport.

Warehousing and Supporting Activities for Transportation
This sector covers storage operations comprising warehousing corporation, cold storage and other storage and warehousing activities. Most of the logistic companies in Afghanistan provide trucking, costume clearing and warehousing and storage services. National Statistical and information authority report the total value of this sector (NSIA).

Post & Communication
The Post and telecommunication sector comprised of services rendered by public and private communication companies. Ministry of Communications and Information Technology of Afghanistan, and the National Statistics and Information Authority (NISA), provide data on the total value of the post and telecommunication sector. Afghanistan Investment Support Agency (AISA)report surveyed information on the public and private telecommunication sector. The survey contained information on job creation, the total amount of investment in telecommunication, revenue generated by this sector, number of mobile users, and total production, Rahima, Baharustani (2013).

Financial Services
The banking sector consists of the commercial banks, banking departments of the Da Afghanistan Bank (central bank), non-banking financial institutions, and informal financial networks. Da Afghanistan Bank (DAB) provides detailed monthly, and annual financial reports and information on all the activities consist of banking sectors. Less disaggregated data can be obtained from the word bank annual country report and Statistical Yearbook of Afghanistan .

Insurance pension Funding
The insurance sector in Afghanistan consists of public insurance and four insurance companies. both public and private insurance companies are offering limited insurance services. Information on services and the value of private insurance companies are not available. However, data on the total value of public insurance companies are obtained from the Statistical yearbook of Afghanistan. data on real estate, renting, and business activities, and other services were also obtained from the statistical yearbook (NSIA).

Real Estate Activities
Real estate activities encompass a range of services relating to the provision of property, such as buying, selling, and renting of commercial, and residential properties or land. The National Statistics and Information Authority (NISA) of Afghanistan presents data on the total value of real estate sector value (NSIA).

Art, recreational and other services activities
The activities considered in this sector are activities of household for own use, entertainment and other services. The Statistical yearbook of Afghanistan report total value of this sector, (NSIA)

Public Administration

This sector consists of public administration, defence, and compulsory social security. National Statistics and Information Authority (NISA) provide data on the total value of public administration and defence (NSIA).

Education, Human Health, &social work activities Activities covered under the education sector are educational and research services, and it includes both private and public institutions.The total value of medical health also consists of both public and private health sectors. National Statistics and Information Authority (NISA) provide data on the total value of education sector, health and social activities, (NSIA).

Dwelling
The activities covered in this sector are actual and imputed income from residential houses. National Sattistical and Infomration Authority provide information on the total value of dwelling sector, (NSIA).

9.2.6 Final Demand

The final demand uses of the gross domestic product have been classified in six categories

- Private final consumption expenditure
- Government Final Consumption expenditure
- Gross fixed capital formation
- Change in stock
- Export
- Import

Private Final Consumption Expenditure
Private final consumption expenditure represents the consumption expenditure of household and non-profit institutions. The statistical yearbook of Afghanistan provides data on the total value of private final consumption expenditure. However, information on the sector-wise disaggregation is not available.

Government Final Consumption Expenditure
Government final consumption expenditure represents the current consumption expenditure of the government. This expenditure comprises compensation of employment, depreciation, and intermediate consumption. The total Government final consumption expenditure is divided based on economic classification into the sector of education, medical and health, water supply, construction, other services, and public administration and defence. Statistical yearbook of Afghanistan reports the total value of Government final consumption expenditure, and also, provide data on the compensation of public sector employees,(NSIA).

Gross Fixed capital formation change in Stock
Detailed commodity-wise information is not available on both gross fixed capital formation, and stock changes. Statistical yearbook report data on their total values, (NSIA).

9.2.7 Export Import

Statistical yearbook of Afghanistan reports the total value of export on f.o.b basis, and import on c.i.f basis. Using the second-best solution (mirroring), the data on the trade flow of Afghanistan disaggregated at the GTAP 65 sector level is reported. Since, Partner countries report their export and import to Afghanistan, by using information from the partner countries, Afghanistan's disaggregated trade flow is reported. Disaggregated trade flow data are obtained from the UN website or through World Bank's World Integrated Trade Solution (WITS) portal. WITS includes an automatic conversion system between several nomenclatures and versions. A reported HS version and standard concordance table is used to map the data to the GTAP sectoral level.

9.2.8 Labour Employment

Using the micro-level data from three rounds of the Afghanistan Living Condition Survey (ALCS), International Labour Organization (ILO) provides detailed information on the employment situation in Afghanistan. The Afghanistan Living Condition Survey (ALCS) is the longest-running and most comprehensive source of information about the social and economic situation of Afghanistan CSO (2016). International labour Organization report information on the structure of employment, labour force participation rates over time, earning of workers, formal and informal employment, and sector-wise disaggregation of employment and earning. A Socio-demographic and economic survey conducted by the National Statistics and Information Authority (NISA) in six provinces of Afghanistan provides information on the characterization of the Afghanistan labour market, which can be used as support for the data provided by the International Labour Organization (ILO), Dasgupta et al. (2019).

9.2.9 Value-added taxes

A 10% value-added taxes (VAT) will be imposed on all imports (irrespective of whether the importer is VAT-registered)and on the sales of goods and services in Afghanistan by businesses registered for VAT. initially, only the largest business will be required to register for VAT. The VAT will replace Business Receipts Tax (BRT) on all imports. Afghan Customs Department (ACD) will collect VAT on imports at the time and place of imports. The Afghan revenue Department ARD administrates the domestic VAT, MOF (2017).

9.3 Mapping between the columns of the Use table and GTAP sector

Mapping Between Afghan and GTAP Secotors and	
Afghan sector	**GTAP Sector Code**
One to One mapping	
Construction	construction (cns)
Accommodation, food and beverage services activities sector	communication (cmn)
professional, scientific and technical activities, and administration and support services sector activities	business services nec (obs)
art, entertainment and recreation, and other services activities	recreational and other services (ros)
public administration and defense sector	Public Administration and defense (osg)
Many to one	
car and motorcycle repair	trade (trd)
wholes and retail trade	
private education	education (edu)
public education	
public health	human health and social work activities (hht)
private health	
health services provided by NGOs	
One to Many	
agriculture	rice (pdr), wheat (wht), cereal (gro), vegetable, and fruit (v_f), oilseeds (osd), sugar crops (c_b), fiber crop (pfb), stimulant, spice and aromatic crops (ocr), Bovine animals (ctl), other animal product (oap), raw milk (rmk), wool (wol), forestry (frs), and fish (fsh).
Mining Sector	Mining of coal and lignite (coa), extraction of crude petroleum, and supported extraction activities (oil), extraction of gas (gas), and mining of metal ores, and other mining and quarrying (oxt)
Food manufacturing	meat of cattle (cmt), other meat (omt), vegetable oil (vol), dairy product (mil), milled rice (pcr), sugar (sgr), food (ofd), beverages and tobacco (b_t)
Manufacturing rest sector	textile (tex), wearing apparel (wap), leather (lea), manufacture of wood (lum), paper and paper product (ppp), coke and refined petroleum (p_c), chemical and chemical product (chm), pharmaceutical product (bph), rubber and plastic product (rpp), other non-metallic products (nmm), basic iron and steal (i_s), basic precious and non-ferrous metal (nfm), fabricated metal product (fmp), computer and electronic (ele), electrical equipment (eeq), machinery and equipment (ome), motor vehicles, trailer (mvh), other transport (otn), and furniture (omf).
energy sector	collection and distribution of electricity, (ely), manufacture of gas (gdt), collection, purification and distribution of water (wtr).
transport sector	land transport (otp), water transport (wtr), air transport (atp), and warehousing and support activities for transportation (whs)
finance sector	financial sector (ofi) and the insurance sector (ins)
real estate sector	real estate activities (rsa) and dwelling (dwe)

9.4 Concordance between GTAP sectors and SUT

Table 5: Concordance between GTAP 65 sectors and SUT

No	GTAP No	GTAP Sector	ISIC code	Section name
1	1	wht	0111	Wheat
2	2	pdr	0113	Paddy
3	3	gro	0112	Barley
4	3	gro	0112	Maize
5	3	gro	0112	Millet
6	4	v_f	01241	Beans
7	4	v_f	01242	Peas
8	4	v_f	01510	Potatoes
9	4	v_f	01233	Eggplants
10	4	v_f	01212	Cabbage
11	4	v_f	01232	Cucumber
12	4	v_f	01253	Onions
13	4	v_f	01234	Tomatoes
14	4	v_f	01251	Carrottes
15	4	v_f	01215	Spinach
16	4	v_f	01254	Leek
17	4	v_f	01254	Celery
18	4	v_f	01235	Squash
19	4	v_f	01270	Mushroom
20	4	v_f	01259	Radish
21	4	v_f	01290	VegO Vegetable
22	4	v_f	01221	Watermelons
23	4	v_f	01229	other melons
24	4	v_f	01259	Vegetable
25	6	c_b	01801	Sugar Cane
26	6	c_b	01802	Sugar beets
27	7	pfb	01921	Cotton

Continued on next page

Table 5 – *Continued from previous page*

No	GTAP No	GTAP Sector	ISIC code	Section name
28	4	v_f	01312	other fruits
29	4	v_f	01354	Strawberries
30	4	v_f	01330	Mulberries
31	4	v_f	01330	Grapes
32	4	v_f	01323	Oranges
33	4	v_f	01329	Citrus Fruit nes
34	4	v_f	01341	Apples
35	4	v_f	01342	Pears
36	4	v_f	01343	Apricots
37	4	v_f	01345	Peaches and Nectarines
38	4	v_f	01346	Plums
39	4	v_f	01349	Pomegranates
40	4	v_f	01371	Almonds
41	4	v_f	01376	Walnuts
42	4	v_f	01375	Pistachios
43	4	v_f	01379	OthN Other nuts
44	4	v_f	01315	Figs
45	4	osd	01450	Olives
46	8	ocr	01651	Pepper and other spices
47	8	ocr	0193	Horticulture and flowers
48	10	oap	02953	Skin
49	9	ctl	0211	Cows and buffalos
50	9	ctl	02122	Sheep
51	9	ctl	02123	Goat
52	12	rmk	022	Milk
53	9	ctl	02131	Livestock
54	9	ctl	02121	Camels
55	12	wol	02941	Wool
56	10	oap	02151	Chicken

Continued on next page

Table 5 – *Continued from previous page*

No	GTAP No	GTAP Sector	ISIC code	Section name
57	10	oap	02321	Eggs
58	10	oap	02910	Honey
59	10	oap	02944	Silk cocoons
60	14	fsh	017	Hunting
61	13	frs	03110	Forestry
62	13	frs	03120	Logging
63	13	frs	03131	Charcoal
64	13	frs	03132	Fire-wood
65	18	oxt	0810	Surface minerals
66	15	coa	0510	Coal
67	17	gas	0620	Natural gas
68	17	gas	0620	Liquid Ammonia
69	17	gas	0620	Condensate
70	18	oxt	0729	Gold
71	18	oxt	08	Oth Minerals & Marble
72	18	oxt	08	Birait
73	18	oxt	08	Talak
74	18	oxt	08	Chona
75	18	oxt	08	Precious stone
76	18	oxt	08	Gash
77	18	oxt	0810	Stone for construction (Nature)
78	18	oxt	0893	Salt
79	25	ofd	2311	Wheat flour mill
80	23	pcr	23162	Rice processing for final use
81	23	pcr	23161	Rice milling
82	25	ofd	23410	Bakery (bread making only)
83	25	ofd	23430	Cookies and cakes
84	25	ofd	23710	Spaghetti & Macaroni
85	25	ofd	1010	Abattoirs

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Table 5 – *Continued from previous page*

No	GTAP No	GTAP Sector	ISIC code	Section name
86	20	omt	2114	Poultry processing
87	19	cmt	211	Meat: other meat production)
88	25	ofd	1020	Fish
89	22	mil	2316	Milk Products
90	21	vol	1040	Oils and fats
91	25	ofd	2149	Processing of fresh and dried fruits, herbs & honey
92	25	ofd	21299	Ready-made food and other food processing
93	24	sgr	23520	Sugar and sweets
94	25	ofd	23921	Tea, black and gree
95	25	ofd	2399	OthF Food items, others
96	25	ofd	2392	Spices and salt, processed
97	26	b_t	244	SoftT Soft drinks Traditional
98	26	b_t	244	SoftM Soft drinks modern
99	26	b_t	25020	Cigarrettes and tobacco, sniff
100	27	tex	1399	Blankets
101	27	tex	1393	Carpets, rugs (ordinary use)
102	27	tex	1393	Carpets for exports
103	27	tex	1311	Yarn and other textile inputs,processing of cotton
104	28	wap	1410	Clothes and wearing apparel
105	29	lea	1520	Shoes and leather products
106	31	ppp	17	Stationery
107	31	ppp	18	Paper, printing, newspapers etc
108	32	p_c	19	Fuels and lubricants, also coke, kerosin
109	33	chm	2012	Fertlizer
110	33	chm	2011	Condensate, gash processed from mining
111	33	chm	2011	Matches
112	33	chm	2011	Oxygen
113	33	chm	2022	Paint
114	33	chm	2023	Soap, washing powder, toilet paper etc

Continued on next page

Table 5 – *Continued from previous page*

No	GTAP No	GTAP Sector	ISIC code	Section name
115	34	bph	2100	Agricultural medicines
116	34	bph	2100	Medicines and medical equipment
117	35	rpp	2211	Tyres
118	36	nmm	2394	Cement
119	36	nmm	2395	Gash processing
120	36	nmm	2396	Stone crushing, processing of minerals
121	36	nmm	2399	Construction materials other than cement, gash, stones
122	36	nmm	2310	Glass, ceramics
123	37	i_s	2410	Metals (basics), incl. Iron and steel
124	39	fmp	2593	Tools, cutlery and other metal products
125	40	ele	26	Computers, electronics (including consumer electronics)
126	41	eeq	27	Electric. equipm., incl. batteries, generators, refrigerators etc.
127	42	ome	2824	CF Constr Construction capital formation
128	42	ome	2829	CF special purpose machines other than for constr./agric.
129	42	ome	2821	Tractors and other agricultural machines
130	43	mvh	2910	Buses
131	43	mvh	2910	Cars
132	43	mvh	2910	Lorries
133	43	mvh	2930	Spare parts for motor vehicles
134	44	otn	3092	Bicycles
135	44	otn	3091	Motorcycles
136	45	omf	31	Furniture and dishes
137	45	omf	32	Machineries
138	45	omf	3290	Other manuf.
139	27	tex	13	Threads
140	27	tex	13	Fabrics

Continued on next page

Table 5 – *Continued from previous page*

No	GTAP No	GTAP Sector	ISIC code	Section name
141	28	wap	14	Cloths
142	29	lea	15	Foot wear
143	32	p_c	19	Petroleum oil and lubricants
144	34	bph	21	Medicines
145	36	nmm	23	Construction material
146	40	ele	26	Electronic
147	41	eeq	27	Household needs
148	43	mvh	29	Spare parts, Machinery.& Vehicles
149	45	omf	32	Medical equipments
150	45	omf	32	Other
151	46	ely	3510	El_im Electricity imports (see sheet "imports")
152	46	ely	3510	Distribution of electricity (Brishna company)
153	46	ely	3510	ElecPub PPublic electricity
154	46	ely	3510	Solar energy by companies
155	46	ely	3510	Solar energy by households
156	47	gdt	3520	Gas distribution mains / pipes
157	48	wtr	3600	Water households by own well
158	48	wtr	3600	empty (reserve)
159	48	wtr	3600	Piped Water distribution
160	48	wtr	3600	Water for opium
161	46	ely	3530	Ice for cooling purpose
162	49	cns	41	Modern Construction
163	49	cns	41	Traditional Construction
164	49	cns	41	Specialized constr
165	50	trd	45	Car and motorcycle repair (Garages)
166	50	trd	46	*Trade*
167	52	otp	4921	Land transport buses, taxis (private), source ALCS
168	52	otp	4921	Taxi Land transport Motorcycles, taxi as per ALCS
169	52	otp	4921	GGBus transp. Gen.Gov. as wages & salar. in kind

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Table 5 – *Continued from previous page*

No	GTAP No	GTAP Sector	ISIC code	Section name
170	52	otp	4922	Trucks Land transport Trucks
171	52	otp	4923	Imports of freight serv.
172	52	otp	4923	Imports travel serv., business (as per BOP)
173	54	atp	51	Imports of travel serv., personal (as per BOP)
174	52	otp	49	Travel expenses (50% of object code 221)
175	52	otp	49	Market outp. GG from transp. Serv.
176	54	atp	51	Air transport Passengers International
177	54	atp	51	Air transport passenger Domestic
178	54	atp	51	Goods Air transport goods International
179	54	atp	51	Air transport goods domestic
180	55	whs	52	Storage (estimate)
181	56	cmn	53	Post
182	51	afs	5510	Hotels/guesthouses
183	51	afs	5610	Restaurants/bars
184	51	afs	5610	RestInf Restaurants / hotels informal
185	51	afs	5621	Wedding halls
186	51	afs	5629	General Gov. provision of food
187	56	cmn	581	Media
188	56	cmn	6110	PuFixed phones Public
189	56	cmn	6110	PrFixed phones Private
190	56	cmn	6120	Mobile phone private
191	56	cmn	6190	Telecommunication
192 57	56 ofi	cmn 6419	6399 FISIM Financial institu-tions	Cafternet caf193
194	57	ofi	6419	Financial institutions
195	57	ofi	6411	DA Bank Non-market output
196	57	ofi	6499	MonCh Money exchange Shops

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Table 5 – *Continued from previous page*

No	GTAP No	GTAP Sector	ISIC code	Section name
197	57	ofi	6499	Street Informal (street exchange money)
198	58	ins	65	Insurance
199	59	rsa	68	Real estate and business services
200	59	rsa	68	GG Real estate market output
201	65	dwe	n.a.	Ownership of Dwellings, imputed
202	60	obs	69	Lawyers and accounting services
203	60	obs	70	good governance, consulting, ..
204	60	obs	70	Techn. Ass. (dom. priv)
205	60	obs	70	Techn. Ass. (dom. priv)
206	60	obs	70	Techn Assist., Devel. Project Managem.,
207	60	obs	7110	Architects, engineers
208	60	obs	7310	Advertising, market research
209	60	obs	7410	Other professional services
210	60	obs	7490	Other business services
211	60	obs	7420	Photo
212	60	obs	7500	Veterinary services
213	60	obs	7722	Video rental
214	60	obs	7729	Rental and Leasing other than videos
215	60	obs	8030	Other business services
216	60	obs	8010	Security, private company
217	60	obs	8020	Security, private individual
218	62	osg	84	Public admin. and defence central governm AFMIS
219	62	osg	84	Public administration and defense Kabul munic.
220	62	osg	84	Public administr. and defence prov. municipalities
221	63	edu	85	Education private
222	63	edu	85	Private education (source ALCS)
223	63	edu	85	Education public (NMP)
224	63	edu	85	Education public (NMP)
225	63	edu	854	Other education (driving schoolsc)

Continued on next page

Table 5 – *Continued from previous page*

No	GTAP No	GTAP Sector	ISIC code	Section name
226	64	hht	86	General hospitals (Source: NHA)
227	64	hht	86	Private doctors
228	64	hht	86	HeaPu Health serv., public (NMP)
229	64	hht	86	
230	64	hht	86	Off-budget TA on health services as per NHA
231	64	hht	86	Health services provided by NPISH as per NHA
232	64	hht	88	NGOSoc NGOs social services
233	61	ros	9000	Cinema
234	61	ros	941	Membership organizations
235	61	ros	952	Bicycle repair
236	61	ros	96	Personal and household services
237	61	ros	96	Personal and Household services
238	61	ros	9601	Cleaning, dry, etc.
239	61	ros	9602	Beauty salon
240	61	ros	9602	Coiffeur

9.5 List of sectors with zero production in the intermediate matrix

9.6 wht

Wheat, gtap(wht), CPC(0111): Wheat is generally consumed in the form of feed (ctl, oap, and rmk), seed (wht), food manufacture (cmt, omt, mil,ofd), and in hotels and restaurant(afs). This implies that in addition to the sectors mentioned above, wheat sector's contribution to other sectors is zero.s.

9.7 pdr

Rice, gtap(pdr), CPC(0113): Rice is mainly consumed in the form of seed (pdr), and food manufacture (ofd). This indicates that apart from the sectors mentioned above, paddy rice sector's contribution to other sectors is zero.s

9.8 grp

Barley, gtap(gro), CPC(0115): Barley is broadly consumed in the form off feed (ctl, oap, and rmk), seed (gro), and food manufacture (cmt, omt, mil,ofd). This shows that beside from the mentioned sectors, Barley sub-sector is not contributing to other sectors.

Maize, gtap(gro), CPC(0112): Maize is mostly consumed in the form of seed (ctl, oap, and rmk), seed (gro), food manufacture (cmt, omt, mil,ofd), and in hotels and restaurant(afs). This shows that aside from the sectors mentioned above, maize sub-sector is not contributing to other sectors.

Miller, gtap(gro), CPC(0118): Miller is generally consumed in the form of seed (ctl, oap, and rmk), seed (gro), and food manufacture (cmt, omt, mil,ofd). This shows that apart from the above sectors, maize sub-sector is not contributing to other sectors.

9.9 v_f

Beans, gtap(v_f), CPC(01241): Bean is mostly consumed in the form of seed (v_f), and food manufacture (ofd). This indicates that in addition to above mentioned sectors, beans sub-sector supply to other sectors is zero.s

Peas, gtap(v_f), CPC(001242): Peas is mainly used in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This shows that beside the above mentioned sectors peas sub-sector is not contributing to other sectors

Potato, gtap(v_f), CPC(01510): Potato is generally consumed in the form off feed (ctl, oap, and rmk), seed (v_f), food manufacture (cmt, omt, mil,ofd), in hotels and restaurants (afs), and by public administration (osg). This suggests that aside from above named sectors potato sub-sector input to other sectors is zero..

Eggplants, gtap(v_f), CPC(01233): Eggplants are largely used in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This indicates that apart from the above mentioned sectors Eggplants sub-sector is not contributing to other sectors

Cabbage, gtap(v_f), CPC(1212): Cabbage is mainly consumed in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This shows that aside from the above named sectors Cabbage sub-sector contribution to other sectors is zero.

Cucumber, gtap(v_f), CPC(01232): Cucumber is generally consumed in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This implies that in addition to the above sectors Cucumber sub-sector input to other sectors is zero.

Onion, gtap(v_f), CPC(01253): Onion is largely consumed in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This point out that apart from the above indicated sectors Onion sub-sector is not contributing to other sectors

Tomato, gtap(v_f), CPC(01234): Tomato is mostly used in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This indicates that apart from the above named sectors Onion sub-sector contribution to other sectors is zero.

Carrot, gtap(v_f), CPC(01251): Carrot is generally consumed in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This shows that aside from the above mentioned sectors Eggplants sub-sector input to other sector is zero.. **Spinach, gtap(v_f), CPC(01235):** Spinach is largely consumed in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This implies that apart from the above mentioned sectors Spinach sub-sector contribution to other sectors is zero.

leek, gtap(v_f), CPC(01254): leek is largely consumed in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This indicates that apart from the above indicated sectors leek sub-sector supply to other sectors is zero.. **Celery, gtap(v_f), CPC(012):** Celery is mainly used in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This shows that apart from the above named sectors Celery sub-sector contribution to other sectors is zero.

Squash, gtap(v_f), CPC(01235): Squash is mostly utilized in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This implies that aside from the above mentioned sectors Squash sub-sector is not contributing to other sectors

Mushroom, gtap(v_f), CPC(01270): Mushroom is generally used in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This point out that beside the above named sectors Mushroom sub-sector input to other sectors is zero.

Radish, gtap(v_f), CPC(01259): Radish is mainly consumed in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This shows that in addition to the above sectors Radish sub-sector is not contributing to other sectors

Vegetable n.e.c, gtap(v_f), CPC(01229): Vegetable n.e.c is mostly consumed in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This shows that apart from the above mentioned sectors Vegetable n.e.c sub-sector contribution to other sectors is zero.

Watermelons, gtap(v_f), CPC(01221): Watermelons is mainly consumed in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg) . This indicatess that aside from the above sectors Watermelons sub-sector supply to other sectors in zero.

Cantaloupes and other melons, gtap(v_f), CPC(01221): Cantaloupes and other melons are generally consumed in the form of seed (v_f), food manufacture (ofd), in hotels and restaurants (afs), and by public administration (osg). This indicates that aside from the above sectors Watermelons sub-sector is not contributing to other sectors

Vegetable n.e.c, gtap(v_f), CPC(01259): Vegetable n.e.c is only consumed in the form of seed (v_f). This implies that apart from the seed, Vegetable n.e.c is mostly consumed by Households.

Bananas and other fruits, gtap(v_f), CPC(01312): Bananas and other fruits are generally utilized in the form of food manufacture (ofd, sgr, b_t), and in hotels and restaurants (afs). This shows that aside from the above sectors Bananas and other fruits sub-sector is not contributing to other sectors

Strawberries, gtap(v_f), CPC(01354): Strawberries are mostly used in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), and and by public administration (osg). This shows that in addition to above sectors Strawberries sub-sector input to other sectors is zero.

Mulberries, gtap(v_f), CPC(01354): Mulberries are mostly consumed in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), and and by public administration (osg). This implies that in addition to above sectors Mulberries sub-sector contribution to other sectors is zero.

Grapes, gtap(v_f), CPC(01330): Grapes are largely consumed in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), by public administration (osg), and in health sector (hht). This implies that in addition to above named sectors Grapes sub-sector input to other sectors is zero.

Orange, gtap(v_f), CPC(01323): Orange is generally used in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), and and by public administration (osg). This indicates that in addition to above mentioned sectors Orange sub-sector supply to other sectors is zero.

Citrus Fruit n.e.c, gtap(v_f), CPC(01329): Citrus Fruit n.e.c are broadly consumed in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), and and by public administration (osg). This implies that in addition to above indicated sectors Citrus Fruit n.e.c sub-sector contribution to other sectors is zero.

Apples, gtap(v_f), CPC(01341): Apples are mostly consumed in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), and and by public administration (osg). This implies that beside the above mentioned sectors apple sub-sector input to other sectors is zero.

pear, gtap(v_f), CPC(01342): pear is widely consumed in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), and and by public administration (osg). This shows that aside from to above named sectors pear sub-sector supply to other sectors is zero.

apricots, gtap(v_f), CPC(01343): apricots is widely consumed in the form of food manufacture (ofd, sgr, b_t), and in hotels and restaurants (afs). This implies that apart from above sectors pear sub-sector contribution to other sectors is zero.

peaches and Nectarines, gtap(v_f), CPC(01345): peaches and Nectarines are mostly consumed in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), and and by public administration (osg). This indicates that beside the above mentioned sectors peaches and Nectarines sub-sector contribution to other sectors is zero.

Plums, gtap(v_f), CPC(01346): Plums are mainly utilized in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), and and by public administration (osg). This suggest that aside from to above indicated sectors Plums sub-sector input to other sectors is zero.

Pomegranates, gtap(v_f), CPC(01342): pear is largely consumed in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), and and by public administration (osg). This point out that apart from above sectors Pomegranates sub-sector contribution to other sectors is zero.

Almond, gtap(v_f), CPC(01371): Almond is mostly consumed in the form of food manufacture (ofd, b_t), and in hotels and restaurants (afs). This shows that apart from above mentioned sectors Almond sub-sector contribution to other sectors is zero.

Walnut, gtap(v_f), CPC(01376): Walnut is generally used in the form of food manufacture (ofd, b_t), and in hotels and restaurants (afs). This implies that apart from above named sectors Walnut sub-sector supply to other sectors is zero.

Pistachio, gtap(v_f), CPC(01375): Pistachio's contribution to other sectors as intermediate is zero.

Other nuts, gtap(v_f), CPC(01379): Other nuts are mostly consumed in the form of food manufacture (ofd, b_t), and in hotels and restaurants (afs). This indicates that beside above named sectors other nuts sub-sector input to other sectors is zero.

Figs, gtap(v_f), CPC(01373): Figs are largely consumed in the form of food manufacture (ofd, sgr, b_t), in hotels and restaurants (afs), and by public administration (osg). This indicates that in addition to above sectors figs sub-sector contribution to other sectors is zero.

9.10 c_d

Sugar Cane, gtap(c_d), CPC(01801): Sugar Cane is consumed in the form of food manufacture (ofd,sgr). This shows that beside the above mentioned sectors Sugar Cane sub-sector is not contributing to other sectors

Sugar Beets, gtap(c_d), CPC(01802): Sugar Beets is totally consumed in the form of seed (c_d), and food manufacture (ofd,sgr). This indicates that in addition to the above sectors Sugar Beets sub-sector contribution to other sector is zero..

9.11 pfb

Cotton, gtap(c_d), CPC(01801): Cotton is mostly used in manufacture sector(tex, wap). This indicates that apart from the above named sectors cotton sub-sector input to other sectors is zero.

9.12 osd

Oliver, gtap(ocd), CPC(01450): Oliver is mostly consumed in the form of food manufacture(pfb,vol), in hotels and restaurants (afs), and by public administration (osg). This indicates that aside from the above mentioned sectors Oliver sub-sector supply to other sectors is zero.

9.13 ocr

Pepper and other spices, gtap(ocd), CPC(01651): Pepper and other spices are largely consumed in the form of food manufacture(pfb), and in hotels and restaurants (afs). This implies that apart from the above mentioned sectors Pepper and other spices sub-sector contribution to other sectors are zero.

Horticulture and flower, gtap(ocd), CPC(0193): Horticulture and flower are totally consumed by household. This shows that horticulture and flower sub-sector contribution to other sectors is zero.

9.14 oap

skin, gtap(oap), CPC(02953): skin is mostly used in manufacture sector(tex, wap, lea, lum, ppp. omf). This indicates that apart from the above mentioned sectors skin sub-sector contribution to other sectors is zero. **Chicken, gtap(ocd), CPC(02151):** Chicken are largely used in food manufacture sector(cmt, ofd), and in hotels and restaurants (afs). This shows that beside the above sectors chicken sub-sector input to other sectors is zero.

Eggs, gtap(ocd), CPC(2321): Eggs are generally consumed in the form of food manufacture sector(ofd), in hotels and restaurants (afs), and public administration (osg). This point out that beside the above sectors eggs sub-sector contribution to other sectors is zero.

Honey, gtap(ocd), CPC(02910): Honey are mostly consumed in the form of food manufacture sector(ofd, b_t), in hotels and restaurants (afs), and public administration (osg). This point out that beside the above sectors honey sub-sector supply to other sectors is zero.

Silk cocoons, gtap(oap), CPC(02944): Silk cocoons is mostly used in manufacture sector(tex, wap). This indicates that apart from the above mentioned sectors Silk cocoons sub-sector input to other sectors is zero.

9.15 ctl

cows, gtap(ctl), CPC(0211): cows are largely consumed in the form of food manufacture sector(omt, ofd), and in hotels and restaurants (afs). This implies that aside from the above named sectors cows sub-sector contribution to other sectors is zero.

sheep, gtap(ctl), CPC(02122): Sheep are mostly consumed in the form of food manufacture sector(cmt, vol,ofd), and in hotels and restaurants (afs). This shows that in addition to the above indicated sectors sheep sub-sector supply to other sectors is zero.

Goat, gtap(ctl), CPC(02123): Goat are mostly consumed in the form of food manufacture sector(cmt, mil,ofd), and in hotels and restaurants (afs). This indicates that aside from the above mentioned sectors goat sub-sector input to other sectors is zero.

camels, gtap(ctl), CPC(02121): camels are generally consumed in the form of food manufacture sector(cmt,ofd), and in hotels and restaurants (afs). This implies that beside the above sectors camels sub-sector contribution to other sectors is zero.

9.16 rmk

Milk, gtap(rmk), CPC(022): Milk are largely consumed in the form of food manufacture sector(mil,ofd, b_t), and in hotels and restaurants (afs). This shows that apart from the above named sectors Milk sub-sector supply to other sectors is zero.

9.17 wol

wol, gtap(wol), CPC(022): Wool is mostly used in manufacture sector(tex, wap, lea). This indicates that apart from the above indicated sectors wool sub-sector contribution to other sectors is zero.

9.18 fsh

Hunting, gtap(fsh), CPC(014): Hunting is generally consumed in the form of food manufacture sector(cmt,omt, vol, ofd), and in hotels and restaurants (afs). This implies that beside the above sectors Hunting sub-sector contribution to other sectors is zero.

9.19 frs

Forestry, gtap(ctl), CPC(0310): Forestry is totally consumed by households. This implies that Forestry sub-sector input to other sectors is zero.

Logging, gtap(ctl), CPC(03120): Logging is totally consumed by manufacturing sectors(lum, nfm, fmp, eeq, ome, mvh, otn, omf). This implies that beside the above sectors Logging sub-sector supply to other sectors is zero.

Fir-wood, gtap(ctl), CPC(03120): Fir-wood is totally consumed b in the form of food manufacture sector(vol, mil, pcr, sgr, ofd, b_t), and in hotels and restaurants (afs). This implies that in addition to the above sectors Fir-wood sub-sector contribution to other sectors is zero.

10 Industry

10.1 oxt

Surface minerals , ISIC, Rev.4(810): Surface minerals are totally used in agriculture (pdr, wht, gro, v_f, osd, c_b, pfb, ocr, ctl, oap, rmk, wol, frs, fsh), in mining(coa, gas, oxt), and construction (cns). This shows that in addition to the above sectors Surface minerals sub-sector input to other sectors is zero.

Other minerals and Marble , ISIC, Rev.4(08): Other minerals and Marble are totally used in manufacture sector(p_c, chm, bph, nmm, i_s, nfm). This suggest that apart from above sectors Other minerals and Marble sub-sector contribution to other sectors is zero.

Talak , ISIC, Rev.4(08): Talak is mainly utilized in manufacture sector(p_c, chm, rpp, nmm, nfm, fmp, eeq, ome). This suggest that apart from the above named sectors Talak sub-sector supply to other sectors is zero.

Chona , ISIC, Rev.4(08): Chona is mainly consumed in manufacture sector(p_c, chm, rpp, nmm, nfm, fmp, eeq, ome). This implies that aside from above sectors chona sub-sector contribution to other sectors is zero.

Precious stone , ISIC, Rev.4(08): Precious stone is generally used in manufacture sector(p_c, chm, rpp, nmm, nfm, fmp, eeq, ome). This implies that beside the above sectors Precious stone sub-sector input to other sectors is zero.

Gash , ISIC, Rev.4(08): Gash is mostly utilized in manufacture sector(p_c, chm, rpp, nmm, nfm, fmp, eeq, ome). This indicates that in addition to the above mentioned sectors Gash sub-sector contribution to other sectors is zero.

Stone for construction , ISIC, Rev.4(08): Stone for construction is mostly consumed in manufacture sector (p_c, chm, rpp, nmm, nfm, fmp, eeq, ome), and construction (cns). This point out that aside from the above named sectors Stone for construction sub-sector contribution to other sectors is zero.

Salt , ISIC, Rev.4(0893): salt is totally used in food manufacture sector(ofd, b_t), and manufacture sector sector(p_c, chm, rpp, nmm, nfm, fmp, eeq, ome). This shows that beside the above indicated sectors salt sub-sector supply to other sectors is zero.

10.2 coa

Coal, ISIC, Rev.4(0510): Coal are mainly used in food manufacture (vol, mil, pcr, sgr, ofd, b_t), in the manufacture sector(tex, ppp, p_c, chm, nmm, i_s, nfm, fmp) and in energy and water sectors (ely, gdt, wtr). This indicates that In addition to the above sectors Coal sub-sector input to other sectors is zero.

10.3 gas

Natural Gas, ISIC, Rev.4(0620): Natural Gas are mainly used in food manufacture (vol, mil, pcr, sgr, ofd, b_t), in the manufacture sector except (lea), and in energy and water sectors (ely, gdt, wtr). This implies that aside from the above indicated sectors natural gas sub-sector input to other sectors is zero.

Condensate, ISIC, Rev.4(0620): Condensate is totally used in the manufacture sector. This implies that aside from the above sectors Condensate sub-sector contribution to other sectors is zero.

10.4 ofd

Flour mill, ISIC, Rev.4(2311): flour mill are mostly consumed in the form of food manufacture sector(mil, ofd), in hotels and restaurants (afs), public administration (osg), education (eud), and health (hht). This implies that aside from the above named sectors flour mill sub-sector input to other sectors is zero.

Bakery, ISIC, Rev.4(23410): Bakery is generally used in the form of food manufacture sector(ofd), in hotels and restaurants (afs), public administration (osg), education (eud), and health (hht). This point out that beside the above mentioned sectors Bakery sub-sector supply to other sectors is zero.

Cookies and cakes, ISIC, Rev.4(23430): Cookies and cakes are mainly utilized in hotels and restaurants (afs), public administration (osg), and health (hht). This implies that beside the above named sectors Cookies and cakes sub-sector input to other sectors is zero.

Spaghetti and Macaroni, ISIC, Rev.4(23710): Spaghetti and Macaroni are mainly consumed in hotels and restaurants (afs), and health (hht). This shows that beside the above sectors Spaghetti and Macaroni sub-sector supply to other sectors is zero.

Abattoirs, ISIC, Rev.4(1010): Abattoirs is generally used in the form of food manufacture sector(cmt, omt, ofd). This suggest that in addition to the above named sectors Abattoirs sub-sector contribution to other sectors is zero.

Fish, ISIC, Rev.4(1020): Fish as intermediate is only consumed in hotels and restaurants (afs). This shows that aside from the above sectors fish sub-sector input to other sectors is zero.

Processing of fresh and dried fruits, herbs honey, ISIC, Rev.4(2149): Processing of fresh and dried fruits, herbs honey is mostly utilized in the form of food manufacture sector(ofd), and in hotels and restaurants (afs). This indicates that aside from the above mentioned sectors Processing of fresh and dried fruits, herbs honey sub-sector supply to other sectors is zero.

Tea, ISIC, Rev.4(23921): Tea is mainly used in hotels and restaurants (afs), professional, scientific, and other support services activities(obs), and health sector(hht). This shows that in addition to the above named sectors tea sub-sector input to other sectors is zero.

Other food item, ISIC, Rev.4(2399): Other food item is mainly employed in the form of food manufacture sector(ofd), in hotels and restaurants (afs), and health sector(hht). This indicates that aside from the above Other food item sub-sector contribution to other sectors is zero.

Spices and salt, ISIC, Rev.4(2399): Spices and salt are mainly used in the form of food manufacture sector(ofd), and in hotels and restaurants (afs). This implies that apart from the above named Spices and salt sub-sector input to other sectors is zero.

10.5 omt

poultry, ISIC, Rev.4(2114): poultry is mainly utilized in the form of food manufacture sector(omt, ofd), in hotels and restaurants (afs), education (eud), and health (hht). This shows that in addition to the above indicated sectors poultry sub-sector supply to other sectors is zero.

10.6 cmt

Meat, ISIC, Rev.4(211): Meat is mostly used in the form of food manufacture sector(cmt, ofd), in hotels and restaurants (afs), and health (hht). This indicates that aside from the above named sectors meat sub-sector input to other sectors is zero.

10.7 mil

Milk product, ISIC, Rev.4(2316): Milk product is mainly employed in the form of food manufacture (mil, fod), in hotels and restaurants (afs), public administration (osg), education (eud), and health (hht). This point out that apart from the above indicated sectors Milk product sub-sector contribution to other sectors is zero.

10.8 vol

Oil and fat, ISIC, Rev.4(1040): Oil and fat are utilized in the form of food manufacture (vol, fod), and in hotels and restaurants (afs). This shows that beside the above named sectors Oil and fat sub-sector supply to other sectors is zero.

10.9 sgr

Sugar and Sweets, ISIC, Rev.4(1040): Sugar and Sweets are consumed in the form of food manufacture (sgr, fod), and in hotels and restaurants (afs). This implies that aside from the above indicated sectors, Sugar and Sweets sub-sector input to other sectors is zero.

10.10 pcr

Rice processing, ISIC, Rev.4(23162): Rice processing is generally consumed in the form of food manufacture sector(pcr, ofd), in hotels and restaurants (afs), public administration (osg), education (eud), and health (hht). This shows that apart from the above mentioned sectors Rice processing sub-sector contribution to other sectors is zero.

Rice milling, ISIC, Rev.4(23161): Rice milling is mostly used in the form of food manufacture sector(pcr, ofd), in hotels and restaurants (afs), public administration (osg), education (eud), and health (hht). This indicates that in addition to the above indicated sectors Rice milling sub-sector supply to other sectors is zero.

10.11 b_t

Soft drinks (traditional) , ISIC, Rev.4(244): Soft drinks (traditional) are mainly consumed in hotels and restaurants (afs), in education sector (edu), and public health sector (hht). This shows that beside the above sectors Soft drinks Traditional sub-sector input to other sectors is zero.

Soft drinks (modern) , ISIC, Rev.4(244): Soft drinks (modern) are mainly consumed in hotels and restaurants (afs), and by public administration (osg). This indicates that apart from the above sectors Soft drinks modern sub-sector contribution to other sectors is zero.

Cigarettes , ISIC, Rev.4(25020): Cigarettes are only consumed by households. This shows that apart from the household sector, Cigarettes sub-sector input to other sectors is zero.

10.12 tex

Blanket, ISIC, Rev.4(1399): Blankets are generally employed in hotels and restaurants (afs), and in health sector(hht). This shows that aside from the above named sectors Blanket sub-sector contribution to other sectors is zero.

Carpet, ISIC, Rev.4(1993): Carpets are mainly consumed in trade sector (trd), hotels and restaurants sector (afs), communication sector (cmn) in financial services sector (ofi), in real estate sector (rsa), by public administration (osg), education sector (edu), health sector (hht), and other services activities (obs). This point out that in addition to the above named sectors Carpet sub-sector supply to other sectors is zero.

Yarn, ISIC, Rev.4(1399): Yarn are mainly utilized in manufacture sector (tex, wap, omf), in hotels and restaurants (afs), other administrative and support activities (obs), and other services activities (ros). This implies that in addition to the above named sectors Yarn sub-sector contribution to other sectors is zero.

Threads, ISIC, Rev.4(13): Threads are only consumed in manufacture sector (tex, wap). This shows that the contribution of threads to other sectors is zero.

10.13 wap

Cloths, ISIC, Rev.4(1410): Cloths are totally consumed by households. This shows that beside the household consumptions cloths sub-sector contribution to other sectors is zero.

10.14 lea

Shoes, ISIC, Rev.4(1520): Shoes are totally used by households. This implies that apart from the household consumptions shoes sub-sector contribution to other sectors is zero.

10.15 lum

Wood product, ISIC, Rev.4(1520): Wood products are mainly employed in agriculture sector, mining sector, food manufacture sector, manufacture sector, energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, real estate sector, Professional, scientific and other administrative and support service activities, and Arts, entertainment and recreation sector. This shows that in addition to the above indicated sectors Wood products sub-sector input to other sectors is zero.

10.16 ppp

Stationery, ISIC, Rev.4(17): Stationery is generally utilized in agriculture sector except (frs, fsh), mining sector, food manufacture sector, manufacture sector except (lea), energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance sector , insurance sector, real estate sector, scientific and other administrative and support service activities, public administration sector (osg) Professional, education sector (edu), health sector, and Arts, entertainment and recreation sector. This shows that in addition to the above sectors stationery sub-sector supply to other sectors is zero.

Paper, printing, ISIC, Rev.4(18): Paper, printing is mostly used in food manufacture sector, manufacture sector except (tex, wap, lea), trade sector, hotels and restaurants sector, communication sector, finance sector , insurance sector, Professional, scientific and other administrative and support service activities, public administration sector (osg) education sector (edu), health sector, and Arts, entertainment and recreation sector. This shows that in addition to the above mentioned sectors paper, printing sub-sector input to other sectors is zero.

10.17 p_c

Fuels and lubricants, also coke, ISIC, Rev.4(19): Fuels and lubricants, also coke are largely employed in agriculture sector except, mining sector, food manufacture sector, manufacture sector except (lea), energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, Professional scientific and other administrative and support service activities, public administration sector (osg), education sector (edu), health sector, and Arts, entertainment and recreation sector. This shows that apart from the above indicated sectors fuels and lubricants, also coke sub-sector input to other sectors is zero.

Petroleum oil and lubricants, duty free, ISIC, Rev.4(19): Petroleum oil and lubricants, are totally used by public administration sector (osg), and education sector (edu). This indicates that apart from the above named sectors Petroleum oil and lubricants, sub-sector contribution to other sectors is zero.

10.18 chm

Chemical materials, ISIC, Rev.4(): Chemical materials are broadly used in agriculture sector, food manufacture sector, manufacture sector, energy sector, construction sector, and health sector. This shows that aside from the above named sectors Chemical materials sub-sector supply to other sectors is zero.

Fertilizer, ISIC, Rev.4(2012): Fertilizer is totally consumed in agriculture sector. This point out that aside from the agriculture sector fertilizer sub-sector input to other sectors is zero.

Condensate, gash processed from mining, ISIC, Rev.4(2011): Condensate, gash processed from mining is totally used in agriculture sector, manufacture sector, and transport sector. This indicates that beside the above sectors Condensate, gash processed from mining sub-sector contribution to other sectors is zero.

Matches, gash processed from mining, ISIC, Rev.4(2011): Matches are partly used in hotels and restaurants sector. This point out that apart from the above indicated sectors Matches sub-sector supply to other sectors is zero.

Oxygen, gash processed from mining, ISIC, Rev.4(2011): Oxygen are totally used in food manufacturing sector. This suggest that aside from the above mentioned sectors Oxygen sub-sector input to other sectors is zero.

Paint, gash processed from mining, ISIC, Rev.4(2022): Paint, gash processed from mining is generally used in agriculture sector, food manufacture sector, manufacture sector, construction sector, trade sector, transport sector, hotels and restaurants sector, real estate sector, Professional scientific and other administrative and support service activities, public administration sector, and Arts, entertainment and recreation sector . This indicates that beside the above sectors Paint, gash processed from mining sub-sector contribution to other sectors is zero.

Soap, washing powder, toilet paper etc, gash processed from mining, ISIC, Rev.4(2023): Soap, washing powder, toilet paper etc are mainly consumed in hotels and restaurants sector, real estate sector, Professional scientific and other administrative and support service activities, public administration sector, and Arts, entertainment and recreation sector . This indicates that beside the above mentioned sectors Soap, washing powder, toilet paper etc sub-sector input to other sectors is zero.

10.19 bph

Medicines and medical equipment, ISIC, Rev.4(2100): Medicines and medical equipment are mainly utilized in health sector. This indicates that, in addition to the health sectors, medicines and medical equipment sub-sector supply to other sectors is zero.

Medicines, duty free, ISIC, Rev.4(21): Medicines are totally used by public administration sector (osg), and education sector (edu). This indicates that apart from the above sectors Medicines sub-sector input to other sectors is zero.

Medical equipments, duty free, ISIC, Rev.4(21): Medical equipments are partly used by health sector. This implies that in addition to the above sectors Medical equipments sub-sector contribution to other sectors is zero.

10.20 rbb

Tyres, ISIC, Rev.4(2211): Tyres are mainly consumed in agriculture sector, mining sector, food manufacture sector, manufacture sector, construction sector, trade sector, transport sector, and Professional scientific and other administrative and support service activities. This indicates that, apart from the above indicated sectors Tyres sub-sector supply to other sectors is zero.

10.21 nmm

Cement, ISIC, Rev.4(2211): Cement are generally used in agriculture sector, construction sector, and real estate. This shows that, apart from the above sectors Cement sub-sector contribution to other sectors is zero..

. **Gash processing, ISIC, Rev.4(2395):** Gash processing are mostly used in construction sector. This suggest that, apart from the above sectors Gash processing sub-sector contribution to other sectors is zero..

. **Stone crushing, processing of minerals, ISIC, Rev.4(2396):** Stone crushing, processing of minerals, processing of minerals are mainly used in construction sector. This implies that, aside from the above sectors Stone crushing, processing of minerals sub-sector contribution to other sectors is zero.

. **Glass, ceramics, ISIC, Rev.4(2310):** Glass, ceramics are mainly used in food manufacture sector, construction sector, trade sector, hotels and restaurants sector, financial sector, and insurance sector, real estate sector, public administration sector. This implies that, apart from the above named sectors glass, ceramics sub-sector input to other sectors is zero.

Construction material, duty free, ISIC, Rev.4(21): Construction material are partially used by public administration sector (osg) This implies that apart from the above sectors Construction material sub-sector contribution to other sectors is zero.

10.22 i_s

Metals (basics), include Iron and steel, ISIC, Rev.4(2410): Metals (basics), include Iron and steel are mainly employed in agriculture sector, food manufacturing sector except (b_t), manufacturing sector, energy sector, construction sector, trade sector, and transport sector. This indicates that, be side the above mentioned sectors metals (basics), include iron and steel sub-sector supply to other sectors is zero.

10.23 fmp

Tools, cutlery and other metal products, ISIC, Rev.4(2593): Tools, cutlery and other metal products are mainly consumed in agriculture sector, food manufacturing sector, manufacturing sector,construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, Professional scientific and other administrative and support service activities, public administration sector, health sector. This shows that, apart from the above sectors Tools, cutlery and other metal products sub-sector input to other sectors is zero..

10.24 ele

computer, ISIC, Rev.4(26): Computer are mainly used in food manufacturing sector except (omt, cmt), manufacturing sector except (wap, lea),construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sectors, Professional scientific and other administrative and support service activities, public administration sector, education sector, and health sector. This point out that, beside the above indicated sectors computer sub-sector supply to other sectors is zero.

Electronic, duty free, ISIC, Rev.4(26): Electronic is partially used by public administration sector (osg). This implies that apart from the public administration sector, electronic sub-sector supply to other sectors is zero.

10.25 eeq

Electric equipments including batteries, generators, refrigerators etc., ISIC, Rev.4(27): Electric equipments including batteries, generators, refrigerators etc. are mainly utilized in agriculture sector, mining sector, food manufacturing sector, manufacturing sector except (wap, lea, bph), construction sector, trade sector, transport sector, hotels and restaurants sector, and public administration sector, education sector. This indicates that in addition to the above mentioned sectors electric equipments including batteries, generators, refrigerators etc. sub-sector supply to other sectors is zero.

Electronic equipment, duty free, ISIC, Rev.4(24): Electronic equipment are totally used by public administration sector (osg), and education sector. This implies that apart from the above sectors Electronic equipment sub-sector contribution to other sectors is zero.

10.26 ome

Special purpose machines other than construction an agriculture, ISIC, Rev.4(2829): special purpose machines other than construction an agriculture is only used by public administration. This suggest that aside from the public administration sector special purpose machines other than construction an agriculture sub-sector contribution to other sectors is zero. **Tractors and other agricultural machines, ISIC, Rev.4(3290):** Tractors and other agricultural machines only contribution is to the gross capital formation.

10.27 mvh

Bus, cars, lorries, ISIC, Rev.4(2910): Bus, cars, lorries, are employed by household and with the contribution to the gross capital formation.

. **Spare parts for motor vehicles, ISIC, Rev.4(24):** Spare parts for motor vehicles are mainly utilized in construction sector, trade sector, transport sector, and in art, entertainment and recreation sectors. This shows that apart from the above mentioned sectors, spare parts for motor vehicles sub-sector supply to other sectors is zero.

10.28 otn

Bicycles, ISIC, Rev.4(2910): Bicycles are totally by household. This suggest that bicycle sub-sector contribution to other sectors is zero.

. **Bus, cars, lorries, ISIC, Rev.4(2910):** Motorcycles are used by household and also with a contribution to the gross capital.

10.29 omf

Furniture and dishes, ISIC, Rev.4(31): Furniture and dishes are mainly utilized in food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sectors, Professional scientific and other administrative and support service activities, real estate sector, public administration sector, education sector, and health sector, and in art, entertainment and recreation sectors. This implies that in addition to the above mentioned sectors, Furniture and dishes sub-sector supply to other sectors is zero.

. **Other manufacturing, ISIC, Rev.4(3290):** Other manufacturing are mainly used in agriculture, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, and in art, entertainment and recreation sectors. This indicates that apart from the above mentioned sectors, other manufacturing sub-sector input to other sectors is zero. subsectionomf

10.30 ely

Distribution of electricity (imported electricity), ISIC, Rev.4(3510): 61% of electricity is distributed with different percentage to all the sectors for the intermediate use.

. **production and distribution of public electricity, ISIC, Rev.4(3510):** Except the hotels and restaurants sector, communication sector, financial and insurance sector, and real estate sector, public electricity is also distributed to the remaining sector for the intermediate use.

production and distribution of solar energy by private companies, ISIC, Rev.4(3510): 54% of solar energy produced by private companies are distributed with different percentage supplied as an input to all the sectors.

production and distribution of solar energy by households, ISIC, Rev.4(3510): Solar energy produced by households are totally consumed by households.

Air conditioning supply, ISIC, Rev.4(3530): Air conditioning is supplied to the food manufacturing sector, trade sector, and hotels and restaurants sector.

10.31 gdt

Gas distribution via pipe, ISIC, Rev.4(3520): Gas is distibuted via pipes to the manufacture sector(tex, pp, p_c, chm, rpp, nmm, i_s, fmp, eeq, ome, mvh, otn), and household for final consumption.

10.32 wtr

Water distribution via pipe, ISIC, Rev.4(3600): 91% of water is distributed via pipelines to the construction sector, hotels and restaurants sector, public administration sector, and education sector.

10.33 cns

Construction, ISIC, Rev.4(3600): Construction sector is mainly contributing to the mining sector, construction sector, real estate sector, public administration sector, education sector, and health sector. This implies that apart from the above mentioned sectors, construction sector supply to other sectors is zero.

11 Services

11.1 trd

Car and motorcycle repair, ISIC, Rev.4(3600): Car and motorcycle repair services are mainly used by agricultural sector, mining sector, food manufacturing sector, manufacturing sector except(tex, wap, lea),energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, Professional scientific and other administrative and support service activities, public administration sector, education sector, health sector, and in art, entertainment and recreation sectors.

11.2 otp

Land transport buses, taxis (private), ISIC, Rev.4(4921): Land transport (buses, taxis (private)) services are generally supplied to mining sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, communication sector, and Professional scientific and other administrative and support service activities. Apart from the above mentioned sectors, Land transport buses, taxis (private) sub-sector input to other sectors is zero

Land transport Motorcycles, ISIC, Rev.4(3600): Land transport (Motorcycles) services are mostly employed in agriculture sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, and art, entertainment, and recreation sector. Apart from the above mentioned sectors, Land transport motorcycles sub-sector supply to other sectors is zero

Land transport Trucks, ISIC, Rev.4(4922): Land transport (trucks) services are mostly used in agriculture sector, mining sector, food manufacturing sector, manufacturing sector, energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, real estate sector, professional, scientific activities and administrative and support service, public administration sector, education sector, and health sector. Apart from the above mentioned sectors, Land transport (trucks) sub-sector contribution to other sectors is zero

Freight import services, ISIC, Rev.4(4923): Freight import services are mostly employed in agriculture sector, mining sector, food manufacturing sector, manufacturing sector, energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, real estate sector, professional, scientific activities and administrative and support service, health sector, and and art, entertainment, and recreation sector. This suggest, apart from the above named sectors, freight import service sub-sector supply to other sectors is zero

Import travel services, ISIC, Rev.4(4923): Import travel services are mostly utilized in agriculture sector, mining sector, food manufacturing sector, manufacturing sector, energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, financial and insurance sector, real estate sector, professional, scientific activities and administrative and support service, education sector, health sector, and and art, entertainment, and recreation sector.

Travel services expenses, ISIC, Rev.4(49): Travel services expenses are used by public administration, education sector,and health sector

Transport Market output, ISIC, Rev.4(49): Transport Market output are mostly employed by mining sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, hotels and restaurants sector, professional, scientific activities and administrative and support service, education sector, health sector, and and art, entertainment, and recreation sector.

11.3 atp

Air transport passengers (Domestic), ISIC, Rev.4(51): Air transport passengers services are mostly employed by manufacturing sector, construction sector, trade sector, communication sector, public administration sector, and health sector.This implies, beside from above indicated sectors, Air transport passengers (Domestic) sub-sector contribution to other sectors is zero.

Air transport passengers (International), ISIC, Rev.4(51): Air transport passengers (international) service are generally utilized by mining sector, food manufacturing sector, manufacturing sector, energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector,finance and insurance sector, real estate sector, public administration sector, and art, entertainment and recreation sector.This implies, in addition to the above named sectors, Air transport passengers (international) sub-sector input to other sectors is zero.

Air Cargo (international), ISIC, Rev.4(51): Air Cargo (international) are mainly used by mining sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, communication sector, public administration sector.

Air Cargo (Domestic), ISIC, Rev.4(51): Air Cargo (domestic) service are largely consumed by mining sector, food manufacturing sector, manufacturing sector, energy sector, construction sector, trade sector, public administration sector. This shows, apart from the above named sectors, Air cargo (Domestic) sub-sector supply to other sectors is zero.

11.4 whs

Storage, ISIC, Rev.4(51): Storage services are largely employed by food manufacture sector, manufacturing sector, construction sector, trade sector, transport sector, professional, scientific activities and administrative and support service sector, and art, entertainment and recreation sector. This indicated, in addition to the above indicated sectors, storage sub-sector input to other sectors is zero.

11.5 afs

Hotels and guest house, ISIC, Rev.4(5510): Hotels and guest houses services are generally used by mining sector, food manufacturing sector, manufacturing sector except (wap, lea), construction sector, trade sector, transport sector, communication sector, finance and insurance sector,real estate sector, professional, scientific activities and administrative and support service sector, public administration sector, education sector, health sector, and art, entertainment and recreation sector. This implies, apart from the above named sectors,hotels and guest house sub-sector contribution to other sectors is zero.

Restaurants bars, ISIC, Rev.4(5610): Restaurants and bars services are mainly supplied to mining sector, food manufacturing sector, manufacturing sector except (wap, lea), energy sector, construction sector, trade sector, transport sector, communication sector, professional, scientific activities and administrative and support service sector, education sector, health sector, and art, entertainment and recreation sector. This shows, in addition to the above indicated sectors, restaurants bars sub-sector input to other sectors is zero.

Restaurants and hotels (informal), ISIC, Rev.4(5610): services provided by restaurants and hotels (informal) sectors are generally consumed by food manufacturing sector, manufacturing sector except (wap, lea), construction sector, trade sector, transport sector, real estate sector, professional, scientific activities and administrative and support service sector, education sector, and art, entertainment and recreation sector. This shows, aside from the above mentioned sectors, Restaurants and hotels (informal) sub-sector contribution to other sectors is zero.

11.6 cmn

Post, ISIC, Rev.4(51): Post services are mostly used by mining sector, food manufacturing sector, manufacturing sector, energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sector, professional, scientific activities and administrative and support service sector, public administration sector, education sector, health sector, and art, entertainment and recreation sector. This implies, beside the above named sectors, post sub-sector input to other sectors is zero.

Media, ISIC, Rev.4(581): media is generally used by manufacturing sector,trade sector, public administration sector, and art, entertainment and recreation sector. This shows that media sector has no contribution to other sectors

Telecommunication, ISIC, Rev.4(6190): The services provided by telecommunication services are mostly used by agriculture sector, mining sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sector, real estate sector, professional, scientific activities and administrative and support service sector, public administration sector, education sector, health sector, and art, entertainment and recreation sector.

11.7 ofi

Financial institutions (FISIM), ISIC, Rev.4(64): Financial institutions (FISIM) provide services to the agriculture sector, mining sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector,real estate sector, professional, scientific activities and administrative and support service sector, health sector, and art, entertainment and recreation sector.

Financial institutions (non-FISIM), ISIC, Rev.4(64): serviced provided by financial institutions (non-FISIM) are mainly consumed by agriculture sector, mining sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector,real estate sector, professional, scientific activities and administrative and support service sector, public administration, health sector, and art, entertainment and recreation sector.

DA Bank (central bank), ISIC, Rev.4(64): DA Bank (central bank) provide 100 % of its service to the government as final consumption.

Money exchange Shops, ISIC, Rev.4(64): The services of Money exchange Shops are used by trade sector, transport sector, and art, entertainment and recreation sector. This implies that the money exchange Shops are not providing services to other sectors.

Street exchange money, ISIC, Rev.4(64): Street exchange money provide services to the trade sector, transport sector, and art, entertainment and recreation sector. This indicates that, apart from the above sectors, street exchange money sub-sector are not providing services to other sectors.

Insurance, ISIC, Rev.4(64): Insurance sector services are employed by agriculture sector, mining sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector,real estate sector, professional, scientific activities and administrative and support service sector, public administration. This indicate that, apart from the above named sectors, insurance sub-sector supply to other sectors is zero.

11.8 rsa

Real estate market output, ISIC, Rev.4(68): Real estate market output are used by trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sector, professional, scientific activities and administrative and support service sector, education sector, health sector, and art and entertainment, and recreation sector. This implies, beside the above indicated sectors, real estate market output sub-sector input to other sectors is zero.

Ownership of Dwellings, ISIC, Rev.4(68): Ownership of Dwellings are used by as intermediate only by real estate sector. This implies that the Ownership of Dwellings contribution to other sectors is zero.

11.9 obs

Lawyers and accounting services, ISIC, Rev.4(69): Lawyers and accounting services are mostly utilized by agriculture sector, mining sector, food manufacturing sector, manufacturing sector, energy sector, construction sector, trade sector, transport sector, communication sector, finance and insurance sector, real estate sector, professional, scientific activities and administrative and support service sector, education sector, health sector, and art, entertainment, and recreation sector. This shows, apart from the above indicated sectors, lawyers and accounting sub-sector contribution to other sectors is zero.

NGOs, good governance consulting,ISIC, Rev.4(70): NGOs good governance consulting provide their services to the agriculture sector, energy sector, and professional, scientific activities and administrative and support service sector. This implies that above mentioned sub-sector has no contribution to other sectors.

Technical assistance,ISIC, Rev.4(70): Technical assistance provide their services only to public administration sector, and education sector, and have zero contribution as intermediate to other sectors.

Architects, and engineers , ISIC, Rev.4(7110): Services provided by Architects, and engineers are mainly consumed by energy sector, construction sector, contraction sector, communication sector, real estate sector, professional, scientific activities and administrative and support service sector, and public administration sector. This shows, apart from the above mentioned sectors, architects, and engineers sub-sector supply to other sectors is zero.

Advertising, market research, ISIC, Rev.4(7310): Advertising, market research services are used by food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sector, real estate sector, professional, scientific activities and administrative and support service sector, public administration sector, and art, entertainment, and recreation sector.

Other professional services, ISIC, Rev.4(7410): Other professional services are used by agriculture sector, food manufacturing sector, manufacturing sector, energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sector, real estate sector, professional, scientific activities and administrative and support service sector, public administration sector, education sector, health sector, and art, entertainment, and recreation sector.

Other business services , ISIC, Rev.4(7490): Other business services provide their services to mining sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sector, real estate sector, professional, scientific activities and administrative and support service sector, education sector, and health sector.

Photo services , ISIC, Rev.4(7420): Photo services are used by food manufacturing sector, manufacturing sector, trade sector, professional, scientific activities and administrative and support service sector, and art, entertainment and recreation sector. This shows, apart from the above mentioned sectors, photo sub-sector input to other sectors is zero.

Veterinary services, ISIC, Rev.4(4500): 100 % of Veterinary services are used by agriculture sector (ctl, oap, rmk, wol, fsh).

Rental and Leasing other than videos, ISIC, Rev.4(7729): Rental and Leasing other than videos services are used by manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, real estate sector, professional, scientific activities and administrative and support service sector, public administration sector, and art, entertainment and recreation sector. This indicates, in addition to the above named sectors, rental and leasing other than videos sub-sector input to other sectors is zero.

Other business services, ISIC, Rev.4(8030): Other business services are used by agriculture sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sector, real estate sector, professional, scientific activities and administrative and support service sector, public administration sector, education sector, health sector, and art, entertainment and recreation sector.

Security (private company) ISIC, Rev.4(8030): The services provided by Security (private companies) are used by agriculture sector, mining sector, food manufacturing sector, manufacturing sector, energy sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sector, real estate sector, professional, scientific activities and administrative and support service sector, public administration sector, education sector, health sector, and art, entertainment and recreation sector.

Security (private individual) ISIC, Rev.4(8030): Security (private individual) provide services to the agriculture sector, food manufacturing sector, manufacturing sector, construction sector, trade sector, transport sector, hotels and restaurants sector, communication sector, finance and insurance sector, real estate sector, professional, scientific activities and administrative and support service sector, education sector, health sector, and art, entertainment and recreation sector.

11.10 osg

Public administration and defence, ISIC, Rev.4(8030): Public administration and defence services are utilized by mining sector, food manufacturing sector, energy sector, construction sector, trade sector, transport sector, communication sector, finance and insurance sector, real estate sector, professional, scientific activities and administrative and support service sector, public administration sector, health sector, and art, entertainment and recreation sector.

11.11 edu

Education, ISIC, Rev.4(85): The services provided by education sector sub-sector are employed by education sector as intermediate, and consumed by households as final consumption.

11.12 hht

Health, ISIC, Rev.4(56): All the services provided by health sector are consumed by household and government sector as a final consumption. This implies that health sector has no contribution to other sectors as intermediated.

11.13 ros

Art, entertainment, and recreation, ISIC, Rev.4(90,94,95,96): The services provided by Cinema, bicycle repair, Personal and household services, beauty salon, and coiffure are consumed by households, and have no contribution to other sectors as intermediate sector. However, Cleaning, dry services are used by hotels and restaurants sector, and art, entertainment and recreation sector.