

M.1 Introduction

This document outlines the preparation of Morocco's 2019 input-output (I-O) table for integration into the Global Trade Analysis Project (GTAP) Data Base. The paper is structured as follows: Section 2 provides an overview of the source data; Section 3 examines the strengths and limitations of the published I-O data; Section 4 describes the procedures used to address anomalies in the raw data; and Section 5 details the mapping process between the original 76 Moroccan I-O sectors and the GTAP sectors.

M.2 Data Sources

The primary input is a 2019 Moroccan Social Accounting Matrix (SAM) received by the High Commission for Planning (HCP, Haut Commissariat au Plan). It is a 76 commodities product-by-industry matrix measured in millions of Dirham.

The SAM contains commodity (Biens et service) account, with detailed agricultural disaggregation. The factor payments in the operating account (exploitation) section are divided into payments to capital (Excédent Brut d'Exploitation), labor (R.salariés) and other taxes on production minus subsidies (Autr I -sub). Institutional accounts are divided into: non-financial corporations (Sociétés non financières), financial corporations (Sociétés financières), government (Administrations publiques), households (Ménages), and non-profit institutions (Institutions sans but lucratif au service des ménages), including primary income allocation (Affactation du revenu primaire), secondary redistribution (Distribution secondaire du revenu) through taxes and social transfers, and use of income (Utilisation du revenu) which reflects final consumption and savings, and a capital account. The SAM includes an aggregated financial account (Financier) that records financial flows corresponding to capital transactions. The rest of the world is divided by current account and capital. The SAM includes trade and transport margins that reconcile producer prices with purchaser prices.

The SAM satisfies the fundamental accounting identity requiring row sums to equal column sums for each account. However, the initial data still requires treatment to meet GTAP's format and the necessary requirements for internal consistency, a sectoral aggregation compatible with GTAP sectors, explicit disaggregation of domestic and imported commodity flows, and final consistency to satisfy the sectoral balance condition. The raw data includes:

1. The intermediate input matrix (Activities $\times$ Commodities or Production $\times$ Biens et service) records the use of commodities as intermediate inputs by production activities. The matrix features detailed disaggregation for agricultural products and food processing industries, while more aggregated classifications for mining, other manufacturing sectors, and services.

Each cell represents the quantity of a specific commodity consumed as an input by a given production activity.

2. The supply matrix displays domestic production with activity (production) in rows, and commodities (biens et service) in columns. Production activities are aggregated into 28 sectors spanning primary, secondary, and tertiary industries, with less details than the commodity classification. The non-diagonal structure allows for secondary production, in other words, industries can produce multiple commodities.
3. The value-added block contains three main components showing factor payments by industry: compensation of employees or labor (R.salariés) representing wages and salaries paid by each industry, gross operating surplus or capital (Excédent Brut d'Exploitation) capturing profits, rents, and other capital income by industry and other taxes on production minus subsidies (Autr I -sub) recording net production taxes paid by each industry.
4. The Absorption matrix shows final demand for commodities (biens et service) across different uses. It comprises final consumption expenditure by institutional sectors, including non-financial corporations, financial corporations, government, households, and non-profit institutions, plus gross fixed capital formation (FBCF) representing investment demand by commodity, and exports to the rest of the world (RDM). Each row represents a commodity, and each column represents a final demand category, with cell values indicating the amount of each commodity absorbed by each final use, complementing the intermediate consumption shown in the production matrix to complete total commodity demand in the economy.
5. The SAM includes explicit trade and transport margin accounts represented by the respective commodity rows.
6. The SAM includes explicit tax accounts showing other taxes on production minus subsidies (Autr I -sub) in the value-added block by activity, and direct taxes on income along with social contributions in the secondary income distribution accounting flowing from institutional sectors to government.

M.3 Strengths and Limitations of the Original Input- Output Data

Several checks were conducted on the data, including verification of the non-negativity condition and balancing conditions of the tables. The plausibility of tax rates, margin rates implied by the data, and the structure of industries' costs and sales were also examined. This section highlights the strengths and limitations of the data, while the next section describes the procedures used to address these limitations.

Strengths

1. From the data source section, the original data has detailed supply and use data for 76 commodities and 28 activities. They provide most of the data necessary for GTAP. Specifically:

(a) high disaggregated agricultural commodities; (b) there are separate trade and transport margins on commodities; (c) explicit tax accounts showing other production taxes minus subsidies; (d) the SAM separates institutional accounts by economic agents in allocation of primary income, secondary distribution of income, utilization of income, and capital.

2. The tables are balanced

Limitations

1. There is no separate domestic and import matrixes at basic values.
2. Two sectors exhibited re-exports, where the value of exports exceeded domestic production, which is not allowed in the GTAP database.
3. Forestry, textiles, wearing apparel, and leather sectors were not disaggregated in the original data.
4. Large taxes, over 100%, related to domestic inputs were present in the original data, in sectors such other manufactures, petroleum and coke, and electronics.
5. There are no separate values for capital and land rentals. They are grouped in only one vector of operating surplus.
6. There are large shares of labor in government and education.
7. There are no separate data for tariffs or export taxes.

M.4 Data Processing

In this section we discuss the adjustments procedures, the additional data sources, and the assumptions that we adopted to address the data issues described in the previous section.

1. Using the *Annuaire Statistique du Maroc* (2018), we obtained the coefficients needed to disaggregate the sector Manufacture of textiles, wearing apparel, leather, and leather products (Fabrication de textiles, d'articles d'habillement, de cuir et d'articles de cuir) into the disaggregated sectors of textiles, wearing apparel, and leather, as requested by GTAP.
2. To distinguish forestry from agriculture, we employed the coefficients derived from the previous Morocco SAM.
3. For commodities identified as having re-exports, we estimated the proportion of exports that represented re-exports and subtracted these values from both total exports and total imports to ensure the SAM remained balanced. Because there was no information on which sectors were responsible for re-exporting each commodity, the adjustment was applied evenly across all users. Additionally, since the original data did not distinguish between the use

of imported and domestically produced commodities, the re-exports were removed before separating imports from domestic goods.

4. To ensure that commodity taxes were distributed appropriately across domestic and imported goods, we calculated domestic and import shares for each product by dividing total domestic supply and total imports by total supply. These shares indicate the relative weight of each source in the market and were then used to split the total commodity tax proportionally between domestic and imported components.

M.5 Converting the Moroccan IO table into GTAP Format

Converting the IO Table From COM x IND to COM x COM

GTAP uses commodity-by-commodity input–output tables. Our original I-O table is commodity-by-industry, so we convert it to the commodity-by-commodity format using the associated transformation procedure described in Horridge et al. 2008.

Putting Margins into Respective Rows for Margin Commodities

There were two margin services, trade and transport, in the initial I-O data. We first constructed a margin matrix to allocate the usage of these margins across commodities. Since the GTAP Data Base does not distinguish between direct and margin usage of these services, the values in the margin matrix were aggregated by summing across all commodities for each margin service. The resulting totals were then recorded as single consolidated rows for each margin commodity in the GTAP input-output table, fulfilling the GTAP requirements.

Mapping Between Moroccan I-O Sectors and GTAP Sectors

The 75 sectors of the Morocco I-O table were aggregated to a set of 41 sectors that best correspond to elements of GTAP’s standard 65 commodities. The mappings from 75 to these 41 sectors and with the respective 65 original GTAP sectors are reported in Table 8.26.

Table 8.26: Concordance between Morocco I-O sectors, aggregate sectors and GTAP sectors in the Contributed table

Original Sector	Description	Sectors	Original GTAP sectors
A00001111	Durum wheat	wht	wht
A00001112	Soft wheat	wht	wht
A00001113	Maize	gro	gro
A00001114	Barley	gro	gro
A00001119	Straw, bales and other cereals	gro	gro
A00001120	Legumes	ocr	ocr

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Original Sector	Description	Sectors	Original GTAP sectors
A00001130	Oilseeds	osd	osd
A00001141	Sugar beets	c_b	c_b
A00001149	Other vegetables and melons, roots and tubers	v_f	v_f
A00001150	Sugar cane	c_b	c_b
A00001160	Raw tobacco	ocr	ocr
A00001170	Fodder plants	ocr	ocr
A00001190	Other non-permanent crops	ocr	ocr
A00001211	Grapes	v_f	v_f
A00001212	Dates	v_f	v_f
A00001213	Citrus fruits	v_f	v_f
A00001219	Other fruits	v_f	v_f
A00001220	Olives	v_f	v_f
A00001290	Other permanent crops	ocr	ocr
A00	Agriculture, forestry and fishing	oagrfrs	rmk; wol; frs
A05	Fishing and aquaculture	fsh	fsh
B00	Extractive industries	min	coa; oil; gas; oxt
C10001001	Butcher's meat	cmt	cmt
C10001002	Poultry meat	omt	omt
C10001003	Canned and prepared meat	cmt	cmt
C10002001	Freezing and deep-freezing of fish and fish products	ofd	ofd
C10002002	Preparations and preserves of fish and fish products	ofd	ofd
C10003001	Fruit and vegetable juices	ofd	ofd
C10003002	Preparation and preserves of fruits and vegetables	ofd	ofd
C10004001	Olive oils	vol	vol
C10004002	Crude vegetable oils	vol	vol
C10004003	Refined vegetable oils	vol	vol
C10004009	Others	ofd	ofd
C10005001	Liquid milk	mil	mil
C10005009	Other dairy products	mil	mil
C10006001	Wheat flour, groats and semolina	ofd	ofd
C10006002	Flours, groats and semolina of other cereals	ofd	ofd
C10006003	Rice, hulled	pcr	pcr
C10006009	Other cereal- and vegetable-based products	ofd	ofd
C10007001	Fresh bread, and bakery	ofd	ofd
C10007002	Pasta and couscous	ofd	ofd
C10007003	Rusks and biscuits	ofd	ofd
C10081001	Raw sugar	sgr	sgr
C10081002	Refined sugar	sgr	sgr
C10081003	Molasses; beet pulp, bagasse and other sugar-industry residues	sgr	sgr
C10082001	Coffee	b_t	b_t
C10082002	Tea	b_t	b_t
C10082003	Chocolate and confectionery products	ofd	ofd
C10082004	Animal feed	ofd	ofd
C10082009	Other food products	ofd	ofd
CA0	Manufacture of food products and beverages	omf	omf
CB0	Manufacture of textiles, clothing, leather and leather products	texwapplea	tex; wap; lea
CC0	Manufacture of wood and paper products; printing and reproduction of media	lumppp	lum; ppp

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Original Sector	Description	Sectors	Original GTAP sectors
CD0	Coke production and manufacture of refined petroleum products	p_c	p_c
CE0	Manufacture of chemical products	chm	chm
CF0	Manufacture of basic pharmaceutical products and pharmaceutical preparations	bph	bph
CG0	Manufacture of rubber and plastic products, and other non-metallic mineral products	rpp	rpp
CH0	Manufacture of basic metal products and fabricated metal products, except machinery and equipment	metalsprd	nmm; i.s; nfm; fmp
CI0	Manufacture of computers, electronic and optical products	ele	ele
CJ0	Manufacture of electrical equipment	eeq	eeq
CK0	Manufacture of machinery and equipment	ome	ome
CL0	Manufacture of transport equipment	otn	otn
CM0	Other manufacturing activities (including furniture), repair and installation	omf	omf
DE0	Distribution of electricity and gas, water distribution, sewerage and waste treatment	elygaswtr	ely; gas; wtr
F00	Construction	cns	cns
G00	Wholesale and retail trade; repair of motor vehicles and motorcycles	trd	trd
H00	Transport and storage	transwar	otp; wtp; atp; whs
I00	Accommodation and food services	afs	afs
J00	Information and communication	cmn	cmn
K00	Financial and insurance activities	ofiins	ofi; ins
L68	Real estate activities	rsa	rsa
MN0	Research and development and business services	obsros	obs; ros
O84	Public administration and compulsory social security	osg	osg
PQ8	Education, human health and social work activities	eduhht	edu; hht
RS0	Other services	oser	ros

M.6 Checking Sectoral Balance and Non-negativity Conditions

Once the Moroccan I-O tables were transformed to meet GTAP Data Base specifications, we ran the sectoral balance and non-negativity tests. The new database met both criteria.

References

Horridge, Mark et al. (2008). *Exercises in Contributing I-O Tables to the GTAP Data Base*. Department of Agricultural Economics, Purdue University, West Lafayette, IN: Global Trade Analysis Project (GTAP). URL: https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=2850.