

Oman

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1. Abstract

This paper describes the production of a 31-sector input-output table for Oman for 2005.

The I-O table was developed by combining disaggregated national accounts and trade data for Oman with a 44-sector I-O table for Kuwait. For major sectors, (e.g. oil and gas and refining) inputs were adjusted to reflect 2005 relative production and processing levels.

The completed I-O table is in thousand Omani riyals (OR), at producer prices.

2. Source data

The following key sources of data were used to produce the input-output table:

- Kuwait I-O table for 2005 with 44 sectors, developed for use in GTAP in 2011.
- Oman National Accounts 2005, Ministry of National Economy
- The National Accounts Statistics 2005, Kuwait Central Statistical Office
- Oman Nine-Sector Social Accounting Matrix 1999, Boughanmi, et al 2002, Department of Agricultural Economics and Rural Studies, Sultan Qaboos University
- UN trade data (Comtrade) for imports and exports.

In addition, various data on specific sectors was also used (e.g. refining capacity, crude oil production, etc.).

2.1 2005 I-O Table

The Kuwait 2005 44-sector I-O table was developed by the author for use in GTAP. The table was constructed from a detailed 54-sector I-O table for 2000, in combination with a 29-sector I-O table for 2005 and detailed national accounts.

The final table comprised a matrix of 44 input sectors (listed in Table 1) together with labour and capital inputs. Final demand was disaggregated by investment, private household consumption, government consumption, changes in stocks and exports.

Table 1

44 I/O Sectors	
No. Description	No. Description
1 Agriculture & livestock	23 Manufacture of other transport equipment N.E.C.
2 Fishing	24 Manufacture of furniture
3 Extraction of crude petroleum & natural gas	25 Manufacture, N.E.C.
4 Service activities incidental to oil & gas extraction excluding surveying	26 Recycling
5 Other mining & quarrying	27 Electricity & gas
6 Manufacture of food products & beverages	28 Water works & supply
7 Manufacture of textiles	29 Construction
8 Manufacture of wearing apparel, dressing & dyeing of fur	30 Wholesale & retail trade
9 Tanning & dressing of leather, manufacture of luggage, hand bags, saddlery & harness	31 Restaurants & hotels
10 Manufacture of wood & cork products, except furniture and articles of straw	32 Transport & storage
11 Manufacture of paper & paper products	33 Communication
12 Publishing, printing & reproduction of recording media	34 Financial institutions
13 Manufacture of coke, refined petroleum products & nuclear fuel	35 Insurance
14 Manufacture of chemical & chemical products	36 Real estate
15 Manufacture of rubber & plastic products	37 Business services
16 Manufacture of other non-metallic mineral products	38 Sanitary services
17 Manufacture of basic metals	39 Educational services
18 Manufacture of fabricated metal products, except machinery & equipment	40 Medical & health services
19 Manufacture of machinery & equipment	41 Social & community services
20 Manufacture of electric machinery & apparatus	42 Recreational & cultural services
21 Manufacture of medical, precision & optical instruments, watches & clocks	43 Personal & household services
22 Manufacture of motor vehicles, trailers & semitrailers	44 Public administration & defense

2.2 National Accounts Data 2005

National accounts data for 2005 was taken from the 2010 National Accounts Bulletin published by the Ministry of National Economy. Their national accounts data is disaggregated into the following fourteen sectors:

- Agriculture
- Fisheries
- Mining and quarrying (including oil and gas)
- Manufacturing
- Electricity and water supply
- Construction
- Wholesale and retail trade
- Hotels and restaurants

- Transport, storage and communications
- Real estate, renting and business activities
- Public administration and defence
- Education
- Health
- Other community, social and personal service activities

The national accounts data also includes sectoral totals for:

- Gross fixed capital formation
- Value added
- Total operating surplus
- Total compensation of employees.

2.3 Social accounting matrix

The social accounting matrix developed for 1999 by Boughanmi, et al, included estimates of value added for the nine sectors of the SAM. These sector were:

- Oil and gas
- Mining
- Agriculture
- Fisheries
- Manufacturing
- Electricity and water
- Construction
- Government services
- Private services.

While the national accounts data for 2005 provided more up-to-date data on value added by sector, the breakdown was different, and the estimates provided by Boughanmi provided a double-check on the separation of government and private services.

3. Process

The Oman I-O table was developed by combining the 44-sector I-O table for Kuwait with disaggregated national accounts and trade data for Oman. In addition, for major sectors such as oil and gas, petrochemicals, metals and fisheries, specific industrial production data was used to adjust sectoral inputs.

3.1 Applying GDP Sector Ratios

As a first step each of the 44 I-O sectors was matched against one of the fourteen GDP sectors (see Table 2). The inputs into each of the 44 sectors are then multiplied by the ratio of Omani to Kuwaiti GDP for the associated sector, taking account of the differences in the exchange rate.

The relative sectoral breakdown was also applied to gross fixed capital formation, value added and compensation to employees. In addition, the value added estimates for 1999 for government and private services was used to assist with the allocation of value added between social and community services, recreational and cultural services, and personal and household services.

Table 2

Concordance: Kuwait 44 I/O Sectors to Oman GDP Sectors	
Kuwait 44 I/O Sectors	Oman GDP Sectors
No. Description	
1 Agriculture and livestock	Agriculture
2 Fishing	Fisheries
3 Extraction of crude petroleum and natural gas	Mining and quarrying, including oil and gas
4 Service activities incidental to oil and gas extraction excluding surveying	
5 Other mining & quarrying	Manufacturing
6 Manufacture of food products and beverages	
7 Manufacture of textiles	
8 Manufacture of wearing apparel, dressing and dyeing of fur	
9 Tanning and dressing of leather, manufacture of luggage, hand bags, saddlery and harness	
10 Manufacture of wood & of products of wood crok, except furniture manufacture of article of straw	
11 Manufacture of paper and paper products	
12 Publishing, printing and reproduction of recording media	
13 Manufacture of coke, refined petroleum products and nuclear fuel	
14 Manufacture of chemical and chemical products	
15 Manufacture of rubber and plastic products	
16 Manufacture of other non-metallic mineral products	
17 Manufacture of basic metals	
18 Manufacture of fabricated metal products, except machinery & equipment	
22 Manufacture of motor vehicles, trailers and semitrailers	
23 Manufacture of other transport equipment, n.e.c.	
20 Manufacture of electric machinery and apparatus	
19 Manufacture of machinery and equipment	
21 Manufacture of medical, precision / optical instruments, watches & clocks	
24 Manufacture of furniture	
25 Manufacture, n.e.c.	
26 Recycling	
27 Electricity and gas	Electricity and water supply
28 Water works and supply	Electricity and water supply
29 Construction	Construction
30 Wholesale and retail trade	Wholesale and retail trade
31 Restaurants and hotels	Hotels and restaurants
32 Transport and storage	Transport, storage and communications
33 Communication	
34 Financial institutions	Real estate, renting and business activities
35 Insurance	
37 Business services	
36 Real estate	
39 Educational services	Education
40 Medical and health services	Health
41 Social and community services	Other community, social and personal service activities
42 Recreational & cultural services	
43 Personal and household services	
38 Sanitary services	Public administration and defence
44 Public administration and defence	

3.2 *Applying Trade Data*

Detailed Omani trade data for 2005 was taken from Comtrade. The trade data was reported in HS-2002 nomenclature and mapping between HS-2002 and the 44 sectors in the I-O table followed the “HS2002-CPC 1.1-ISC, Rev3-GTAP Concordance” by Thomas Hutcheson¹.

The trade data was then mapped into the 44 I-O sectors using the concordance detailed in Table 3. While most of the GTAP sectors mapped discreetly into the 44 I-O sectors, the following splits had to be made:

- GTAP sectors 15 “coal,” 16 “oil” and 17 “gas” were matched against sectors 3 “extraction of crude petroleum and natural gas” and 4 “service activities incidental to oil and gas extraction excluding surveying.” The split between the two sectors was according to relative shares of total intermediate inputs (from the Kuwait I-O table).
- GTAP sector 31 “paper products, publishing” was split between sector 11 “manufacture of paper and paper products” and sector 12 “publishing, printing and reproduction of recording media” according to relative shares of total intermediate inputs.
- GTAP sector 42 “manufactures, nec” was split between sectors 21 “manufacture of medical, precision and optical instruments, watches and clocks,” 24 “manufacture of furniture,” 25 “manufacture, nec” and 26 “recycling” according to relative shares of total intermediate inputs.
- GTAP sector 47 “trade” was split between sectors 30 “wholesale and retail trade” and 31 “restaurants and hotels” according to relative shares of total intermediate inputs.
- GTAP sector 55 “recreational and other services” was split between sectors 42 “recreational and cultural services” and 43 “personal and household services” according to relative shares of total intermediate inputs.
- GTAP sector 56 “public administration, defence, education, health” was split between sectors 38 “sanitary services,” 39 “educational services,” 40 “medical and health services,” 41 “social and community services” and 44 “public administration and defence” according to relative shares of total intermediate inputs.

3.3 *Zero settings*

The other components of final demand, notably import taxes, import tariffs and consumption taxes were left blank, as little data was available for 2005 for either Kuwait or Oman. In general taxes in Oman are very low by international standards: there is no income tax, no inheritance tax, no sales tax or VAT, corporation tax has a ceiling of 12% for local companies and import tariffs average 4%. Total tax revenues as a percentage of GDP is around 3%, which is one of the lowest levels in the world.

Other factors inputs (e.g. land) and changes in stock were also set to zero.

¹ <https://www.gtap.agecon.purdue.edu/resources>

Table 3

Concordance: 57 GTAP Sectors to 44 I/O Sectors			
57 GTAP Sectors		44 I/O Sectors	
No. Code	Description	No.	Description
1 PDR	Paddy rice	1	Agriculture and livestock
2 WHT	Wheat		
3 GRO	Cereal grains nec		
4 V F	Vegetables, fruit, nuts		
5 OSD	Oil seeds		
6 C B	Sugar cane, sugar beet		
7 PFB	Plant-based fibers		
8 OCR	Crops nec		
9 CTL	Bovine cattle, sheep and goats, horses		
10 OAP	Animal products nec		
11 RMK	Raw milk		
12 WOL	Wool, silk-worm cocoons		
13 FRS	Forestry		
14 FSH	Fishing	2	Fishing
15 COA	Coal	3	Extraction of crude petroleum and natural gas
16 OIL	Oil		
17 GAS	Gas	4	Service activities incidental to oil and gas extraction excluding surveying
18 OMN	Minerals nec	5	Other mining & quarrying
19 CMT	Bovine meat products	6	Manufacture of food products and beverages
20 OMT	Meat products nec		
21 VOL	Vegetable oils and fats		
22 MIL	Dairy products		
23 PCR	Processed rice		
24 SGR	Sugar		
25 OFD	Food products nec		
26 B T	Beverages and tobacco products		
27 TEX	Textiles	7	Manufacture of textiles
28 WAP	Wearing apparel	8	Manufacture of wearing apparel, dressing and dyeing of fur
29 LEA	Leather products	9	Tanning and dressing of leather, manufacture of luggage, hand bags, saddlery and harness
30 LUM	Wood products	10	Manufacture of wood & of products of wood crok, except furniture manufacture of article of straw
31 PPP	Paper products, publishing	11	Manufacture of paper and paper products
32 P_C	Petroleum, coal products	12	Publishing, printing and reproduction of recording media
		13	Manufacture of coke, refined petroleum products and nuclear fuel
33 CRP	Chemical, rubber, plastic products	14	Manufacture of chemical and chemical products
34 NMM	Mineral products nec	15	Manufacture of rubber and plastic products
		16	Manufacture of other non-metallic mineral products
35 I S	Ferrous metals	17	Manufacture of basic metals
36 NFM	Metals nec	18	Manufacture of fabricated metal products, except machinery and equipment
37 FMP	Metal products		

Continued....			
57 GTAP Sectors		44 I/O Sectors	
No.	Description	No.	Description
38 MVH	Motor vehicles and parts	22	Manufacture of motor vehicles, trailers and semitrailers
39 OTN	Transport equipment nec	23	Manufacture of other transport equipment, n.e.c.
40 ELE	Electronic equipment	20	Manufacture of electric machinery and apparatus
41 OME	Machinery and equipment nec	19	Manufacture of machinery and equipment
42 OMF	Manufactures nec	21	Manufacture of medical, precision and optical instruments, watches and clocks
		24	Manufacture of furniture
		25	Manufacture, n.e.c.
		26	Recycling
43 ELY	Electricity	27	Electricity and gas
44 GDT	Gas manufacture, distribution		
45 WTR	Water	28	Water works and supply
46 CNS	Construction	29	Construction
47 TRD	Trade	30	Wholesale and retail trade
		31	Restaurants and hotels
48 OTP	Transport nec	32	Transport and storage
49 WTP	Water transport		
50 ATP	Air transport		
51 CMN	Communication	33	Communication
52 OFI	Financial services nec	34	Financial institutions
53 ISR	Insurance	35	Insurance
54 OBS	Business services nec	37	Business services
57 DWE	Dwellings	36	Real estate
55 ROS	Recreational and other services	42	Recreational & cultural services
		43	Personal and household services
56 OSG	Public Administration, Defense, Education, Health	44	Public administration and defence
		38	Sanitary services
		39	Educational services
		40	Medical and health services
		41	Social and community services

3.4 *Balancing the table*

Each of the input sectors was then balanced in turn (by row), from sector 1 through 44. Though as the sectors are connected, some sectors had to be adjusted several times.

The adjustments focussed on ensuring that the following balancing criteria were met:

- Imports do not exceed domestic demand
- Exports do not exceed domestic production
- Sum of rows = sum of columns

To meet the criteria and balance the table, adjustments were made to:

- The multiplier for inputs into the sector
- The multiplier the components of final demand
- The level of labour and capital inputs.

The adjustments made took into account a number of factors including differences in the resource base and industrialisation in the Kuwait and Oman. Also, where relevant, levels of final consumption (per capita) were checked to see if they remained in line with relative per capita GDP.

The final detailed balancing of the table rows and columns was achieved through micro adjustments to the multiples used for the components of final demand.

The key adjustments made in balancing the I-O table were in the following sectors:

- Fishing and agriculture: the overall inputs/outputs were adjusted downward to ensure that per capita consumption levels in Oman did not significantly exceed those in Kuwait.
- Food and beverages: Oman has a more developed food-processing sector, and inputs into the sector were increased by 30% above equivalent levels for Kuwait.
- Wood and wood products: the Omani woodworking sector is substantially more developed than Kuwait, not least as it is one of the few countries in the Gulf with domestic timber resources. As a result inputs into the sector were raised to around twice the equivalent Kuwaiti levels.
- Refining: with a much smaller oil and gas reserve base, the Omani refining sector is significantly smaller than Kuwait's. Inputs and outputs for the sector were reduced in line with relative refining capacities.
- Electrical machinery: in comparison to Kuwait, Oman has a well-developed electrical machinery sector, and inputs-outputs were increased.
- Transport equipment: Oman's ship repair, boat construction and truck superstructure assembly sectors are more developed than Kuwait's, and input-outputs in this sector were increased.
- Public services: Oman and Kuwait have similar sized populations. However, in 2005 Kuwaiti GDP was more than twice Oman's. As a result input-outputs into public services that are linked to population (e.g. education, health) were all increased.

3.5 Mapping to GTAP

As a final step, the 44 I-O sectors were then mapped to a final set of 32 GTAP sectors, as detailed in Table 4.

With reference to the GTAP sectors, it should be noted that the following sectors are either non-existent in Oman or where they do exist they are insignificant economically:

5	OSD	Oil seeds
6	CB	Sugar cane
7	PFB	Plant-based fibres
12	WOL	Wool, silkworm cocoons
13	FRS	Forestry
15	COA	Coal

Table 4

Concordance: Kuwait 44 I/O Sectors to Oman 31 I/O Sectors		
Kuwait 44 I/O Sectors		Oman 31 I/O Sectors
No.	Description	No. Code Description
1	Agriculture & livestock	1 A L Agriculture & livestock
2	Fishing	2 FSH Fishing
3	Extraction of crude petroleum & natural gas	3 O_G Extraction of crude petroleum & natural gas
4	Service activities incidental to oil & gas extraction excluding surveying	
5	Other mining & quarrying	4 OMN Other mining & quarrying
6	Manufacture of food products & beverages	5 F B Manufacture of food products & beverages
7	Manufacture of textiles	6 TEX Manufacture of textiles
8	Manufacture of wearing apparel, dressing & dyeing of fur	7 WAP Manufacture of wearing apparel, dressing & dyeing of fur
9	Tanning & dressing of leather, manufacture of luggage, h& bags, saddlery & harness	8 LEA Tanning & dressing of leather, manufacture of luggage, h& bags, saddlery & harness
10	Manufacture of wood, wood & cork products, except furniture manufacture of article of straw	9 LUM Manufacture of wood, wood & cork products, except furniture manufacture of article of straw
11	Manufacture of paper & paper products	10 PPP Manufacture of paper & paper products, publishing
12	Publishing, printing & reproduction of recording media	
13	Manufacture of coke, refined petroleum products & nuclear fuel	11 P_C Manufacture of coke, refined petroleum products & nuclear fuel
14	Manufacture of chemical & chemical products	12 CRP Manufacture of chemicals, rubber & plastic products
15	Manufacture of rubber & plastic products	
16	Manufacture of other non-metallic mineral products	13 NMM Manufacture of other non-metallic mineral products
17	Manufacture of basic metals	14 I S Manufacture of basic metals
18	Manufacture of fabricated metal products, except machinery & equipment	15 NFM Manufacture of fabricated metal products, except machinery & equip.
22	Manufacture of motor vehicles, trailers & semitrailers	19 MVH Manufacture of motor vehicles, trailers & semitrailers
23	Manufacture of other transport equipment, n.e.c.	20 OTN Manufacture of other transport equipment, n.e.c.
20	Manufacture of electric machinery & apparatus	17 ELE Manufacture of electric machinery & apparatus
19	Manufacture of machinery & equipment	16 OME Manufacture of machinery & equipment
21	Manufacture of medical, precision & optical instruments, watches & clocks	18 OMF Manufactures nec
24	Manufacture of furniture	
25	Manufacture, n.e.c.	
26	Recycling	
27	Electricity & gas	21 E G Electricity & gas
28	Water works & supply	22 WTR Water works & supply
29	Construction	23 CNS Construction
30	Wholesale & retail trade	24 TRD Wholesale & retail trade, restaurants & hotels
31	Restaurants & hotels	
32	Transport & storage	25 T S Transport & storage
33	Communication	26 CMN Communication
34	Financial institutions	27 OFI Financial institutions
35	Insurance	28 ISR Insurance
37	Business services	29 OBS Real estate & other business services
36	Real estate	
42	Recreational & cultural services	31 ROS Recreational & cultural services
43	Personal & household services	
44	Public administration & defence	30 OSG Public administration, defence, education, health
38	Sanitary services	
39	Educational services	
40	Medical & health services	
41	Social & community services	