

R Costa Rica

***Marlon Molina, Diego Agüero, Henry Vargas, Gabriela Saborío
and Arlina Gómez***

R.1 Introduction

This document describes the contribution of the 2017 Input-Output (I-O) table from Costa Rica to the Global Trade Analysis Project (GTAP), version 11. Section 2 describes the source of data; Section 3 discusses the strengths and limitations of the I-O data. Then, section 4 shows the difficulties or anomalies in the raw data, and finally, section 5 shows the mapping between the 184 Costa Rican products to the GTAP sectors.

R.2 Data Sources

The primary raw input was a 184-products input-output matrix. It was provided by the Macroeconomic Statistic Department of the Central Bank of Costa Rica, measured in millions of Costa Rican colones. The data are elaborated from the supply and use tables at purchasers' prices for 184-products.

- The Supply table shows the total output of 184 commodities, imports, transport margins, trade margins, and taxes on domestic and imported goods, by commodity.
- Accounts are categorized based on the origin of capital. With Costa Rica's growing integration into international markets, especially in the service sector, and increased access to foreign direct investment (FDI), it is essential to have harmonized statistics for national accounts and balance of payments.
- The Use table shows the demand for industries, private households, government, investment, changes in inventories and exports.

The Supply and Use Tables' main sources are: Domestic Production: domestic production was estimated using sales data from the Central Bank's Registry of Economic Variables for Businesses and Establishments (over 26.500 observations). International Production: it was used imports data from the Costa Rican General Customs Directorate to build an import matrix (CIF values), that contains intermediate demand, final demand and fixed capital formation. Ministry of Finance's Annual Declaration of Clients, Suppliers and Specific Expenses was used in conjunction with administrative data to determine the destination of sales –especially for wholesalers –to distribute imports into the industries that use them. Taxes and subsidies:

- Value added tax was calculated for final consumption by households, intermediate consumption, and fixed capital formation:

- Final consumption by households: The applicable tax rate for each product category was estimated using data from the Central Bank’s National Survey of Income and Expenditures.
 - Intermediate consumption: The Value Added Tax was used to determine the activities for which different companies can deduce the sales tax from. The government and all companies in Free Zones are exempt from paying taxes.
 - Fixed capital formation: Since almost all products in this category are imported, the 13% tax rate was applied after adjusting customs taxes.
- Import and export taxes: The applicable tax rate was estimated based on data from the Costa Rican General Customs Directorate.
- Selective consumption tax and other taxes on products: The applicable tax rate was estimated using information provided by the Ministry of Finance.

Distribution margins: it was used administrative data from the Ministry of Finance. Domestic use: the structure of domestic use was estimated using the following data sources:

- Agriculture: 100 case studies based on several site visits and interviews with the main producers of 38 products.
- Services and manufacturing: a sample of over 1100 companies was constructed pooling data from three data sources:
 - Central Bank’s Economic Study of Firms (includes companies with more than five employees and above the 15 th percentile in revenue).
 - Trade Promotion Agency’s financial and administrative data from companies in special economic regimes (Free Zone’s law requires companies to give information to this Trade Promotion Agency).
 - Interviews with specific firms for clarification purposes.
- Wholesale and retail trade: its production was assumed equivalent to trade margins.
- Construction: data of public construction projects was obtained from the Ministry of Transportation and from local governments. Data on private construction projects was obtained through the Federated Association of Engineers and Architects. This institution, by law, is required to collect this information.
- Government and state-owned enterprises: administrative data reported by all these institutions.
- Financial intermediary sector and insurance services: data from audited-financial statements was obtained from the financial regulatory bodies (census of 177 financial institutions).

International use export data: it was obtained from the General Customs Directorate and the Balance of Payments. Final consumption of households: this data was estimated based on the National Household Survey (ENIGH) of the National Institute for Statistics and Census, for 2018, and was complemented with sales records from the Ministry of Finance. This survey contains information about 3,300 products. Final consumption of NGOs: this data was estimated based on information reported by non-profit associations collected through the Central Bank's Economic Enterprises Survey. Final consumption of the government: a dataset was constructed from basic data provided by government institutions. Fixed capital formation: since most goods in this category are imported, data was constructed based on foreign trade records from the General Customs Directorate. This data was used to determine which products are capital assets and the final economic activities in which they are used. Additional data from the Federated Association of Engineers and Architects was also used (construction). Changes in inventories: tax declarations to the Ministry of Finance were used.

R.3 Strengths and limitations of the data

In order to obtain the optimal conditions of the I-O Table, we conducted several tests and procedures, including the consolidation of the national accounts in the Supply and Use Table, in addition to the non-negativity conditions and the balancing conditions of the table.

Strengths

- The data follow the structure of the supply and use with the totality products of the national economy (184 products).
- It was not used any aleatory process to close balances. Each product was balanced in an individual way.
- The original structure of activities follows The Standard Industrial Classification (SIC), revision 4, and the goods and services follow the Central Classification of Products (rev. 2), this provides a solid framework to create a correlation map with GTAP sectors.
- The valuation of the matrix is in basic prices.
- Each economic activity was analyzed in order to obtain a series of reliable production accounts.
- New standards were adopted from the SNA 2008 recommendations:
 - Exports of manufacturing services: only imports and exports including change in ownership were registered.
 - Central Bank production: a distinction is drawn between nonmarket services (cost-based estimation), and market services (revenue-based estimation).

- Production of non-life insurance: compensations and premiums were smoothed over time in order to remove the appearance of volatility.
- Indirectly measured financial intermediation services: all deposits and loans offered by or deposited in financial institutions are included and calculated using a shared risk-free interest rate.

Limitations

The Central Bank of Costa Rica has released its third input-output (I-O) table, which provides valuable insight into the interdependence between different sectors of the country's economy. The accuracy and reliability of the table can be attributed to the knowledge and experience of the team involved in its creation, as well as the careful attention given to data collection, analysis, accountability, and methodology. It's worth noting that the Ministry of Foreign Trade of Costa Rica played a key role in the process by helping to submit the table to GTAP. However, the process did reveal some limitations, which the team worked to address. Specifically:

- Two values with inconsistent signs were identified and deleted.
- The production of cattle meat and other meat was split as a proportion of their production level, sharing the same structure as the main aggregate sector meat in the Supply and Use table.
- There were some re-exports for the Manufacture of machinery and equipment, which were carefully not accounted for in the final table.

Other limitations are included in the assumptions of section 5 of this document.

R.4 Data processing

This section shows the necessary steps to get the final Input-Output Table with the scheme of sector of GTAP.

- Check the balance of the original 184-products Input and Output table. The final demand of every sector is equal to the supply of the sector, which is the same value of gross production.
- Check if any negative values exist in any transaction of the table. There were some small values, however there were no negative flows in any submatrix of the table.
- The small values, that stay near to zero, were changed to zero to keep a clean balance.
- With the intention of homogenize the prices of imports and exports, the price was adjusted on the imports side. In order to correspond the price to the FOB form, insurance and freight were subtracted from total imports.

- To identify the application of the Value Added Tax (VAT), it was necessary to divide payment into three elements: final household consumption, intermediate consumption, and Gross Capital Formation (GCF). For the first case, the payment of the tax was in the final step, that means that is necessary identified the applied rate by law (13%), apply to the expenditure of household and get respectively payment. The data was obtained from the National Survey of Household Income and Expenditure of households (ENIGH).

In the case of intermediate consumption, tax credits only apply for some activities. For those activities that cannot deduct the tax, they must absorb the payment. Once the intermediate consumption by economic activity is obtained, the proportion of the economic activity that cannot be deducted is determined, as well as the proportion of the product that is taxed²³, and the VAT payment is calculated as follows:

$$T_i = c_i p_i (1 - p_a) \tau_i$$

Where:

T_i : VAT payment of product i.

c_i : Intermediate consumption of product i.

p_i : Percent of by-products within the product i that pay VAT.

$(1 - p_a)$: Percent of activity a that can't deduce the fiscal credit.

τ_i : VAT rate of the product i.

Three cases were found: a) activities that can deduct the payment of tax completely; b) activities that partially deduct the payment of taxes; and c) activities that can't fully deduct the payment of VAT completely.

For the treatment of goods -identified in the ENIGH-, it is determined which percentage of composed good i is taxed. In the case of services, the ratio between taxed sales and non-taxed sales was calculated. In the case of gross capital formation, most of goods are imported (CIF value), for that reason it was necessary to apply a ratio between of VAT of GCF imports and the CIF value of GCF imports.

- It is important to mention that it was not necessary to create new sectors for the GTAP aggregation, the only ones that needed a special treatment were Dwellings and Water Transportation. The original breakdown of Costa Rica's I-O Table did not include division between water and air transport; therefore, both are included in sector 49.
- Treatment on Gas, Oil and Petroleum:
 - Supply side: 100% is imported, it was calculated using information from the Costa Rican General Customs Directorate.
 - Uses sides: final consumption was estimated using data from the Central Bank's National Survey of Income and Expenditures, intermediate consumption was obtained through the financial reports of the enterprises and change of inventories was obtained using data directly from the state-owned enterprise who has the monopoly on the import and distribution of oil, gas and petroleum (RECOPE).

²³According with the General Sales Tax Law (VAT equivalent).

- Treatment of Dwellings: according to the SNA, household consumption expenditure should include both the actual expenditure by households on rents for dwellings and an estimate of how much the owner-occupiers would have paid in rent if they had to pay rents for their dwellings instead of owning them. This estimation is referred to as an “imputation” and the SNA suggests that the best way of making this imputation is to use rents actually paid for similar dwellings. This was made and it appears in the global final consumption (code 57). From the supply side, it was possible to obtain a production account for own final use of “Real estate activities”.

Table 8.32: Macroeconomic Aggregates from Costa Rica I-O Table

GDP components on the expenditure side			GDP components on the income side		
Component	Level CR millions	Share	Component	Level CR millions	Share
Consumption	22 365 798,5	65,1%	Compensation of employees	15 221 845,8	44,3%
Investment	6 248 911,9	18,2%	Gross operating surplus	12 572 894,7	36,6%
Government	5 617 993,8	16,4%	Mixed income	2 958 330,6	8,6%
Stocks	-44 775,2	-0,1%	Land	not available	
Net Exports	155 718,4	0,5%	Indirect Tax	3 590 576,4	10,5%
GDP	34 343 647,5	100,0%		34 343 647,5	100,0%

R.5 Conversion of the Costa Rica I-O Table to GTAP form

The original input-output (I-O) table was created in two formats: industry by industry and product by product, which made it unnecessary to transform the table into any other format. However, as part of the 2017-rebase year project, Costa Rica’s Central Bank produced a series of I-O matrices for institutions and research programs such as the OECD and GTAP. In this context, translating Costa Rica’s original I-O table into the parameters required by each institution is part of upgrade process.

However, it’s important to note that any aggregation of data results in the loss of relevant information. For instance, GTAP 65’s products do not distinguish between bananas and pineapples or have a specific sector for medical devices, all of which are relatively important to the Costa Rican economy. As a result, users of the I-O table should be aware of these limitations when analyzing the data.

Procedures to get the GTAP format:

Prices: Currency: the domestic IOT is in Costa Rican colones. In the case of the IO-Table, the Costa Rica Central Bank provided the annual average exchange rate used in the national accounts. Current vs. constant prices: both the domestic I-O Table and the GTAP are at current prices.

Basic vs. producer prices: both the domestic I-O Table and the GTAP are at basic prices. Sector categorization: The survey data used to construct the I-O Table highlights a significant trend in Costa Rica's economic landscape. In 2017, most firms primarily focused on core activities, with around 93% of production attributed to these activities. To capture this distinction, the I-O Table was created in two formats: industry by industry and product by product for the base year. Year: The year of the IOT is 2017.

Assumptions:

While the input-output scheme uses a symmetrical product-by-product matrix, the SUT uses a structure of the economic activities in columns, and products in rows. For Costa Rica (2017), there is an asymmetric matrix of 184 products and 144 economic activities. While production information is available by product, intermediate consumption data is not. Therefore, intermediate consumption had to be distributed among the products of economic activities consisting of more than one product. This distribution uses the hypothesis that all products within the same economic activity have the same technology (sectoral homogeneity) and that the distribution of inputs is only a function of the level of production in that sector (strict proportionality), so the quantity of inputs varies in the same proportion as production. The inputs of the economic activities that have more than one product are distributed according to the percentage of production of each product of the respective economic activity. Once this distribution is carried out, a symmetrical SUT is obtained, product by product. With this SUT, the necessary product aggregations are made to be able to do the 65x65 size matrix, this matrix did not lose any data.

Mapping Between Costa Rican I-O Sectors and GTAP Sectors (Table 8.33):

Table 8.33: Concordance between Original sectors and GTAP sectors

65 GTAP Sectors	184 Costa Rican I-O sectors
4. v_f	NP001. Bean
3. gro	NP002. Corn
2. wht	NP003. Wheat
3. gro	NP004. Other cereals
5. osd	NP005. Legumes and other oilseeds
1. pdr	NP006. Rice
4. v_f	NP007. Melon
4. v_f	NP008. Onion
4. v_f	NP009. Chayote
4. v_f	NP010. Potato
4. v_f	NP011. Roots and tubers
4. v_f	NP012. Vegetables
6. c_b	NP013. Sugar Cane
8. ocr	NP014. Flowers
8. ocr	NP015. Foliage
4. v_f	NP016. Banana
4. v_f	NP017. Platain
4. v_f	NP018. Pineapple
5. osd	NP019. Palm oil

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65 GTAP Sectors	184 Costa Rican I-O sectors
4. v_f	NP020. Coffee fruit
4. v_f	NP021. Watermelon
4. v_f	NP022. Mango
4. v_f	NP023. Orange
4. v_f	NP024. Other fruits, nuts and other oilseeds
4. v_f	NP025. Heart of palm
8. ocr	NP026. Other non-perennial and perennial plant products n.e.c
8. ocr	NP027. Live plants and roots
9. ctl	NP028. Cattle
10. oap	NP029. Pigs
10. oap	NP030. Live chickens
10. oap	NP031. Other live animals
10. oap	NP032. Eggs
11. rmk	NP033. Raw milk
10. oap	NP034. Other animal products n.e.c
60. obs	NP035. Support services for agriculture, livestock and post-harvest activities
13. frs	NP036. Products from forestry, wood extraction and hunting
14. fsh	NP037. Fishery products
14. fsh	NP038. Aquaculture products
18. oxt	NP039. Stone, sand and clay
18. oxt	NP040. Salt
16. oil	NP041. Petroleum and natural gas
18. oxt	NP042. Other metallic and non-metallic minerals and support services
20. omt	NP043. Edible offal and meat of birds
19. cmt	NP044. Edible offal and meat of cattle
20. omt	NP045. Edible offal and meat of pigs
20. omt	NP046. Sausages and other meat products
25. ofd	NP047. Preserved fish, crustaceans and mollusks
25. ofd	NP048. Preserved fruits, legumes and vegetables
21. vol	NP049. Vegetable and animal oils and fats
22. mil	NP050. Dairy products
23. per	NP051. Hulled, processed and semi-processed rice
25. ofd	NP052. Wheat flour
25. ofd	NP053. Other milling products n.e.c., starches and their derivatives
25. ofd	NP054. Bakery and tortilla products made from wheat and corn
24. sgr	NP055. Cane sugar, molasses, syrups and other sugars
25. ofd	NP056. Cocoa, chocolates and confectionery products
25. ofd	NP057. Macaroni, noodles and similar farinaceous products
25. ofd	NP058. Green coffee beans
25. ofd	NP059. Ground, soluble, extract and concentrate coffee
25. ofd	NP060. Prepared meals and dishes
25. ofd	NP061. Other food products n.e.c.
25. ofd	NP062. Prepared animal feed
26. b_t	NP063. Distilled alcoholic beverages and wines
26. b_t	NP064. Beer, malt, non-alcoholic beverages and bottled water
26. b_t	NP065. Tobacco products
27. tex	NP066. Spinning and weaving
27. tex	NP067. Textile products, except clothing
28. wap	NP068. Clothing
29. lea	NP069. Leather and related products, except footwear
29. lea	NP070. Footwear

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65 GTAP Sectors	184 Costa Rican I-O sectors
30. lum	NP071. Wood and cork, wood and cork products, except furniture
31. ppp	NP072. Paper and paper products
31. ppp	NP073. Edition, printing and recording products except for computer programs
32. p_c	NP074. Gasoline
32. p_c	NP075. Diesel
32. p_c	NP076. Bunker
32. p_c	NP077. Lubricating oils and greases
32. p_c	NP078. Other petroleum and coke derivatives
33. chm	NP079. Basic chemicals and fertilizers, nitrogen compounds, pesticides and other chemicals for agricultural use
33. chm	NP080. Primary forms of plastics and synthetic rubber
33. chm	NP081. Paints, varnishes, coatings, printing inks and putties
33. chm	NP082. Soaps, detergents, perfumes and toiletries
33. chm	NP083. Artificial fibers and chemicals n.e.c
34. bph	NP084. Pharmaceutical and medicinal products
35. rpp	NP085. Rubber products
35. rpp	NP086. Plastic products
36. nmm	NP087. Glass and glass products
36. nmm	NP088. Refractory products, clay building materials and other porcelain and ceramic products
36. nmm	NP089. Cement, lime and gypsum
36. nmm	NP090. Concrete, cement and plaster articles and other non-metallic mineral products n.e.c.
37. i_s	NP091. Basic products of iron and steel
38. nfm	NP092. Primary products of aluminum, zinc, gold, silver and other semi-finished products by a casting process
39. fmp	NP093. Metal products
40. ele	NP094. Electronic components and boards, computers and peripherals
40. ele	NP095. Communications equipment and consumer electronic devices
40. ele	NP096. Measurement, testing, navigation and control equipment and watches
40. ele	NP097. Radiation, electronic, medical and therapeutic equipment Optical, photographic instruments, magnetic and optical media
40. ele	NP098. Optical, photographic instruments, magnetic and optical media
41. eeq	NP099. Batteries, accumulators, cables and wiring devices
41. eeq	NP100. Refrigerators, stoves, washing machines and other household appliances
42. ome	NP101. General and special purpose machinery, parts and pieces
41. eeq	NP102. Motors, generators, transformers and other electrical equipment
43. mvh	NP103. Motor vehicles, bodies, trailers and semi-trailers
43. mvh	NP104. Parts and pieces for motor vehicles
44. otn	NP105. Other types of transport equipment
45. omf	NP106. Wooden furniture
45. omf	NP107. Furniture of other materials
45. omf	NP108. Medical and dental instruments and supplies
45. omf	NP109. Other manufacturing products
45. omf	NP110. Waste and refuse
45. omf	NP111. Machinery and equipment repair and installation services
45. omf	NP112. Manufacturing services
46. ely	NP113. Electricity, gas, steam and air conditioning supply
48. wtr	NP114. Drinking water
48. wtr	NP115. Wastewater collection and treatment services
48. wtr	NP116. Waste collection, treatment and disposal services; material recovery
62. osg	NP117. Environmental protection services
49. cns	NP118. Residential buildings

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65 GTAP Sectors	184 Costa Rican I-O sectors
49. cns	NP119. Non-residential buildings
49. cns	NP120. Roads and railways
49. cns	NP121. Construction of public service projects and other civil engineering works
49. cns	NP122. Specialized construction services
50. trd	NP123. Trade services
50. trd	NP124. Maintenance and repair of motor vehicles
52. otp	NP125. Rail transport
52. otp	NP126. Land passenger transport services except taxis
52. otp	NP127. Taxi services
52. otp	NP128. Freight transport
53. wtp	NP129. Passenger transport by sea
54. atp	NP130. Passenger transport by air
55. whs	NP131. Storage and warehousing services
55. whs	NP132. Parking services
55. whs	NP133. Loading, unloading and other transport-related services
55. whs	NP134. Other transport support services
56. cmn	NP135. Postal and courier services
51. afs	NP136. Accommodation services
51. afs	NP137. Food and beverage supply services
56. cmn	NP138. Radio, television, film, video and related services
56. cmn	NP139. Telephone and internet services
56. cmn	NP140. Other telecommunications services
60. obs	NP141. Information, programming and computer consulting services, software editing and related services
57. ofi	NP142. Central banking services
57. ofi	NP143. Other explicit monetary intermediation services
57. ofi	NP144. Indirectly measured financial intermediation service
57. ofi	NP145. Other financial and investment banking services
58. ins	NP146. Insurance, reinsurance and pension fund services
57. ofi	NP147. Auxiliary monetary and financial intermediation services
58. ins	NP148. Auxiliary insurance and pension fund services
59. rsa	NP149. Rental housing services
65. dwe	NP149-B. Imputed rental of housing services
59. rsa	NP150. Rental of non-residential real estate and other real estate services
60. obs	NP151. Legal services
60. obs	NP152. Accounting, tax consulting and other services
60. obs	NP153. Financial management consulting services, human resources consulting services, marketing consulting services, main office consulting services, and related services
60. obs	NP154. Architectural, engineering, and related services
60. obs	NP155. Scientific research and development services
60. obs	NP156. Advertising, provision of advertising space, and market research services
60. obs	NP157. Other professional, scientific, and technical services
61. ros	NP158. Veterinary services
60. obs	NP159. Car rental services
60. obs	NP160. Personal and household goods rental services
60. obs	NP161. Machinery and equipment rental services
60. obs	NP162. Rental and leasing of licenses, copyrights, patents, and franchises
60. obs	NP163. Employment placement agencies services
60. obs	NP164. Travel agency services, tour operators, reservation services, and related activities
60. obs	NP165. Security and investigation services
60. obs	NP166. Building cleaning and landscape care and maintenance

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65 GTAP Sectors	184 Costa Rican I-O sectors
60. obs	NP167. Office administrative and support services and other business support activities
62. osg	NP168. General government public services
62. osg	NP169. Services to the general community
62. osg	NP170. Administrative services of mandatory social security regimes
63. edu	NP171. Education services
64. hht	NP172. Human health care and social assistance services
61. ros	NP173. Creative, artistic, and entertainment services
61. ros	NP174. Library, archive, and museum services and other cultural services
61. ros	NP175. Gambling and betting services
61. ros	NP176. Sports services
61. ros	NP177. Leisure and recreational services
61. ros	NP178. Business, professional, trade, labor, political, and other similar association services
61. ros	NP179. Computer, personal effects, and household appliance repair services
61. ros	NP180. Laundry, drying, and cleaning services for clothing
61. ros	NP181. Hairdressing and other beauty treatments services
61. ros	NP182. Funeral and related services
61. ros	NP183. Other services n.e.c. (not elsewhere classified)
61. ros	NP184. Domestic services

R.6 Balance and Non-negativity conditions

After converting the Costa Rican I-O tables to the format required by GTAP Data Base, we conducted the sectoral balance and non-negativity checks. The new data base passed the sectoral balance check and non-negativity conditions.