Costa Rica

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1. Introduction

This chapter describes the contribution of the 2011 Input-Output (I-O) table from Costa Rica to the Global Trade Analysis Project (GTAP), version 10. 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 77 Costa Rican sectors to the GTAP sectors.

2. Data Sources

The primary raw input was a 77-sector 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 basic prices for 77 sectors.

- The Supply table shows the total output of 183 commodities, imports, transport margins, trade margins, and taxes on domestic and imported goods, by commodity.
- 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 –in order to distribute imports into the industries that use them.

Taxes and subsidies:

a) 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, applying a 13%

tax to all taxable goods and (some) services consumed by the sample (2.500 households) and then extrapolating it.

- Intermediate consumption: The General Sales Tax Law (GSTL) 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.

b) Import and export taxes: The applicable tax rate was estimated based on data from the Costa Rican General Customs Directorate.

c) 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 (a sample of 620 wholesalers with trade and transport margins for each product).

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 450 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 15th 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 2004, and extrapolated to the year 2011 using price and volume indicators. This survey contains information about 2,415 products and was complemented with sales records from the Ministry of Finance.

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.

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 of the most representative products of the national economy (183 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

- This was the first I-O Table created by the Central Bank of Costa Rica. The sources and the information collected for 2011's I-O Table is not as exhaustive as we would have liked. For example, the financial firms did not include cooperatives. This has changed in more recent years.
- Other limitations are included in the assumptions of section 5 of this document.

4. Data processing

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

a. Check the balance of the original 77-sectors 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.

b. 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.
c. The small values, that stay near to zero, where changed to zero to keep a clean balance.
d. 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.
e. 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 taxed[1], and the VAT payment is calculated as follows:

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

   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.
f. 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.
g. Treatment on Gas, Oil and Petroleum:
   a. Supply side: 100% is imported, it was calculated using information from the Costa Rican General Customs Directorate.

[1] According with the General Sales Tax Law (VAT equivalent).

b. 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).

h. 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 1. Macro 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	13 689 311	67	Labour	9 270 999	45
Investment	4 241 304	21	Capital	8 934 035	44
Government	3 634 413	18	Land	ND	
Stocks	232 981	1	Indirect Tax	2 248 274	11
Net Exports	-1 344 701	-7			
GDP		100			100

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

The original I-O Table was designed in the form of product by product; therefore, it was not necessary to transform the table to any other format.

As a part of the 2012-rebase year project, Costa Rica's Central Bank produced a series of input-output matrix for institutions or research programs such as the OECD, ECLAC, WIOD and GTAP. In this context, it was not hard to translate Costa Rica original I-O Table into the parameters that each institution or research program required.

It is important to say, however, that any aggregation implicates losing relevant data. For example, GTAP 55's products don't make a breakthrough between bananas and pineapples, two products relatively important to the Costa Rican economy.

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 revealed that in the case of Costa Rica firms rarely engage in secondary activities, which means that the sector categorization according to products and industries is very similar. Future versions of the domestic I-O Table will use an industry by industry approach.

Year:

The year of the IOT is 2011.

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 (2011), there is an asymmetric matrix of 183 products and 136 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 in order to be able to do the 57x57 size matrix, this matrix did not lose any data.

Mapping Between Costa Rican I-O Sectors and GTAP Sectors:

Table 2. Concordance map between 77 Costa Rican I-O sectors, 57 GTAP sectors and 46 sectors in the contributed table.

46 sectors	57 GTAP sectors	77 Costa Rican I-O sectors
1 pdr	1 pdr	1. Rice
2 othAgri	2 wht, 3 gro, 6 c_b, 7 pfb	2. Other cereals
		3. Food crops
3 v_f	4 v_f	3. Food crops
4 osd	5 osd	2. Other cereals

46 sectors	57 GTAP sectors	77 Costa Rican I-O sectors
		3. Food crops
5 ocr	8 ocr	3. Food crops
		4. Non-food crops
6 lvstk	9 ctl, 10 oap, 11 rmk, 12 wol	5. Cattle and poultry
7 frs	13 frs	6. Forestry
8 fsh	14 fsh	7. Fishing
9 coa	15 coa	
10 oilgas	16 oil, 17 gas	8. Crude oil and natural gas
11 omn	18 omn	11. Nonmetallic minerals and quarries
12 cmt_omt	19 cmt, 20 omt	14. Meat products and dairy products
13 vol	21 vol	15. Other food products
14 mil	22 mil	14. Meat products and dairy products
15 pcr_ofd	23 pcr 24 sgr, 25 ofd	12. Grains and ground flour
		13. Fishery products
		15. Other food products
16 b_t	26 b_t	16. Beverages products
		17. Tobacco products
17 tex	27 tex	22. Other products textiles
18 wap	28 wap	21. Wearing apparel
19 lea	29 lea	23. Leather products
20 lum	30 lum	24. Lumber
21 ppp_furn	31 ppp	27. Paper and paper pulp
		28. Printing and publication
22 p_c	32 p_c	34. Petroleum coal products
23 crp	33 crp	29. Synthetic fibers and resins
		31. Fertilizers and pesticides
		32. Medicaments
		33. Other chemical products
		35. Plastics products
		37. Other rubber products
24 nmm	34 nmm	
25 i_s	35 i_s	41. Iron and steel
26 nfm	36 nfm	42. Non-ferrous metals
27 fmp	37 fmp	43. Metal products
28 mvh	38 mvh	55. Motor vehicles
29 otn	39 otn	58. Other transport equipment
30 ele	40 ele	49. Television and communication equipment
		50. Computing machinery
31 ome	41 ome	45. General machinery
		48. Heavy electrical equipment
		53. Household electrical equipment

46 sectors	57 GTAP sectors	77 Costa Rican I-O sectors
		54. Lighting fixtures, batteries, wiring and others
		59. Precision machinery
32 omf	42 omf	25. Wooden furniture
		38. Cement and cement products
		39. Glass and glass products
		40. Non-metallic mineral products
		60. Other manufacture products
		D. Waste, scrap and manufacturing services produced and supplied internally
33 ely_gdt	43 ely, 44 gdt	61. Electricity and gas
24 wtr	45 wtr	62. Water supply
35 cns	46 cns	63. Building construction
		64. Other construction
36 trd	47 trd	55. Motor vehicles
		65. Wholesale and retail trade
		72. Restaurants
		73. Hotels
		74. Other services
37 otp	48 otp	66. Transport
		74. Other services
38 wtp	49 wtp	
39 atp	50 atp	
40 cmn	51 cmn	67. Telecommunications
		74. Other services
41 ofi	52 ofi	68. Finance and insurance
42 isr	53 isr	68. Finance and insurance
43 obs	54 obs	69. Real estate activities
		70. Education and investigation
		74. Other services
44 ros	55 ros	66. Transport
		74. Other services
		D. Waste, scrap and manufacturing services produced and supplied internally
44 osg	56 osg	70. Education and investigation
		71. Health
		74. Other services
		75. Public administration
46 dwe	57 dwe	77. Dwellings

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.