



## THE ROLE OF AGRICULTURE AND FOOD PROCESSING IN THE CHILEAN ECONOMY: RESULTS FROM AN INPUT-OUTPUT ANALYSIS<sup>1</sup>

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### Abstract

*Chilean agricultural and food processing industries have experienced considerable investment in recent years and are an important part of the export base in Chile. In this paper we use an Input-Output (IO) analysis to review the relative importance of agriculture and food processing to Chile's economy. We also use the input-output table to examine fifty different sectors contribution to Chilean gross domestic product, value added and trade. This analysis is based on data provided by the Global Trade Analysis Project (GTAP) of Purdue University. The contribution of agricultural and processed food exports to total supply throughout the Chilean economy is estimated with an Input-Output model of the Chilean economy. This IO model was derived from a new, flexible price, general equilibrium model that was constructed by the authors and is being used for the analysis of selected trade policies in Chile.*

### Resumen

*Las industrias agrícola y procesadora de alimentos chilenas han invertido fuertemente en los años recientes y son una parte importante de la base exportadora de Chile. En este trabajo se usa una metodología Insumo-Producto (IP) para analizar la importancia relativa de la agricultura y el procesamiento de alimentos para la economía de Chile. También se emplea la tabla insumo-producto para examinar la contribución de cincuenta sectores distintos al producto bruto doméstico, el valor agregado y el comercio de Chile. El análisis se basa en los datos provistos por el Global Trade Analysis Project (GTAP) de la Universidad de Purdue. La contribución de las exportaciones agrícolas y de*

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*alimentos procesados a la oferta total a través de la economía chilena se estima con un modelo Insumo-Producto de la economía de Chile. Este modelo IP se derivó de un nuevo modelo de equilibrio general con precios flexibles que fue construido por los autores y se está empleando para el análisis de algunas políticas de comercio específicas de Chile.*

**Keywords:** *Chile, Agriculture and food processing, GTAP data, Input-Output analysis.*

**JEL Classification:** *C67, F14, Q11.*

## 1. INTRODUCTION

With over three billion (1995 US dollars) in annual exports the agricultural and food processing industries are major contributors to the export base in Chile. Yet as economically significant as this figure is, it fails to capture the true economic significance of the agriculture and food processing as these industries impact jobs and income throughout the Chilean economy. The reason is that like few other commodities produced in Chile, agricultural and food commodities set off a chain of economic activities that dwarf the original production industry.

In spite of a general understanding by growers, food processing managers, and agricultural scientists of the above described complex there has been no recent scientific study of the inter-industry and general economic relationships between the above named industries and their economic impact on the Chilean economy. The purpose of this paper is to provide that study. Using inter-industry data developed by the Global Trade Analysis Project (Hertel, 1997) input-output accounts were constructed for Chile. The data in these accounts represent fifty different industries in Chile and are used in this paper to outline the broad contours of the Chilean economy in terms of the relative economic contribution of these industries and to examine the role of agriculture and food processing in the Chilean economy. In the next section we outline and compare the contribution to gross domestic product and international trade made by each industry in the Chile input-output accounts. A section that examines the mix of factor cost and indirect business taxes paid by industry follows this. Finally, we present the results of an input-output analysis developed from an input-output model of Chile based on GTAP data. We utilize the input-output framework to examine the contribution of agriculture and food processing to the economic base of Chile.

## 2. REVIEW OF INPUT/OUTPUT ACCOUNTS IN CHILE AND THE GTAP DATA

According to Hertel: "The Global Trade analysis Project (GTAP) was established in 1992, with the objective of lowering the cost of entry for those seeking to conduct quantitative analyses of international economic issues in an economy-wide framework. The Project consists of several components:





- a fully documented, publicly available, global database,
- a standard general equilibrium-modeling framework,
- software for manipulating the data and implementing the standard model,
- a global network of researchers (over 200 are subscribed to our discussion list) with a common interest of multi-region trade analysis and related issues,
- a consortium of national and international agencies providing leadership and a base level of support for the Project, and
- a Worldwide Web site for dissemination of data, software and Project-related information ([www.agecon.purdue.edu/gtap/](http://www.agecon.purdue.edu/gtap/)).

The version 4 database that is used in this paper is heavily based on earlier work at Purdue. Readers who are interested in history of that work are referred to the web address noted above. The version 4 data disaggregates each regional economy into 50 sectors. The data for Chile originate from a 1986 study done by the Central Bank of Chile. The input-output data were up-dated to match observed macroeconomic, trade and protection data for 1995. For example, data on private household consumption, C, investment, I, and government, G, were obtained from the World Bank while exports ,E, and imports ,M, were obtained by an aggregation of bilateral trade data form the UN's COMTRADE data base.

Bilateral trade data (imports and exports) for a given country were reconciled with a worldwide trade estimates in order obtain the most accurate trade data possible. It is believed that some sectors of the original Chile table were disaggregated into 50 sector GTAP sectoring scheme by using average coefficients from a world level representative input-output model (McDougall, Elbehri, and Truong (eds) Liu and McDougall, 1998) Available on-line at: ([http://ae761-e.agecon.purdue.edu/gtap/databases/v4/v4\\_doco.asp](http://ae761-e.agecon.purdue.edu/gtap/databases/v4/v4_doco.asp)).

The GTAP table for Chile was assembled using the FIT software developed at the Australian Industry Commission. "FIT is an economic model of a regional economy that allows targeting of economic magnitudes to match conditions in a particular year. These target variables are shocked, and changes in all other variables of the model are computed in response to these shocks. FIT maintains market clearing and zero profit conditions, while fixing primary factor prices and permitting value-added, as well as the intensity of input usage to adjust, subject to a pre-specified penalty function. Eight exogenous variables were targeted for the update in each region: (1) exports by commodity, (2) imports by commodity, (3) aggregate household consumption expenditures, (4) aggregate government spending, (5) aggregate expenditures for gross capital formation, (6) import tariffs, (7) export subsidies, and (8) production subsidies/taxes. The updated data represent an internally consistent I/O table that can be incorporated into the GTAP data base" (McDougall, Elbehri, and Truong (eds) McDougall, Yu and Malcolm, 1998). Readers who wish learn more of database handling procedures are referred to the data base documentation section of the GTAP web site ([www.agecon.purdue.edu/gtap/](http://www.agecon.purdue.edu/gtap/)). Readers who wish to review an analysis of structural change in Chile using input-output models from 1962, 1977 and 1986 are referred to the work of J.M. Jalbala-Bertrand (Jalbala-Bertrand, 1999a, 1999b).

### 3. A SUMMARY DESCRIPTION OF THE CHILEAN ECONOMY BASED ON THE INPUT-OUTPUT ACCOUNTS

Tables 1 and 2 report sales for each of the sectors in the input-output accounts. Table 1 represents this information in value terms (million of 1995 US\$) and Table 2 presents the information in share terms. It should be understood that these data are import ridden. That is the sales figures represent both imported supply and domestic supply. Sales to intermediate demand (inter-industry sales) are represented by (V). Private consumption (households) by (C), investment and inventory change (I), government consumption (G), exports (E) and imports (M). Q represents domestic production (supply)  $Q = V+C+I+G+E-M$ . Gross domestic product (GDP) is represented by the familiar  $GDP = C+I+G+E$ .

Most agricultural sectors are shown to supply mainly domestic demand. For example, Raw Milk is sold mainly to other industries and directly to households with virtually no sales to export. As expected, the Vegetables and Fruit sector supplies both domestic demand and export demand (Table 1). In fact the Vegetables and Fruit industry has by far the largest exports of any agricultural sector.

Turning to processed food products, the major exporting sectors are the Beverage and Tobacco sectors and the Food Products n.e.c. (not elsewhere classified). The other food producing sectors such as Cattle and Sheep Meat Products in Chile are producing mainly for domestic demand—interindustry demand, or household demand.

The import figures (M) along with estimates of domestic supply (Q) provide information on the import dependency of Chile. Example of sectors where Chile is very dependent on imported supply relative to domestic supply are Coal, Oil, Motor Vehicles, and Electronic Equipment (Table 1) The high percentage of imported supply leads to percentage figures which appear strange in Table 2. In this table we have simply divided total sales in each column of Table 1 by domestic supply in the respective sector (Q). In industries where imports are a large percentage of total (imported plus domestic) supply, the percentage figures exceed 100. This means that most of the consumption is coming from imported sources. For example, for Motor Vehicles and Parts, sales to Investment was 243 percent of domestic supply, implying that most of the supply was from imports (Table 2). In fact when we look at imported supply versus domestic supply for Motor Vehicles and Parts, Imports are 461 percent (nearly 5 times larger) of domestic supply. The reader may note that in the equation for gross domestic supply ( $Q = V+C+I+G+X-M$ ) imports are subtracted from the other variables in the equation. In Table 2 the negative sign on imports is maintained in order to preserve the adding up condition (ie. that the total should equal 100 percent).

Tables 3 and 4 present the cost structure of each sector. IU represents the cost of intermediate inputs. Land represents payments to the land resource, Capital represents payments to capital, NR represents payment to other natural capital, and VA is the sum of Land, Labor, Capital and NR payments, and IT represents indirect business taxes. These are taxes paid by firms on the inputs that they purchase. It includes property taxes.

TABLE 1  
EXPENDITURE ON GDP  
(1995 US\$ million)

| Sector                          | V     | C     | I     | G    | X     | M     | Q=C+I+G+V+X-M |
|---------------------------------|-------|-------|-------|------|-------|-------|---------------|
| Paddy rice                      | 28    | 15    | 2     | 0    | 0     | 2     | 42            |
| Wheat                           | 725   | 242   | 27    | 0    | 0     | 91    | 902           |
| Cereal grains n.e.c.            | 332   | 97    | 11    | 0    | 25    | 96    | 369           |
| Vegetables, fruit, nuts         | 1677  | 792   | 300   | 0    | 1113  | 51    | 3832          |
| Oil seeds                       | 27    | 1     | 4     | 0    | 9     | 4     | 37            |
| Sugar cane, sugar beet          | 341   | 0     | 22    | 0    | 0     | 20    | 343           |
| Plant-based fibers              | 63    | 1     | 6     | 0    | 2     | 62    | 10            |
| Crops n.e.c.                    | 154   | 72    | 33    | 0    | 181   | 137   | 303           |
| Cattle, sheep, etc.             | 619   | 90    | 3     | 0    | 3     | 1     | 714           |
| Animal prods n.e.c.             | 848   | 137   | 9     | 0    | 21    | 16    | 998           |
| Raw milk                        | 275   | 76    | 3     | 0    | 0     | 0     | 354           |
| Wool, silk-worm cocoons         | 91    | 16    | 1     | 0    | 13    | 1     | 120           |
| Forestry                        | 279   | 11    | 55    | 0    | 207   | 1     | 551           |
| Fishing                         | 1085  | 134   | 3     | 0    | 157   | 27    | 1352          |
| Coal                            | 203   | 0     | 0     | 0    | 1     | 140   | 64            |
| Oil                             | 1061  | 0     | 44    | 0    | 24    | 997   | 133           |
| Gas                             | 115   | 4     | 29    | 1    | 8     | 87    | 71            |
| Minerals n.e.c.                 | 2419  | 0     | 127   | 0    | 2693  | 240   | 4999          |
| Cattle, sheep, etc. meat prods  | 359   | 817   | 3     | 0    | 62    | 152   | 1089          |
| Meat prods n.e.c.               | 258   | 1024  | 3     | 0    | 31    | 17    | 1300          |
| Vegetable oils & fats           | 136   | 47    | 2     | 0    | 7     | 130   | 61            |
| Dairy prods                     | 212   | 769   | 8     | 0    | 30    | 69    | 950           |
| Processed rice                  | 30    | 33    | 2     | 0    | 0     | 21    | 44            |
| Sugar                           | 323   | 140   | 17    | 0    | 2     | 49    | 433           |
| Food prods n.e.c.               | 1828  | 3282  | 354   | 8    | 2060  | 249   | 7283          |
| Beverages, tobacco prods        | 296   | 1637  | 47    | 0    | 201   | 97    | 2085          |
| Textiles                        | 1402  | 911   | 159   | 0    | 99    | 684   | 1887          |
| Wearing apparel                 | 124   | 1624  | 166   | 0    | 72    | 358   | 1627          |
| Leather prods                   | 340   | 472   | 30    | 0    | 42    | 297   | 588           |
| Wood prods                      | 968   | 224   | 255   | 0    | 764   | 131   | 2081          |
| Paper prods, publishing         | 1802  | 525   | 2     | 0    | 1696  | 500   | 3526          |
| Petroleum, coal prods           | 1038  | 479   | 22    | 0    | 30    | 256   | 1315          |
| Chemical, rubber, plastic prods | 4669  | 1370  | 205   | 0    | 673   | 2393  | 4525          |
| Mineral prods n.e.c.            | 1239  | 93    | 35    | 0    | 18    | 236   | 1149          |
| Ferrous metals                  | 873   | 0     | 17    | 0    | 108   | 592   | 405           |
| Metals n.e.c.                   | 1658  | 0     | 24    | 0    | 4144  | 157   | 5669          |
| Metal prods                     | 1427  | 99    | 400   | 0    | 108   | 364   | 1671          |
| Motor vehicles, parts           | 864   | 660   | 1244  | 0    | 101   | 2357  | 511           |
| Transport equipment n.e.c.      | 404   | 80    | 384   | 0    | 75    | 544   | 400           |
| Electronic equipment            | 383   | 334   | 841   | 0    | 19    | 1010  | 567           |
| Machinery, equipment n.e.c.     | 1639  | 280   | 2251  | 0    | 201   | 3619  | 752           |
| Manufactures n.e.c.             | 222   | 354   | 99    | 0    | 43    | 464   | 254           |
| Electricity                     | 1703  | 519   | 0     | 0    | 0     | 0     | 2223          |
| Gas manufacture, distribution   | 956   | 233   | 0     | 0    | 0     | 0     | 1189          |
| Water                           | 620   | 348   | 0     | 0    | 0     | 0     | 968           |
| Construction                    | 1510  | 0     | 7362  | 1    | 0     | 2     | 8872          |
| Trade, transport                | 11139 | 9352  | 875   | 0    | 2479  | 1446  | 22399         |
| Financial, business, etc. serv. | 8773  | 5886  | 2     | 512  | 979   | 1622  | 14531         |
| Public admin., education, etc.  | 25    | 216   | 0     | 5365 | 6     | 4     | 5609          |
| Dwellings                       | 0     | 4640  | 0     | 0    | 0     | 0     | 4641          |
| Total                           | 57562 | 38138 | 15488 | 5891 | 18510 | 19791 | 115797        |

TABLE 2  
EXPENDITURE ON GDP  
(Percent of domestic supply)

| Sector                          | V     | C     | I     | G    | X    | M      | Q=C+I+G+V+X-M |
|---------------------------------|-------|-------|-------|------|------|--------|---------------|
| Paddy rice                      | 65.3  | 34.4  | 3.9   | 0.1  | 0.0  | -3.7   | 100.0         |
| Wheat                           | 80.3  | 26.8  | 3.0   | 0.0  | 0.0  | -10.1  | 100.0         |
| Cereal grains n.e.c.            | 90.0  | 26.3  | 2.9   | 0.0  | 6.8  | -26.0  | 100.0         |
| Vegetables, fruit, nuts         | 43.8  | 20.7  | 7.8   | 0.0  | 29.1 | -1.3   | 100.0         |
| Oil seeds                       | 72.7  | 3.0   | 10.0  | 0.0  | 24.1 | -9.8   | 100.0         |
| Sugar cane, sugar beet          | 99.4  | 0.0   | 6.3   | 0.0  | 0.0  | -5.7   | 100.0         |
| Plant-based fibers              | 607.3 | 7.1   | 62.1  | 0.1  | 17.4 | -594.0 | 100.0         |
| Crops n.e.c.                    | 50.8  | 23.7  | 11.0  | 0.0  | 59.9 | -45.3  | 100.0         |
| Cattle, sheep, etc.             | 86.7  | 12.6  | 0.5   | 0.0  | 0.4  | -0.1   | 100.0         |
| Animal prods n.e.c.             | 84.9  | 13.7  | 0.9   | 0.0  | 2.1  | -1.6   | 100.0         |
| Raw milk                        | 77.7  | 21.4  | 0.9   | 0.0  | 0.0  | 0.0    | 100.0         |
| Wool, silk-worm cocoons         | 75.7  | 13.2  | 0.6   | 0.0  | 11.0 | -0.5   | 100.0         |
| Forestry                        | 50.6  | 2.0   | 9.9   | 0.0  | 37.6 | -0.3   | 100.0         |
| Fishing                         | 80.2  | 9.9   | 0.2   | 0.0  | 11.6 | -2.0   | 100.0         |
| Coal                            | 314.5 | 0.3   | 0.6   | 0.0  | 1.7  | -217.1 | 100.0         |
| Oil                             | 797.3 | 0.0   | 33.4  | 0.0  | 18.3 | -749.0 | 100.0         |
| Gas                             | 162.3 | 5.7   | 40.5  | 1.8  | 12.0 | -122.2 | 100.0         |
| Minerals n.e.c.                 | 48.4  | 0.0   | 2.5   | 0.0  | 53.9 | -4.8   | 100.0         |
| Cattle, sheep, etc. meat prods  | 33.0  | 75.0  | 0.3   | 0.0  | 5.7  | -14.0  | 100.0         |
| Meat prods n.e.c.               | 19.9  | 78.8  | 0.2   | 0.0  | 2.4  | -1.3   | 100.0         |
| Vegetable oils & fats           | 221.5 | 76.1  | 2.8   | 0.0  | 11.1 | -211.5 | 100.0         |
| Dairy prods                     | 22.3  | 80.9  | 0.8   | 0.0  | 3.2  | -7.3   | 100.0         |
| Processed rice                  | 68.0  | 75.4  | 3.5   | 0.0  | 0.0  | -46.9  | 100.0         |
| Sugar                           | 74.6  | 32.3  | 4.0   | 0.1  | 0.5  | -11.4  | 100.0         |
| Food prods n.e.c.               | 25.1  | 45.1  | 4.9   | 0.1  | 28.3 | -3.4   | 100.0         |
| Beverages, tobacco prods        | 14.2  | 78.5  | 2.3   | 0.0  | 9.6  | -4.7   | 100.0         |
| Textiles                        | 74.3  | 48.3  | 8.4   | 0.0  | 5.2  | -36.2  | 100.0         |
| Wearing apparel                 | 7.6   | 99.8  | 10.2  | 0.0  | 4.4  | -22.0  | 100.0         |
| Leather prods                   | 57.9  | 80.4  | 5.1   | 0.0  | 7.1  | -50.5  | 100.0         |
| Wood prods                      | 46.5  | 10.8  | 12.3  | 0.0  | 36.7 | -6.3   | 100.0         |
| Paper prods, publishing         | 51.1  | 14.9  | 0.1   | 0.0  | 48.1 | -14.2  | 100.0         |
| Petroleum, coal prods           | 79.0  | 36.5  | 1.7   | 0.0  | 2.3  | -19.4  | 100.0         |
| Chemical, rubber, plastic prods | 103.2 | 30.3  | 4.5   | 0.0  | 14.9 | -52.9  | 100.0         |
| Mineral prods n.e.c.            | 107.8 | 8.1   | 3.1   | 0.0  | 1.6  | -20.6  | 100.0         |
| Ferrous metals                  | 215.4 | 0.0   | 4.2   | 0.0  | 26.7 | -146.2 | 100.0         |
| Metals n.e.c.                   | 29.3  | 0.0   | 0.4   | 0.0  | 73.1 | -2.8   | 100.0         |
| Metal prods                     | 85.4  | 5.9   | 24.0  | 0.0  | 6.5  | -21.8  | 100.0         |
| Motor vehicles, parts           | 169.0 | 129.1 | 243.5 | 0.0  | 19.7 | -461.3 | 100.0         |
| Transport equipment n.e.c.      | 101.1 | 20.1  | 96.0  | 0.1  | 18.9 | -136.2 | 100.0         |
| Electronic equipment            | 67.6  | 59.0  | 148.3 | 0.0  | 3.3  | -178.2 | 100.0         |
| Machinery, equipment n.e.c.     | 218.0 | 37.2  | 299.3 | 0.0  | 26.7 | -481.3 | 100.0         |
| Manufactures n.e.c.             | 87.1  | 139.3 | 39.0  | 0.0  | 16.8 | -182.2 | 100.0         |
| Electricity                     | 76.6  | 23.4  | 0.0   | 0.0  | 0.0  | 0.0    | 100.0         |
| Gas manufacture, distribution   | 80.4  | 19.6  | 0.0   | 0.0  | 0.0  | 0.0    | 100.0         |
| Water                           | 64.1  | 35.9  | 0.0   | 0.0  | 0.0  | 0.0    | 100.0         |
| Construction                    | 17.0  | 0.0   | 83.0  | 0.0  | 0.0  | 0.0    | 100.0         |
| Trade, transport                | 49.7  | 41.8  | 3.9   | 0.0  | 11.1 | -6.5   | 100.0         |
| Financial, business, etc. serv. | 60.4  | 40.5  | 0.0   | 3.5  | 6.7  | -11.2  | 100.0         |
| Public admin., education, etc.  | 0.4   | 3.9   | 0.0   | 95.7 | 0.1  | -0.1   | 100.0         |
| Dwellings                       | 0.0   | 100.0 | 0.0   | 0.0  | 0.0  | 0.0    | 100.0         |
| Total                           | 49.7  | 32.9  | 13.4  | 5.1  | 16.0 | -17.1  | 100.0         |

TABLE 3  
COST SUMMARY, CHILE  
(1995 US\$ Million)

| Sector                          | Intermediate |      |       |         | Natural Resources | Value Added | Indirect Taxes | Q      |
|---------------------------------|--------------|------|-------|---------|-------------------|-------------|----------------|--------|
|                                 | Use          | Land | Labor | Capital |                   |             |                |        |
| Paddy rice                      | 17           | 7    | 11    | 6       | 0                 | 23          | 2              | 42     |
| Wheat                           | 374          | 139  | 234   | 124     | 0                 | 498         | 31             | 902    |
| Cereal grains n.e.c.            | 165          | 54   | 90    | 48      | 0                 | 192         | 12             | 369    |
| Vegetables, fruit, nuts         | 1537         | 613  | 1029  | 547     | 0                 | 2189        | 105            | 3832   |
| Oil seeds                       | 14           | 6    | 10    | 5       | 0                 | 21          | 1              | 37     |
| Sugar cane, sugar beet          | 124          | 58   | 98    | 52      | 0                 | 209         | 10             | 343    |
| Plant-based fibers              | 5            | 1    | 2     | 1       | 0                 | 5           | 0              | 10     |
| Crops n.e.c.                    | 130          | 46   | 77    | 41      | 0                 | 164         | 8              | 303    |
| Cattle, sheep, etc.             | 274          | 122  | 205   | 109     | 0                 | 435         | 4              | 714    |
| Animal prods n.e.c.             | 486          | 142  | 238   | 127     | 0                 | 507         | 6              | 998    |
| Raw milk                        | 205          | 41   | 69    | 37      | 0                 | 147         | 2              | 354    |
| Wool, silk-worm cocoons         | 63           | 16   | 26    | 14      | 0                 | 56          | 1              | 120    |
| Forestry                        | 101          | 0    | 69    | 333     | 40                | 442         | 8              | 551    |
| Fishing                         | 607          | 0    | 150   | 278     | 300               | 728         | 17             | 1352   |
| Coal                            | 36           | 0    | 14    | 1       | 13                | 28          | 1              | 64     |
| Oil                             | 63           | 0    | 6     | 33      | 30                | 70          | 1              | 133    |
| Gas                             | 19           | 0    | 5     | 28      | 18                | 51          | 1              | 71     |
| Minerals n.e.c.                 | 2521         | 0    | 635   | 1483    | 343               | 2461        | 17             | 4999   |
| Cattle, sheep, etc. meat prods  | 890          | 0    | 101   | 99      | 0                 | 200         | -1             | 1089   |
| Meat prods n.e.c.               | 1073         | 0    | 115   | 113     | 0                 | 227         | -1             | 1300   |
| Vegetable oils & fats           | 52           | 0    | 3     | 6       | 0                 | 9           | 0              | 61     |
| Dairy prods                     | 708          | 0    | 73    | 167     | 0                 | 240         | 3              | 950    |
| Processed rice                  | 37           | 0    | 2     | 5       | 0                 | 7           | 0              | 44     |
| Sugar                           | 384          | 0    | 16    | 33      | 0                 | 49          | 0              | 433    |
| Food prods n.e.c.               | 5512         | 0    | 566   | 1201    | 0                 | 1767        | 4              | 7283   |
| Beverages, tobacco prods        | 1530         | 0    | 275   | 269     | 0                 | 544         | 10             | 2085   |
| Textiles                        | 1148         | 0    | 304   | 428     | 0                 | 731         | 8              | 1887   |
| Wearing apparel                 | 1251         | 0    | 171   | 197     | 0                 | 369         | 7              | 1627   |
| Leather prods                   | 479          | 0    | 52    | 54      | 0                 | 106         | 3              | 588    |
| Wood prods                      | 1111         | 0    | 283   | 666     | 0                 | 949         | 20             | 2081   |
| Paper prods, publishing         | 2121         | 0    | 454   | 927     | 0                 | 1381        | 24             | 3526   |
| Petroleum, coal prods           | 1162         | 0    | 18    | 132     | 0                 | 150         | 3              | 1315   |
| Chemical, rubber, plastic prods | 2883         | 0    | 677   | 953     | 0                 | 1631        | 11             | 4525   |
| Mineral prods n.e.c.            | 536          | 0    | 175   | 429     | 0                 | 604         | 9              | 1149   |
| Ferrous metals                  | 257          | 0    | 43    | 103     | 0                 | 146         | 2              | 405    |
| Metals n.e.c.                   | 3471         | 0    | 640   | 1525    | 0                 | 2166        | 33             | 5669   |
| Metal prods                     | 1138         | 0    | 238   | 292     | 0                 | 529         | 3              | 1671   |
| Motor vehicles, parts           | 434          | 0    | 29    | 60      | 0                 | 89          | -12            | 511    |
| Transport equipment n.e.c.      | 202          | 0    | 78    | 124     | 0                 | 202         | -4             | 400    |
| Electronic equipment            | 369          | 0    | 103   | 92      | 0                 | 196         | 2              | 567    |
| Machinery, equipment n.e.c.     | 508          | 0    | 149   | 93      | 0                 | 242         | 2              | 752    |
| Manufactures n.e.c.             | 161          | 0    | 44    | 44      | 0                 | 88          | 6              | 254    |
| Electricity                     | 809          | 0    | 215   | 1195    | 0                 | 1410        | 4              | 2223   |
| Gas manufacture, distribution   | 550          | 0    | 132   | 497     | 0                 | 629         | 9              | 1189   |
| Water                           | 509          | 0    | 182   | 274     | 0                 | 456         | 3              | 968    |
| Construction                    | 4635         | 0    | 1783  | 1888    | 0                 | 3672        | 566            | 8872   |
| Trade, transport                | 10004        | 0    | 3043  | 8708    | 0                 | 11751       | 643            | 22399  |
| Financial, business, etc. serv. | 4159         | 0    | 4153  | 5748    | 0                 | 9902        | 470            | 14531  |
| Public admin., education, etc.  | 1873         | 0    | 3446  | 23      | 0                 | 3469        | 267            | 5609   |
| Dwellings                       | 863          | 0    | 30    | 3379    | 0                 | 3409        | 368            | 4641   |
| Total                           | 57562        | 1245 | 20564 | 32993   | 745               | 55547       | 2688           | 115797 |

TABLE 4  
COST SUMMARY, CHILE  
(Percent)

| Sector                          | Intermediate |      |       |         | Natural Resources | Value Added | Indirect Taxes | Q     |
|---------------------------------|--------------|------|-------|---------|-------------------|-------------|----------------|-------|
|                                 | Use          | Land | Labor | Capital |                   |             |                |       |
| Paddy rice                      | 40.9         | 15.5 | 26.0  | 13.8    | 0.0               | 55.4        | 3.7            | 100.0 |
| Wheat                           | 41.5         | 15.4 | 25.9  | 13.8    | 0.0               | 55.1        | 3.4            | 100.0 |
| Cereal grains n.e.c.            | 44.7         | 14.6 | 24.5  | 13.0    | 0.0               | 52.1        | 3.2            | 100.0 |
| Vegetables, fruit, nuts         | 40.1         | 16.0 | 26.9  | 14.3    | 0.0               | 57.1        | 2.7            | 100.0 |
| Oil seeds                       | 39.4         | 16.2 | 27.1  | 14.4    | 0.0               | 57.8        | 2.8            | 100.0 |
| Sugar cane, sugar beet          | 36.3         | 17.1 | 28.6  | 15.2    | 0.0               | 60.9        | 2.8            | 100.0 |
| Plant-based fibers              | 47.6         | 13.8 | 23.1  | 12.3    | 0.0               | 49.3        | 3.1            | 100.0 |
| Crops n.e.c.                    | 42.9         | 15.2 | 25.5  | 13.6    | 0.0               | 54.3        | 2.7            | 100.0 |
| Cattle, sheep, etc.             | 38.4         | 17.1 | 28.7  | 15.2    | 0.0               | 61.0        | 0.6            | 100.0 |
| Animal prods n.e.c.             | 48.6         | 14.2 | 23.9  | 12.7    | 0.0               | 50.8        | 0.6            | 100.0 |
| Raw milk                        | 57.9         | 11.6 | 19.5  | 10.4    | 0.0               | 41.5        | 0.6            | 100.0 |
| Wool, silk-worm cocoons         | 52.4         | 13.1 | 22.1  | 11.7    | 0.0               | 47.0        | 0.6            | 100.0 |
| Forestry                        | 18.4         | 0.0  | 12.5  | 60.5    | 7.2               | 80.2        | 1.4            | 100.0 |
| Fishing                         | 44.9         | 0.0  | 11.1  | 20.6    | 22.2              | 53.9        | 1.2            | 100.0 |
| Coal                            | 56.1         | 0.0  | 21.3  | 0.9     | 20.6              | 42.8        | 1.1            | 100.0 |
| Oil                             | 47.2         | 0.0  | 4.5   | 25.1    | 22.6              | 52.2        | 0.6            | 100.0 |
| Gas                             | 27.3         | 0.0  | 7.0   | 39.3    | 25.6              | 71.9        | 0.7            | 100.0 |
| Minerals n.e.c.                 | 50.4         | 0.0  | 12.7  | 29.7    | 6.9               | 49.2        | 0.3            | 100.0 |
| Cattle, sheep, etc. meat prods  | 81.7         | 0.0  | 9.3   | 9.1     | 0.0               | 18.4        | -0.1           | 100.0 |
| Meat prods n.e.c.               | 82.6         | 0.0  | 8.8   | 8.7     | 0.0               | 17.5        | 0.0            | 100.0 |
| Vegetable oils & fats           | 84.8         | 0.0  | 4.9   | 10.3    | 0.0               | 15.2        | 0.0            | 100.0 |
| Dairy prods                     | 74.5         | 0.0  | 7.6   | 17.6    | 0.0               | 25.2        | 0.3            | 100.0 |
| Processed rice                  | 84.0         | 0.0  | 5.2   | 10.6    | 0.0               | 15.8        | 0.2            | 100.0 |
| Sugar                           | 88.7         | 0.0  | 3.6   | 7.6     | 0.0               | 11.2        | 0.1            | 100.0 |
| Food prods n.e.c.               | 75.7         | 0.0  | 7.8   | 16.5    | 0.0               | 24.3        | 0.1            | 100.0 |
| Beverages, tobacco prods        | 73.4         | 0.0  | 13.2  | 12.9    | 0.0               | 26.1        | 0.5            | 100.0 |
| Textiles                        | 60.8         | 0.0  | 16.1  | 22.7    | 0.0               | 38.8        | 0.4            | 100.0 |
| Wearing apparel                 | 76.9         | 0.0  | 10.5  | 12.1    | 0.0               | 22.7        | 0.4            | 100.0 |
| Leather prods                   | 81.6         | 0.0  | 8.8   | 9.2     | 0.0               | 18.0        | 0.5            | 100.0 |
| Wood prods                      | 53.4         | 0.0  | 13.6  | 32.0    | 0.0               | 45.6        | 1.0            | 100.0 |
| Paper prods, publishing         | 60.2         | 0.0  | 12.9  | 26.3    | 0.0               | 39.2        | 0.7            | 100.0 |
| Petroleum, coal prods           | 88.4         | 0.0  | 1.4   | 10.0    | 0.0               | 11.4        | 0.2            | 100.0 |
| Chemical, rubber, plastic prods | 63.7         | 0.0  | 15.0  | 21.1    | 0.0               | 36.0        | 0.2            | 100.0 |
| Mineral prods n.e.c.            | 46.7         | 0.0  | 15.2  | 37.3    | 0.0               | 52.6        | 0.8            | 100.0 |
| Ferrous metals                  | 63.5         | 0.0  | 10.6  | 25.3    | 0.0               | 36.0        | 0.5            | 100.0 |
| Metals n.e.c.                   | 61.2         | 0.0  | 11.3  | 26.9    | 0.0               | 38.2        | 0.6            | 100.0 |
| Metal prods                     | 68.1         | 0.0  | 14.2  | 17.5    | 0.0               | 31.7        | 0.2            | 100.0 |
| Motor vehicles, parts           | 84.9         | 0.0  | 5.6   | 11.8    | 0.0               | 17.4        | -2.3           | 100.0 |
| Transport equipment n.e.c.      | 50.5         | 0.0  | 19.6  | 30.9    | 0.0               | 50.5        | -1.0           | 100.0 |
| Electronic equipment            | 65.1         | 0.0  | 18.2  | 16.3    | 0.0               | 34.6        | 0.3            | 100.0 |
| Machinery, equipment n.e.c.     | 67.5         | 0.0  | 19.9  | 12.4    | 0.0               | 32.2        | 0.3            | 100.0 |
| Manufactures n.e.c.             | 63.2         | 0.0  | 17.3  | 17.2    | 0.0               | 34.6        | 2.3            | 100.0 |
| Electricity                     | 36.4         | 0.0  | 9.7   | 53.8    | 0.0               | 63.4        | 0.2            | 100.0 |
| Gas manufacture, distribution   | 46.3         | 0.0  | 11.1  | 41.8    | 0.0               | 52.9        | 0.8            | 100.0 |
| Water                           | 52.6         | 0.0  | 18.8  | 28.3    | 0.0               | 47.1        | 0.3            | 100.0 |
| Construction                    | 52.2         | 0.0  | 20.1  | 21.3    | 0.0               | 41.4        | 6.4            | 100.0 |
| Trade, transport                | 44.7         | 0.0  | 13.6  | 38.9    | 0.0               | 52.5        | 2.9            | 100.0 |
| Financial, business, etc. serv. | 28.6         | 0.0  | 28.6  | 39.6    | 0.0               | 68.1        | 3.2            | 100.0 |
| Public admin., education, etc.  | 33.4         | 0.0  | 61.5  | 0.4     | 0.0               | 61.9        | 4.8            | 100.0 |
| Dwellings                       | 18.6         | 0.0  | 0.7   | 72.8    | 0.0               | 73.5        | 7.9            | 100.0 |
| Total                           | 49.7         | 1.1  | 17.8  | 28.5    | 0.6               | 48.0        | 2.3            | 100.0 |





As a percent of total cost including intermediate inputs, indirect business taxes for the Chilean economy average 2.3 percent (Table 4). Similarly, land payments average 1.1 percent, labor 17.8 percent and capital 28.5 percent. Intermediate inputs (IU) average not quite 50 percent of total costs. To put these figures in perspective we can compare them the averages for all the countries in the GTAP4 database. The world average figures are IU 49.8 percent, Land 0.5 percent, Labor 28.9, Capital 18.5, NR 0.4 and IT 1.9 percent (McDougall, Elbehri, and Truong (eds), McDougall and Ejlbehri Chapter 3, [www.agecon.purdue.edu/gtap](http://www.agecon.purdue.edu/gtap) Documentation of the GTAP4 data base). The main differences between Chile and the world averages are in returns to labor and capital. The figure for Chile for labor and capital respectively are 17.8 and 28.5 percent. The world average figures for labor and capital respectively are 28.9 and 18.5 percent.

The natural resource based sectors such as agriculture, forestry and mining tend to be characterized by relatively low intermediate input cost and relatively high payments to primary inputs as summarized by Value Added figures (Table 4).

Sectors characterized by high percentage payment to labor are Public admin. Education etc., which is a very labor-intensive sector and the agricultural sectors, which paid roughly 25 percent of total industry cost in the form of payments to labor (Table 4).

Dwellings stand out as a sector with high payments to capital, but most of that presumably is an imputed rent for owner occupied housing. Trade and transport, and Financial, Business etc services are two sectors with payment to capital approaching 40 percent of total cost. The utility sectors such as Electricity, and Gas also show high percentage payments to capital. In the next section we turn to the findings from the input-output model.

#### 4. REVIEW OF INPUT/OUTPUT MODELS AND ANALYSIS

The input/output framework of analysis was developed by Wassily Leontief who received the Nobel Prize in economics (Leontief) for this work. The input/output (I/O) model is a system of linear equations that describes the purchases of inputs and the sale of output of an industry throughout an economy. The model represents all production and consumption in the economy and is known as a general equilibrium model. The assumptions underlying the model depict an economic world where supply is assumed to respond to demand. The endogenous variables are estimates of regional supply (sales),  $X$ , while estimates of final demand such as household consumption  $C$ , gross private domestic investment  $I$ , government consumption  $G$ , and export demand  $E$ , make up the set of exogenous variables.

There are two basic types of I/O models: Open models which generate Type I multipliers and closed models which generate Type II multipliers (Miller and Blair, 1985). In the open (Type I) model, all the components of gross domestic product are treated as part of assumed exogenous final demand, while in the closed (Type II) model, changes in household income are treated as endogenous driving changes in household consumption.





The  $A$  matrix in the input-output model is called the matrix of technical coefficients and represents the production functions of all the industries in the model. Through algebraic manipulation of the  $A$  matrix, we derive the input-output model and the output multipliers. The following equations describe the derivation of the analytic model:

$$(1) \quad X = AX + Y$$

$$(2) \quad (I - A)X = Y$$

$$(3) \quad X = (I - A)^{-1} Y$$

where  $X$  is total industry output,  $I$  is identity matrix,  $A$  is the  $A$  matrix and  $Y$  is final demand. Equation (1) simply states that supply is a function of intermediate demand ( $AX$ ) and final demand ( $Y$ ). Equation (3) then shows that supply ( $X$ ) is a function of final demand ( $Y$ ) through the Leontief inverse  $(I - A)^{-1}$ . This can be also interpreted as:

$$(4) \quad \Delta X = (I - A)^{-1} \Delta Y$$

where  $\Delta X$  is change in total industry output and  $\Delta Y$  is change in final demand.

In a Type I model such as the one constructed for this study, the impact of changes in final demand ( $\Delta Y$ ) on changes in supply ( $\Delta X$ ) can be broken down into the following two components:

- *direct effects* are the initial changes to the industries to which a final demand change was made;
- *indirect effects* are the changes in inter-industry purchases as industries throughout the economy respond to the new demands of the directly affected industries;

The input-output model constructed for this study utilizes an open (Type I) closure which means that  $C$ ,  $I$ ,  $G$ , and  $E$  are all treated as exogenous. Since the system of equations depict an economy in which domestic supply responds to changes in final demand, it was necessary to purge all sales figures such as those reported in Tables 1 and 2 as well as intermediate sales of imports. The GTAP4 database provides estimates of imports of each commodity by each industry and by each component of final demand. The matrix of imports was subtracted from the matrix of import ridden sales figures to obtain matrix of domestic demand (intermediate demand and final demand). This means that  $X$  and  $Y$  in Equation (3) refer to Chilean produced output ( $X$ ) and final demand for Chilean produced output ( $Y$ ), and likewise the matrix of technical coefficients ( $A$ ) is import purged.

The output multipliers for an input-output model show the change in output throughout the whole economy associated with a one unit change in final de-





mand for a giving industry. The output multipliers may be obtained as the column sum of each industry (column) represented in the Leontief inverse. Although output multipliers are not provided in this paper they may be obtained from the authors upon request. The term “backward linkages” refers to the relation between an individual industry and the other industries from which that industry buys inputs. The strength of backward linkages for a given industry is given by output multiplier for that industry. Industries that have large output multipliers also have large backward linkages.

## 5. THE ROLE OF AGRICULTURAL EXPORTS AS A DRIVER OF THE ECONOMY

Table 5 shows the sales across different sectors that are driven by agricultural commodity exports. Agriculture is defined to include all of the industries represented in Table 5 starting with the Paddy rice sector and finishing with wool sector. In total there are twelve separate sectors in the agricultural classification. The estimates of “Sales Driven by Agricultural Exports” in column one (Table 5) were obtained by post multiplying the Type I Leontief matrix by the vector of agricultural exports. Including agricultural itself the total sales for the whole economy accounted by agricultural exports are a bit over \$2 billion (Table 5.) This is about 2 percent of total sales for the whole economy (Table 5). Sectors shown to have the strongest backward linkages stemming from agriculture, are Petroleum products, Chemical, rubber, plastic products, Trade, transport services, and Financial, business etc. services (Table 5). For example, a bit less than \$ 200 million of Trade, transport output is shown to be driven by agricultural exports (Table 5).

In Table 6 we extend our definition of agriculture to include the agriculture processing (food) sectors and we examine the impact of agricultural and food exports from Chile. The food sectors start with the Cattle, Sheep etc. meat products sector and extend to include the Beverages, tobacco prods. sector. In total there are eight individual food sectors in the model. Table 6 captures the backward linkages from food exports as well as agricultural commodity exports. This includes the twelve agricultural sectors and the eight food sectors.

An example of an economic linkage between food exports and the rest of the economy is the \$ 317 million of sales of the fishing industry that are driven by exports of the food processing industry. Likewise, over \$ 160 million of wheat sales, and \$ 80 million of sugar sales are tied to the export of processed foods (Table 6). More than one half billion sales is accounted for in the Trade, transport sector, which is 2.4 percent of total sales in the sector. The ripple effect on most non-agricultural sectors stemming from agricultural and food exports is on the order of one to two percent of total sector sales. For example, electricity sales are estimated to be \$ 58 million which is 2.6 percent of total electricity sales. Exceptions are Metal prods., Petroleum prods., Chemical prods. and Business services where the impact is on the order of three to four percent of sales (Table 6).



TABLE 5  
SUPPLY DRIVEN BY AGRICULTURAL EXPORTS, CHILE  
(1995 US\$ million)

| Sector                          | Sales driven by Ag. Exports | Total Sales | Percent |
|---------------------------------|-----------------------------|-------------|---------|
| Paddy rice                      | 0.1                         | 42.4        | 0.26    |
| Wheat                           | 2.2                         | 902.3       | 0.24    |
| Cereal grains n.e.c.            | 28.5                        | 369.2       | 7.73    |
| Vegetables, fruit, nuts         | 1265.3                      | 3831.6      | 33.02   |
| Oil seeds                       | 9.7                         | 36.8        | 26.35   |
| Sugar cane, sugar beet          | 0.6                         | 342.7       | 0.17    |
| Plant-based fibers              | 2.0                         | 10.4        | 19.07   |
| Crops n.e.c.                    | 203.7                       | 302.7       | 67.28   |
| Cattle, sheep, etc.             | 4.5                         | 713.5       | 0.63    |
| Animal prods n.e.c.             | 23.5                        | 998.4       | 2.35    |
| Raw milk                        | 0.3                         | 354.0       | 0.09    |
| Wool, silk-worm cocoons         | 14.2                        | 119.9       | 11.85   |
| Forestry                        | 1.3                         | 551.1       | 0.23    |
| Fishing                         | 1.4                         | 1352.0      | 0.10    |
| Coal                            | 0.3                         | 64.5        | 0.40    |
| Oil                             | 1.3                         | 133.1       | 1.01    |
| Gas                             | 0.8                         | 70.9        | 1.09    |
| Minerals n.e.c.                 | 36.8                        | 4998.8      | 0.74    |
| Cattle, sheep, etc. meat prods  | 1.0                         | 1089.1      | 0.09    |
| Meat prods n.e.c.               | 1.0                         | 1300.4      | 0.08    |
| Vegetable oils & fats           | 0.1                         | 61.4        | 0.08    |
| Dairy prods                     | 1.0                         | 950.4       | 0.10    |
| Processed rice                  | 0.0                         | 43.9        | 0.07    |
| Sugar                           | 0.5                         | 433.1       | 0.12    |
| Food prods n.e.c.               | 9.5                         | 7283.4      | 0.13    |
| Beverages, tobacco prods        | 1.5                         | 2085.0      | 0.07    |
| Textiles                        | 1.3                         | 1887.3      | 0.07    |
| Wearing apparel                 | 0.4                         | 1626.8      | 0.03    |
| Leather prods                   | 0.3                         | 587.9       | 0.05    |
| Wood prods                      | 14.1                        | 2080.9      | 0.68    |
| Paper prods, publishing         | 5.4                         | 3526.0      | 0.15    |
| Petroleum, coal prods           | 29.9                        | 1314.8      | 2.28    |
| Chemical, rubber, plastic prods | 50.0                        | 4524.6      | 1.10    |
| Mineral prods n.e.c.            | 3.1                         | 1148.9      | 0.27    |
| Ferrous metals                  | 1.6                         | 405.1       | 0.40    |
| Metals n.e.c.                   | 6.2                         | 5669.0      | 0.11    |
| Metal prods                     | 12.4                        | 1670.7      | 0.74    |
| Motor vehicles, parts           | 4.9                         | 511.0       | 0.96    |
| Transport equipment n.e.c.      | 3.8                         | 399.7       | 0.95    |
| Electronic equipment            | 1.7                         | 566.9       | 0.30    |
| Machinery, equipment n.e.c.     | 9.0                         | 752.0       | 1.19    |
| Manufactures n.e.c.             | 0.3                         | 254.4       | 0.13    |
| Electricity                     | 11.1                        | 2222.5      | 0.50    |
| Gas manufacture, distribution   | 4.7                         | 1188.6      | 0.40    |
| Water                           | 7.0                         | 968.1       | 0.72    |
| Construction                    | 2.4                         | 8872.2      | 0.03    |
| Trade, transport                | 199.1                       | 22398.6     | 0.89    |
| Financial, business, etc. serv. | 59.1                        | 14530.7     | 0.41    |
| Public admin., education, etc.  | 0.2                         | 5608.6      | 0.00    |
| Dwellings                       | 0.0                         | 4640.7      | 0.00    |
| Total                           | 2039.0                      | 115796.8    | 1.76    |

TABLE 6  
SUPPLY DRIVEN BY AGRICULTURAL AND FOOD EXPORTS, CHILE  
(1995 US\$ million)

| Sector                          | Sales driven by Ag. Exports | Total Sales | Percent |
|---------------------------------|-----------------------------|-------------|---------|
| Paddy rice                      | 1.4                         | 42.4        | 3.29    |
| Wheat                           | 164.8                       | 902.3       | 18.27   |
| Cereal grains n.e.c.            | 90.0                        | 369.2       | 24.39   |
| Vegetables, fruit, nuts         | 1552.1                      | 3831.6      | 40.51   |
| Oil seeds                       | 14.6                        | 36.8        | 39.86   |
| Sugar cane, sugar beet          | 58.6                        | 342.7       | 17.11   |
| Plant-based fibers              | 2.1                         | 10.4        | 19.78   |
| Crops n.e.c.                    | 205.5                       | 302.7       | 67.90   |
| Cattle, sheep, etc.             | 44.3                        | 713.5       | 6.21    |
| Animal prods n.e.c.             | 50.4                        | 998.4       | 5.05    |
| Raw milk                        | 11.0                        | 354.0       | 3.12    |
| Wool, silk-worm cocoons         | 18.4                        | 119.9       | 15.30   |
| Forestry                        | 9.6                         | 551.1       | 1.74    |
| Fishing                         | 317.4                       | 1352.0      | 23.48   |
| Coal                            | 4.1                         | 64.5        | 6.40    |
| Oil                             | 2.8                         | 133.1       | 2.08    |
| Gas                             | 1.6                         | 70.9        | 2.23    |
| Minerals n.e.c.                 | 72.5                        | 4998.8      | 1.45    |
| Cattle, sheep, etc. meat prods  | 72.4                        | 1089.1      | 6.65    |
| Meat prods n.e.c.               | 40.6                        | 1300.4      | 3.12    |
| Vegetable oils & fats           | 14.6                        | 61.4        | 23.85   |
| Dairy prods                     | 39.7                        | 950.4       | 4.18    |
| Processed rice                  | 2.4                         | 43.9        | 5.55    |
| Sugar                           | 80.6                        | 433.1       | 18.60   |
| Food prods n.e.c.               | 2346.3                      | 7283.4      | 32.21   |
| Beverages, tobacco prods        | 214.1                       | 2085.0      | 10.27   |
| Textiles                        | 15.3                        | 1887.3      | 0.81    |
| Wearing apparel                 | 3.7                         | 1626.8      | 0.23    |
| Leather prods                   | 2.3                         | 587.9       | 0.40    |
| Wood prods                      | 29.0                        | 2080.9      | 1.39    |
| Paper prods, publishing         | 69.2                        | 3526.0      | 1.96    |
| Petroleum, coal prods           | 59.8                        | 1314.8      | 4.54    |
| Chemical, rubber, plastic prods | 145.7                       | 4524.6      | 3.22    |
| Mineral prods n.e.c.            | 21.2                        | 1148.9      | 1.84    |
| Ferrous metals                  | 8.4                         | 405.1       | 2.08    |
| Metals n.e.c.                   | 33.6                        | 5669.0      | 0.59    |
| Metal prods                     | 66.9                        | 1670.7      | 4.00    |
| Motor vehicles, parts           | 7.8                         | 511.0       | 1.53    |
| Transport equipment n.e.c.      | 11.4                        | 399.7       | 2.85    |
| Electronic equipment            | 6.1                         | 566.9       | 1.07    |
| Machinery, equipment n.e.c.     | 22.1                        | 752.0       | 2.94    |
| Manufactures n.e.c.             | 4.3                         | 254.4       | 1.68    |
| Electricity                     | 58.6                        | 2222.5      | 2.63    |
| Gas manufacture, distribution   | 30.4                        | 1188.6      | 2.56    |
| Water                           | 30.4                        | 968.1       | 3.14    |
| Construction                    | 16.4                        | 8872.2      | 0.19    |
| Trade, transport                | 544.7                       | 22398.6     | 2.43    |
| Financial, business, etc. serv. | 433.9                       | 14530.7     | 2.99    |
| Public admin., education, etc.  | 0.6                         | 5608.6      | 0.01    |
| Dwellings                       | 0.0                         | 4640.7      | 0.00    |
| Total                           | 7053.8                      | 115796.8    | 6.09    |



## 6. THE ROLE OF AGRICULTURAL AND FOOD FINAL DEMAND AS A DRIVER OF THE ECONOMY

In this final section we examine the role of agriculture and food products in the Chilean economy with respect to all final demand for agricultural and food products. In addition to export sales (examined in the previous section), the other major source of demand for agricultural and food products is household demand (consumption, C, see Table 1). There is also a small amount of agricultural and food product inventory change reflected in the investment vector. Government demand is also included, although there is almost no agricultural or food demand by the Chilean government except for a small amount of Food prods. n.e.c. (Table 1).

Final demand for food and agricultural commodities is found to account for 23 percent (\$ 27 Billion) of total output in the Chilean economy (Table 7). Virtually all sectors except for Public Admin., education, etc., and Dwellings are impacted to some degree. Eight percent of Paper prods. supply (roughly \$ 294 million) and nearly 5 percent of Wood prods. supply is driven by agricultural and food final demand. For Petroleum, coal prods. and Chemical, rubber, plastic prods. the respective percentages are 14 percent and 12 percent. Six percent of the Forestry sector's output is accounted for by agricultural and food final demand.

The reader may notice that not all of the sales in the agricultural sectors and food processing sectors are accounted for in Table 7. This is because some agricultural and food output is driven by final demand in sectors other than agriculture and food. For example, demand in the Trade, transport sector. drives some supply in the food industries because food is used as input into the transport industry (airlines serve food). In general, agricultural and food final demand drives roughly 85-95 percent of agricultural and food supply, depending on the sector. This leaves 5 to 15 percent of food and agricultural supply to be a function of final demand in other sectors.

## 7. CONCLUSIONS

The purpose of this paper was to first provide an over-view of the basic configuration of the Chilean economy and second to better understand the role and importance of agriculture and food processing in the economy.

The paper is based on the 1986 input-output table as updated to 1995 by GTAP (McDougall, R.A., A. Elbehri, and T.P. Truong, 1998). Given the possibility of errors in the updating process, the data and findings in this paper should be approached with caution. However, as described in the second section of this paper, considerable effort and cross checking for accurate trade flows characterized construction of the data base, so it seemed reasonable to use the data until the central bank comes out with better information in the form of a new table.

The story of the basic flow data is relatively self-evident. Most agricultural commodities are sold mainly to other industries as inputs to be processed into food or sold directly to Chilean households. The only agricultural sector with significant agricultural exports is Vegetables, fruit, nuts. Food exports are mainly

TABLE 7  
 SUPPLY DRIVEN BY AGRICULTURAL AND FOOD FINAL DEMAND, CHILE  
 (1995 US\$ million)

| Sector                          | Sales Driven by Ag.<br>and Food Final Demand | Total Sales | Percent |
|---------------------------------|--|-------------|---------|
| Paddy rice                      | 37.9   | 42.4        | 89.43   |
| Wheat                           | 844.1  | 902.3       | 93.55   |
| Cereal grains n.e.c.            | 347.0  | 369.2       | 94.00   |
| Vegetables, fruit, nuts         | 3672.5                                       | 3831.6      | 95.85   |
| Oil seeds                       | 35.0   | 36.8        | 95.23   |
| Sugar cane, sugar beet          | 315.8  | 342.7       | 92.16   |
| Plant-based fibers              | 8.2  | 10.4        | 78.84   |
| Crops n.e.c.                    | 293.7  | 302.7       | 97.02   |
| Cattle, sheep, etc.             | 621.7  | 713.5       | 87.14   |
| Animal prods n.e.c.             | 898.6  | 998.4       | 90.00   |
| Raw milk                        | 327.1  | 354.0       | 92.42   |
| Wool, silk-worm cocoons         | 108.3  | 119.9       | 90.33   |
| Forestry                        | 34.6   | 551.1       | 6.27    |
| Fishing                         | 934.9  | 1352.0      | 69.15   |
| Coal                            | 15.3   | 64.5        | 23.81   |
| Oil                             | 8.9  | 133.1       | 6.66    |
| Gas                             | 5.1  | 70.9        | 7.18    |
| Minerals n.e.c.                 | 234.8  | 4998.8      | 4.70    |
| Cattle, sheep, etc. meat prods  | 942.8  | 1089.1      | 86.56   |
| Meat prods n.e.c.               | 1151.4                                       | 1300.4      | 88.54   |
| Vegetable oils & fats           | 59.0   | 61.4        | 96.06   |
| Dairy prods                     | 853.2  | 950.4       | 89.78   |
| Processed rice                  | 37.6   | 43.9        | 85.60   |
| Sugar                           | 402.9  | 433.1       | 93.03   |
| Food prods n.e.c.               | 6880.0                                       | 7283.4      | 94.46   |
| Beverages, tobacco prods        | 1924.2                                       | 2085.0      | 92.29   |
| Textiles                        | 49.8   | 1887.3      | 2.64    |
| Wearing apparel                 | 13.2   | 1626.8      | 0.81    |
| Leather prods                   | 8.1  | 587.9       | 1.38    |
| Wood prods                      | 101.2  | 2080.9      | 4.86    |
| Paper prods, publishing         | 294.2  | 3526.0      | 8.34    |
| Petroleum, coal prods           | 189.4  | 1314.8      | 14.40   |
| Chemical, rubber, plastic prods | 523.2  | 4524.6      | 11.56   |
| Mineral prods n.e.c.            | 133.7  | 1148.9      | 11.64   |
| Ferrous metals                  | 32.9   | 405.1       | 8.13    |
| Metals n.e.c.                   | 131.9  | 5669.0      | 2.33    |
| Metal prods                     | 251.9  | 1670.7      | 15.08   |
| Motor vehicles, parts           | 23.0   | 511.0       | 4.51    |
| Transport equipment n.e.c.      | 35.8   | 399.7       | 8.95    |
| Electronic equipment            | 20.4   | 566.9       | 3.59    |
| Machinery, equipment n.e.c.     | 65.1   | 752.0       | 8.66    |
| Manufactures n.e.c.             | 14.6   | 254.4       | 5.75    |
| Electricity                     | 236.9  | 2222.5      | 10.66   |
| Gas manufacture, distribution   | 119.6  | 1188.6      | 10.06   |
| Water                           | 112.5  | 968.1       | 11.62   |
| Construction                    | 66.5   | 8872.2      | 0.75    |
| Trade, transport                | 2114.7                                       | 22398.6     | 9.44    |
| Financial, business, etc. serv. | 1596.9                                       | 14530.7     | 10.99   |
| Public admin., education, etc.  | 2.0  | 5608.6      | 0.04    |
| Dwellings                       | 0.1  | 4640.7      | 0.00    |
| Total                           | 27132.6                                      | 115796.8    | 23.43   |

concentrated in Beverages, Tobacco prods. sector and the Food Prods. n.e.c. sector, with the latter sector having more that \$ 2 billion in export sales.

The story of the role of agriculture and food final demand as a driver of supply throughout the economy is summarized in the final table. Roughly, one quarter (23.4 percent) of total supply in Chile is driven by final demand in the agricultural and food processing sectors. Virtually all industries in Chile owe some of their sales to their linkage with agriculture and food. For selected and important manufacturing sectors like Petroleum, Chemicals and Mineral prods. this linkage accounts for about 12 to 14 percent of their total sales. In the utility sectors as well as the transportation and business services industries, 10 to 12 percent of their total sales is linked to final demand for agricultural and food products.

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