Statistical experience in compiling the input-output tables (IOT) based on the Chilean National Accounts 2008 Benchmark Compilation[1]

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[1] This paper is based on the methodological developments of the National Accounts Department, Central Bank of Chile. More detailed information can be found in www.bcentral.cl.

Abstract

This paper presents Chile's experience in preparing the National Accounts 2008 Benchmark Compilation, from which are derived the Input-Output Tables (IOT) based on Supply-Use Tables (SUT). This project required the availability of a great volume of statistical data on the different economic activities (industries) and variables, furthering the incorporation of SNA recommendations and defining more detailed activity and product classifications. Given the characteristics and scale of a National Accounts Benchmark Compilation, this project has been ongoing since 2009 and was published in December 2011. It presents SUTs for 176 products and 111 activities and a symmetric IOT for 111 activities and 111 products. The SUT transactions, of both domestic and imported goods, are valued at basic prices, producer and purchaser prices.

This paper describes the experience of organizing, validating and processing basic data used for compiling production accounts and SUTs, in order to draw up the input-output tables within the framework of national accounts, all of which involved considerable effort of data compilation and conciliation.

Basic information was mainly gathered from surveys carried out by the National Statistics Office (INE) and the Central Bank of Chile (CBCh), administrative registers and special studies in the case of some industries and variables. All this data was organized, systemized and validated according to national accounts criteria, and used to draw up industrial production accounts, and at the same time those of supply and hypothetical use of each product, both intermediate sales and final demand.

Conciliating the SUTs was an iterative process which allowed an equilibrium to be achieved between supply and use for each product, a process which involved arbitrating differences by analyzing the economic consistency of the results and the reliability and quality of the data sources used.

1. Introduction

Benchmark compilations (BC) of National Accounts constitute the most detailed estimation for macroeconomic aggregates for an economy for a given year. The main objectives of these compilations are, firstly, to revise previous estimates obtained from non benchmark years (follow up compilation), secondly, to introduce comprehensive innovation in methods and new classifications of industries and products, and, thirdly, to gather data for the preparation of the input output tables (IOT). Given the characteristics and scale of a National Accounts Benchmark Compilation, a considerable effort in terms of data collection, compilation and conciliation are required.

This paper presents the experience of Chile in preparing the National Accounts 2008 Benchmark Compilation, from which are derived the Input-Output Tables (IOT) based on Supply-Use Tables (SUT). This project has been ongoing since 2009 and was published in December 2011. It presents SUTs for 176 products and 111 activities and a symmetric IOT for 111 activities and 111 products. The SUT transactions, of both domestic and imported goods, are valued at basic, producer and purchaser prices.

The 2008 BC represented a significant improvement in the compilation of Chilean National Accounts. The project considered extended information collection and a comprehensive use of the habitual sources available for any follow-up year. All this data was organized, systemized and validated according to national accounts criteria, and used to draw up industrial production accounts and, at the same time, those of supply and hypothetical use of each product, both intermediate sales and final demand. Conciliating the SUTs was an iterative process which allowed balancing supply and use for each product. This process involved arbitrating differences by analyzing the economic consistency of the results and the reliability and quality of the data sources used.

In addition, several innovations were introduced with the 2008 BC, following international recommendations set in SNA.

The main innovations in terms of sources of information are, firstly, redesigned forms for structural economic surveys, secondly, inclusion of new relevant sources not available for follow up compilation, such as household budget survey and agricultural census, among others, thirdly, execution of specific studies, including agriculture/livestock and forestry, trade margins, and passenger transport, and finally, revised and updated business register.

The main innovations in terms of methods are, firstly, the definition of more detailed activity and product classifications, secondly, new estimation method and allocation of financial intermediation services indirectly measured (FISIM), thirdly, the introduction of the “user cost” method in the estimation of dwelling services, and finally, the registration of software and mining prospection as gross fixed capital formation (GFCF).

The paper is organized as follows. Chapter 2 presents the experience of organizing, validating and processing basic data used for compiling production accounts and SUTs. Chapter 3 describes the processing of the data into national accounts in order to draw up production accounts and expenditure side variables. Chapter 4 presents the methods used to compile SUTs and the iterative process of balancing supply and use. Chapter 5 shows how IOTs are obtained from SUTs. Finally, Chapter 6 presents some final remarks and the main conclusions.

2. Data Sources: Organization and Validation

As stated above, the 2008 BC considered an extended information collection and a comprehensive use of the habitual sources available for any follow-up year. The main information sources used for this compilation were economic surveys and case studies, administrative records and special studies conducted by the CBCh.

Economic surveys were collected for almost all industries and were conducted either by the INE or the CBCh, obtaining, in all, information for a sample of more than 14.000 establishments/companies.

Previous to the collection process, a significant effort was made in terms of standardizing the contents, nomenclature and valuation of the questionnaires. The forms of the surveys were organized in a modular basis, covering the information required for the compilation of industrial production accounts and expenditure side variables. The modular organization of the survey made possible to collect significant information regarding the innovation that were introduced in this exercise, such as GFCF in software and a more detailed product classifications.

Administrative records were used more intensively than in previous BCs, involving greater number of variables and enlarging the coverage of them. The records used in the 2008 BC included tax, financial, and foreign trade data, provided mainly by the Tax Revenue Service (SII) and National Customs Service (Customs), among other governmental institutions. The main innovation in this matter was the inclusion of information on higher value purchases/sales and real estate transactions, both from SII.

In the process of validation and imputation of the administrative records, the use of statistical techniques was extended, making possible to analyze a larger number of variables and obtaining improved results compared to previous compilations.

In addition to the above mentioned sources of information, special studies were conducted by the CBCh in order to collect specific information of industries not covered appropriately with surveys or administrative records. This is the case for agriculture/livestock, forestry, construction, capture fishery and aquaculture, trade, and passenger road transport. These

studies gathered information on prices of products, inputs and trade margins, needed for estimating production accounts.

A variety of other statistics were use in this BC, including Consumer Price Index (CPI), Producer Price Index (PPI), product prices, employment and compensation of employees, companies' balance sheets, financial statements, annual reports and statistical yearbooks of various institutions and industries.

Additionally, the 2008 BC incorporated new sources of information that were not available in the previous BC. Specifically, this exercise incorporated the VII Agricultural-Livestock-Forestry Census, I Fishery and Aquacultural Census, and Household Budget Survey (EPF). Both censuses presented a significant contribution in the elaboration of production accounts related to agriculture and aquaculture industries, while EPF improved the estimation of the household consumption.

3. Compiling industry production accounts and cross-industry estimates

3.1. Industry production accounts

Production accounts are compiled using three methods, censused industry, sampled industry and product. The choice of the method depends on the available information for each industry. Where data cover the universe of an industry, the censused method is used, conversely if data covers only a sample of the industry, the sample methods is utilized. In addition, the product method is considered for industries where there is no information of companies or establishments, but instead data on products and prices can be collected.

Censused industry method consists in estimating the total by industry (SUT column total) at the universe level, using data directly from surveys and/or financial statements of all companies. Output breakdown is obtained mainly from the surveys as well as the intermediate consumption (IC) and value added (VA).

Sampled industry method estimates the total by industry (SUT column total) extrapolating to the universe the information obtained from a sample of companies or establishments. Universe level is obtained mainly from tax records provided by SII. Additionally, economic surveys provide information on the sample of production unit, detailing output breakdown as well as costs structure, including IC and VA.

Product method consists in estimating the total by product (SUT row total) at the universe level. It is based on the measurement of value through price and quantity (commodity

flows), by using data on supply of products. Once output levels had been obtained, cost structures were derived based on estimated production functions or economic surveys.

A special characteristic in the compilation of production accounts in Chile is the fact that a hypothetical use is estimated for output. This estimation is based mainly on information collected in the surveys that indicates whether the products is used for final or intermediate consumption, investment, kept in stock or exported.

3.2. Cross industry estimates

Conversely to the compilation of industry accounts, expenditure side and income variables are estimated using diverse methods. The main variables compiled are household consumption, gross fixed capital formation, inventory change and foreign trade.

The estimation of household consumption was based on data obtained in EPF. This survey collected the monthly expenditure from a sample of more than 10,000 households of Greater Santiago and the regional capitals. The sample was expanded to the population universe, separately between Greater Santiago and the rest of the country, based on an expansion factor constructed for each area, based on INE population data. The household consumption vector thus obtained was incorporated in the SUT.

Gross fixed capital formation was estimated by product and demanding industry, using mainly data from the compilation of production accounts of the construction industry, the imports of capital goods, tax records and economic surveys. In the 2008 BC a service component was added as intangible fixed asset, related to software and mining prospecting, in line with the recommendations of the System of National Accounts (SNA).

The estimation of inventories employed varied sources of information, including income tax records, economic surveys and financial statements. In order to ensure comparability with the rest of the expenditure aggregates in the SUT, the method used to obtain the value of the inventory change considered valuating stocks at the average price of the benchmark period (year 2008). To this end, inventory turnover rate (period of product permanence in stock), and inventory entry and exit prices were estimated, in order to elaborate an appropriate deflator.

The main source of information in the compilation of foreign trade is the data from customs that records all transaction of goods between Chile and the rest of the world.

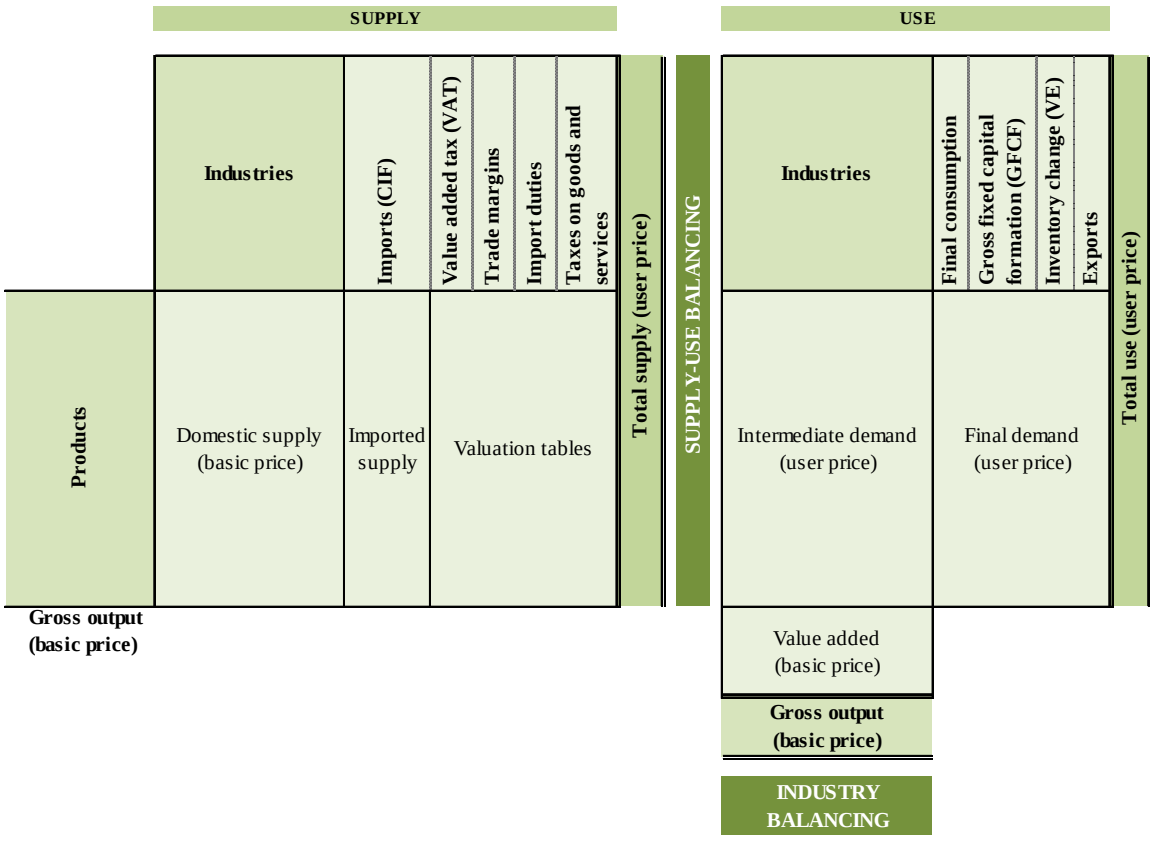
4. Compilation and Balancing of SUTs

The supply-use table (SUT) is the main tool for consistency and integration of the statistics, sorting out the information on supply and use, by product and industry, to ensure accounting balances.

SUTs are composed by two types of tables, transaction and valuation, as shown in figure 1. Transaction tables are supply, use, and value added; while valuation tables are the ones of non-deductible value added tax, trade margins, import duties, and taxes on goods and services.

Figure 1

Components of the supply-use table, user prices



In the case of the supply table, the primary and secondary products within domestic supply were evaluated at basic prices and by industry, using industry data. To register purchases of goods and services within the imported supply component, information from the Chilean customs service was used. To determine total supply at purchaser prices, valuation tables were applied to these two tables at basic prices

Regarding valuation table, wholesale and retail trade margins were estimated using information from a specific study. For domestic margins, margin rates obtained in the study were applied to basic price valuation. For margins derived from imported products, margin rates were applied to the table of imports traded in Chile.

The non-deductible VAT table was prepared using the actual amount collected by the government, which was distributed using a theoretic VAT. The latter was constructed with the purchaser price value excluding VAT, for purchases by exempt industries and for household consumption, which pay tax. The import tariff table, meanwhile, was constructed using records from the national customs service, in which each transaction includes an amount for duties paid. These amounts were reconciled and corrected according to amounts actually received by government. Finally the table for taxes on domestic goods was distributed independently, according to the associated product. Fuels, for example, were distributed among intermediate and final users, while figures for revenues from tobacco taxes were completely assigned to households.

Estimation on intermediate and final uses involves establishing a use hypothesis in the SUT framework. In the use hypothesis for domestic supply, for each product, the total of domestic production was corrected for inventory change in finished and in-process products, to estimate the total supply of domestic products. Exports are subtracted from total supply, thus determining the supply of products available to satisfy domestic demand. In this case, intermediate and final use hypotheses were also developed, with the latter distinguishing between capital and consumption goods.

For the imported supply hypothesis, disaggregated figures for use and commercialization components were used, processing figures for the supply of imported products by customs entry, classified by the type of good, into intermediate, consumption and capital. Two arrays for imported supply by type of purchaser were then developed, one using direct imports by users, and the other imports purchased for the wholesale and retail trade.

Within the demand hypothesis, the intermediate absorption table was constructed using structure for intermediate consumption by type of input for each industry. These figures came from industrial production accounts. The final use table, meanwhile, was estimated by component, as presented in chapter 3.

The value added table was prepared using figures for wages, depreciation and others tax on production from industrial studies. Information from cross-industry analysis, regarding wage estimations, based on tax figures, was also used.

Gross surplus for each industry was obtained as the remainder between the value added and the sum of the rest of their components.

SUTs were elaborated for domestic and imported goods, valued at basic, producer and purchaser prices and with a breakdown of 176 products and 111 activities. Balancing the SUT was an iterative process, which involved arbitrating differences by analyzing the economic consistency of the results and the reliability and quality of the data sources used. In the Chilean context, the information system generally set as predetermined variables associated with the production table, imports, exports, import duties, taxes on production and non-deductible VAT. Less important changes affected variables in the wholesale and retail trade margins and value added tables. The variables subjected to the most analysis were those of less quality for components of final and intermediate absorption.

The process consists in detecting any inconsistencies that may arise and making any necessary ad-hoc adjustments. Data thus corrected are included back into the balancing process, which ends when no more discrepancies are found; in this way, consistency of the SUT is attained.

5. Input output tables

The input-output table (IOT) is a double-entry table that measures the relationships between the markets of goods and services or industries, to facilitate the analysis of the production and demand structure in an economy. IOT columns present production cost structures, while the rows distribute production among the different users. This way, each IOT cell represents a production operation and use of goods or services.

The SUT and IOT tables take different approaches. The SUT look at basic data and ensure their coherence with Gross Domestic Product (GDP) measures using a product, income and expenditure focus, based on ensuring cross-table consistency through microdata-based balancing. The IOT, meanwhile, explores the economy's structural properties and establishes temporal consistency among the records in national accounts.

The procedure to obtain the IOT using SUT is as follows:

a) Converting the total use at purchaser prices into domestic use at purchaser prices: Imports of goods and services are removed from both supply and use. Since this alters the industry equilibrium (column), a row vector of total imports by industry and type of final demand is added.

b) Converting the domestic use at purchaser prices into domestic use at producer prices: Trade margins are re-distributed from each cell of the use of goods matrix, to the trade row. Row and column equilibriums remain.

c) Converting the domestic use at producer prices into domestic use at basic prices: Taxes net of subsidies on products are deleted from both supply and use. Since this alters the industry equilibrium (column), a row vector of taxes net of subsidies on products by industry and type of final demand is added.

d) Converting the domestic use at basic prices into a symmetric domestic matrix at basic prices, that is, the IOT. This one may be either product-by-product (PxP) or industry-by-industry (IxI).

The IOT of the Chilean economy was developed within the framework of the 2008 BC, and it was composed of 111 x 111 industries, under technology-industry assumption.

6. Conclusion

This paper presented the experience of Chile in preparing the National Accounts 2008 Benchmark Compilation. This project represented a significant improvement in the compilation of Chilean National Accounts and required a considerable effort in terms of data collection, compilation and conciliation. The 2008 BC presented several innovations regarding sources of information and methods. In addition, the statistic infrastructure of national accounts as to classifications, methods, and concepts for the new compilation cycle was set.

From this BC onward, follow up estimates will presents SUTs at currents prices with the same breakdown of industries and products than the BC, as well as valuation at basic, producers and purchaser prices. Similarly, IOT will be elaborated and published annually for 111 industries. This represents a significant improvement compared to the previous compilation cycle where IOT were only available for the benchmark year.

Regarding future developments, an important aspect to be explored is the use of statistical techniques in order to balance and reconcile SUTs. In this way, more systematized estimates can be obtained, making results more replicable.

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