# Estimation of SUTs at previous year prices in Chile[1]

Felipe A. Labrin[*]

Viviana A. Rosales [♦]

The purpose of this paper is to present the compilation and conciliation methods used by the Central Bank of Chile in the production of Supply-Use Tables (SUTs). Since the released of the 2008 Benchmark Compilation, SUTs are compiled yearly, both at current prices and in volume terms. SUTs are presented with a breakdown of 111 economic activities and 176 products at current prices and 30 economic activities and 30 products in volume terms. Volume measures are based on previous year prices for each variables contained in the SUTs. This document reviews the compilation methods of production accounts and other variables used for the elaboration of SUTs, as well as its balancing process. In addition, the method to obtain SUTs at previous year prices is reviewed in depth, along with the main information sources and price indicators involved in the process.

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[*] flabrino@bcentral.cl

[♦] vrosales@bcentral.cl

# Introduction

This work attempts to provide a general view of the process of obtaining Supply-Uses Tables (SUTs) at previous year prices. This process is embedded in the compilation of national accounts where SUTs are used as the most suitable instrument to organize and analyse economic information and to ensure consistency between macroeconomic aggregates.

The Central Bank of Chile (CBC) is the legal responsible for producing National Accounts in Chile, and in order to do so, estimates are organized in compilation cycles. Each cycle is composed of a benchmark compilation and several follow ups estimations. The benchmark compilation sets the statistical infrastructure and the methods to be used in every cycle. The most recent benchmark exercise carried out in Chile corresponds to year 2008.

This document presents the methods used in the 2008 Benchmark Compilation (BC) and follow up estimations, for producing SUTs in both current and previous years' prices (PYP). SUTs are compiled firstly at current prices, then, volume terms are obtained through a deflation process, in which a price indicator is selected for every variable contained in the SUT. Gross value added is derived through double deflation, i.e. deducting output and intermediate consumption in volume terms.

The balancing of SUTs in current and previous years' prices is carried out simultaneously, ensuring the consistency between prices and volume measures. During the process, the effects that current prices' adjustments have on balances in volume terms are revised, providing an important feedback to the balancing procedure.

In terms of the structure of this paper, the first section deals with the compilation of SUTs at current prices, focusing on the data sources and briefly presenting the treatment given to the variables for their inclusion in SUTs. While the second part renders a detailed description of the deflation process to obtain PYP SUTs, the third section presents the balancing process of SUTs. The final section gives the concluding remarks of this work, and presents the future improvements to be included in SUTs compilation in the context of a new Benchmark Compilation 2013.

# SUTs at current prices: Sources and Methods.

In this section we briefly review the compilation of the datasets needed to obtain SUTs at current prices, previous to the balancing process[2].

SUTs in Chile are compiled yearly, at a breakdown of 145 industries by 240 products aggregations[3]. The construction of SUTs requires the compilation of the following information: Production Accounts (PA), Foreign Trade in goods and services and other Final Demands.

Regarding Production Accounts (PA), they are compiled for 145 industries. The sources of information for these accounts include administrative records and economic surveys, among others[4]. Three different methods are used in order to compile these accounts and the specific use of each of them depends on the available information for the corresponding industry. The methods are:

- ❖ *Censused Industry Method*: It is utilized when there is total coverage of an industry in terms of Output, Intermediate Consumption (IC) and Gross Value Added (GVA). Most of the sources used in this method are economic surveys and cover the vast majority of statistical units.

- ❖ *Sampled Industry Method*: This method is more suitable for atomized industries in which a census is difficult to carry out. In this case, sample estimations for Output (generally obtained from economic surveys), IC and GVA are extrapolated to the population level, measured mainly by administrative records.

- ❖ *Product Method*: It is used in cases where there is no available information at the establishment level, but there are measures for the production of goods or services at the population level (commodity flows).

A special feature of the compilation of PAs in Chile is that a hypothetical use is produced. That is, the output of industries enters the process of balancing, already assigned to the different uses in the SUTs (Guerrero, 2012). This hypothetical assignment is mainly estimated with information from economic surveys and according to the characteristics of the good or service in question. Further on in the process this hypothetical use will be compared during the balancing phase to the actual vectors conforming the use side of the SUTs.

Foreign Trade in goods and services data is collected mainly from the National Customs Service and by the Central Bank of Chile. The retrieved information is collected from economic surveys or administrative records depending on the institution and it is processed by the Balance of Payments

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[2] More detailed information on the basic data and sources is provided in the Benchmark Compilation of National Accounts of Chile 2008 (Banco Central de Chile, 2011), in Spanish.
[3] The aggregation level at which SUTs are published is 111 activities to 176 products.
[4] For a more detailed enumeration of the different sources, see (Guerrero, 2012).

Department. For its use in the balancing process, imports are also allocated in hypothetical uses in the same way domestic supply is. The allocation is based on the characteristics of the good or service, recognizing products with dual use, such as, for example, fuel that can be used for household final consumption or for intermediate consumption of the transport industry. Furthermore, goods and services allocated as intermediate consumption are broken down by its user industry. This allocation will allow, later on, the obtaining of domestic and imported intermediate consumption separately.

As to Final Demands estimations, vectors of use are compiled in addition to the hypothetical use collected from the PAs and imports. Household Expenditure is measured by a mix of economic surveys, primarily the Household Budget Survey[5] (EPF, by its Spanish initials) and several monthly indicators.

Government Final Expenditure is obtained from the Fiscal Statistics and other public offices, primarily, the General Comptroller of the Republic of Chile. Gross Fixed Capital Formation (GFCF) is estimated by product and demanding industry using sources that range from imports of capital goods, tax records and economic surveys. Finally, Changes in Inventories (CI) are estimated by product, using Economic Surveys, administrative records and business records. Concerning the CI, it is important to mention that a specific method is used to obtain measures at average year prices, as business records and other sources are measured at the end of the year prices[6].

It is important to note that all the information obtained from the different variables mentioned above is compiled in current terms. SUTs are composed by transactions, placing domestic supply from industries and imported goods and services on the supply side of the table. Regarding the valuations of these measurements, domestic supply is measured at basic prices whilst imports are collected at CIF, next to them, as shown in Figure 1, the valuation tables take supply into purchasers' prices by adding the 1) Value Added Tax (VAT), 2) Trade Margins, 3) Import duties and 4) Taxes on goods and services. On the other hand, all the components of the uses side of the table are measured at purchasers' prices allowing the process to equal both sides for each product. However, variables in the uses side can also be split into their corresponding valuations, making possible to go easily from equilibrium at purchasers' prices to equilibrium at basic prices.

At this stage of the process, the information available allows the estimation of the main macroeconomic aggregates. GDP can be obtained by industry, the expenditure side and by income. However these measures will not necessarily be consistent with each other and a process of balancing is needed to obtain a more accurate measure of the GDP.

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[5] This Survey is carried out by the National Institute of Statistics (INE), and it is also used in the elaboration of the Consumer Prices Index (CPI).
[6] (Banco Central de Chile, 2011)

**Figure 1: Supply - Uses Table (SUT) and its components**

# Obtaining SUTs at Previous Year Prices: Sources, Methods and Results

The process of obtaining SUTs at PYP can be described broadly as a deflation process which takes SUTs at current year prices and delivers estimations at PYP for each variable within the SUTs. In this section we will review: 1) The price indicators used in PYP SUTs and 2) The process of deflation and its outcomes.

<div align="center">Price Indicators used in SUTs at PYP</div>

There are three main sources of information for prices. The first are Price Indexes compiled and published monthly by the National Statistic Institution (INE). The following Prices Indexes are used by the CBC for obtaining SUTs at PYP:

- ❖ *Consumer Prices Index (CPI)*: measures the evolution of prices of a fixed basket of personal consumption. The basket is derived from the EPF and it collects information for 321 families of products classified using the COICOP. The survey is conducted on urban selling points and it is representative at a national level[7]. It is matched to the internal classifications of products, followed by the CBC, which is based on the CPC.

- ❖ *Producer Prices Index (PPI)*: this index follows the change in basic prices of products excluding any kind of services related to its commercialization and transportation. Surveys are carried on an industry/product basis and the classifications used are the ISIC rev.3 for industries and the CPC for products.

- ❖ *Labour Cost Index (LCI)*: this index measures the evolution of the labour cost based on the total of hours paid, including all the expenses incurred by companies in maintaining their workers, this means that within this index, wages and non-ordinary expenses are included. The measurements are representative at national level, and are compiled by industry (ISIC rev.3). In order to include these indicators in the compilation of SUTs at PYP, an industry/product match is needed. The use of this indicator is concentrated among services.

Along with the set of indicators reviewed above, other sources of information are also utilized. Three sources are the most significant:

- ❖ *Foreign Trade information*: Data of exports and imports of goods allow for the calculation of Unit Value Indexes (UVIs). Although UVIs are not the recommended instrument to measure the evolution of prices - due to their inability to capture the heterogeneity of goods within each aggrupation and the ever increasing quality of new manufactured goods - they

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[7] For detailed information on the elaboration of this index, see (Instituto Nacional de Estadísticas de Chile, 2013)

are used as second best for deflating foreign trade data. The shortcomings of UVIs are corrected partially by calculating indexes at a higher breakdown (8 digits of the harmonized system). For imports, UVIs are calculated using a sample of codes of the harmonized system, in order to remove some of the heterogeneity observed in some products, for example n.e.c. codes (not elsewhere classified). In the case of high technology products, UVIs are not estimated, instead, international price indexes are used. For exports, on the other hand, UVIs are obtained for most of the products, since they are less heterogeneous and more intensive in commodities[8].

❖ *PAs implicit deflators*: In some cases, the compilation of production accounts provides information on volume for their principal outputs and/or intermediate consumptions whenever available or plausible. This information allows the obtaining of implicit prices which are used in the deflation process.

❖ *Changes in Inventories deflator (CIDs)*: This indicator is obtained directly from the compilation process carried out for change in inventories. It considers the turnover rate of products held in stock and assumes mainly a FIFO[9] accounting method.[10]

The process of deflation and its outcomes

Deflation of SUTs is carried out for transactions on the uses side at basic prices, distinguishing by origin (domestic or imported).

Each transaction follows an algorithm in order to determine the best available price. As it has been stated above, PAs can offer specific deflators for some products and industries. These deflators are considered the most suitable, whenever available. In the absence of them, the selected price indicators are:

❖ *Intermediate Consumption*: PPI is the main deflator for goods of domestic origin, for imported goods, the best available prices are UVIs. On the other hand, services are mostly deflated by LCI independently of their origin.

❖ *Final Consumption*: In the case of domestic and imported supply of goods for final consumption the selected deflator is the CPI. For services, LCI is also used.

❖ *Gross Fixed Capital Formation*: Domestic supply for GFCF is deflated according to the PPI if it refers to goods and LCI when it refers to services. For GFCF of goods from a foreign origin the best choices are UVIs, while services are deflated by LCI.

❖ *Changes in inventories*: CI of both domestic and imported origin are deflated using CIDs

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[8] For a better understating of the methodology used by the CBC, see (Méndez, 2007).
[9] (First In, First Out).
[10] The methodology of this indicator is presented in (Banco Central de Chile, 2011)

Once the vectors of uses have been adjusted, the supply side of SUTs is obtained by applying the aggregate deflators from the uses side of SUTs to domestic and imported supply separately. Other valuations on both sides are given the evolution of the basic price component.

Despite the deflation process, some specific cases require a more detailed treatment. One of these cases is non-market production industries. As their production is not provided at market prices, the amounts of the services provided are estimated by the cost of production, that is, by adding the components of IC and GVA. Therefore, price indicators for production cannot be calculated. As an alternative, price indicators for the components of production are elaborated. Intermediate Consumption is deflated by prices already obtained in the IC algorithm. GVA components are deflated by the LCI lines associated to public offices, the government, public schools and public health. The reason to this particular choice is that wages have the highest share of GVA of those industries.

Regarding valuations within transactions, one important concern in the process is to keep the ratios of composition inside each transaction stable. For this, previous year monetary ratios are the first hypothesis, and it stands as definitive in the absence of any other information indicating a particular change of the composition within each transaction. In detail, imports duties are given the evolution of the CIF component of imports, preserving its participation, everything else constant. In the case of trade margins, previous year participation is maintained, as long as no new information is available.

## Balancing Process: Methods and Analysis

Besides deflation, which has already been presented, there is another main aspect of the compilation of SUTs: the balancing process. The need for it comes from the natural discrepancies reached between variables obtained from a wide scope of sources. Those discrepancies are often referred to as "gaps". Consistency between variables will be achieved by means of multiple adjustments in order to balance the supply and demand of the diverse goods and services in the entire economy. Those adjustments might alter any variable in the SUTs, being the less robust sources the ones that receive most of the adjustments in order to close or shorten the gaps. However, as it can modify parts of output or parts of intermediate consumption, it is also possible to balance industries as well as products. The latter is the reason why this process can be described as being both iterative and simultaneous, that is, it is possible that balancing a product might affect the previous balance of and industry, and vice versa (Banco Central de Chile, 2011).

There are two methods most distinctively used by the CBC. The first of them is the s*ystems approach*, which brings out gaps and resolves them iteratively in order to achieve cross section balances. The second method, the *optimization approach*, takes into account the time-series behaviour of variables, in order to settle the discrepancies or reduce the existing gaps[11].

Within the set of adjustments introduced at this stage, it is important to mention that it is possible to introduce adjustments in price indicators in order to achieve more accurate measures of the transactions involved. This becomes of importance when the underlying evolution of the variable in volume terms shows inconsistency but the measured at current prices does not admit further adjustments due to its own evolution or robustness.

The iterative and simultaneous character of the balancing process brings forth important implication to the deflation, which is constantly fed back by adjustments in current year prices, that is, whenever a new equilibrium is reached, the resulting SUTs needs to be deflated. The number of iterations will depend on the magnitude of the original gaps and the overall quality of the estimations for each variable. However, once a definitive equilibrium in current prices is reached, a last iteration is carried, obtaining the definitive SUTs at PYP simultaneously

After the closure of the balancing process, the SUTs at PYP are grouped up to a breakdown of 30 economic activities and 30 product families, in order to be published. It is worth noting that the breakdown at current year prices is 111 economic activities and 176 products families.

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[11] (Banco Central de Chile, 2011).

# Further improvements and concluding remarks

This paper is an effort to depict the entire process of obtaining SUTs at PYP. The relevance of this document is that it details the logic followed by this method, as well as all of the inputs required for the process to be performed. It reviews the different types of indicators used, and the treatment given to them for its correct inclusion in the context of the compilation of National Accounts. In addition, it presents the selection of prices followed for every transaction composing the SUTs. It reviews the general cases and some specific necessary adjustments, as the deflation of non-market activities.

It can be concluded from the depiction of the process that a higher breakdown in SUTs would increase the robustness of estimations, as it would allow for a better allocation of supplies into their uses, as consequence of the latter, a more accurate selection of price indicators could be carried out for each transaction and products in the SUTs.

In the current setting, there are several opportunities to improve the process both theoretically and practically. The CBC seeks to tackle these challenges in the context of the new Benchmark Compilation 2013, and its consecutives follow up estimations.

One improvement is the utilization of a monthly inventories survey. This survey [12] collects information of the stocks of products kept by business in the mining industries, the manufacturing industries and the trading sector. The availability of this survey allows the estimation of monthly changes in inventories. The information of the survey delivers a better identification of the products maintained in stock, as well as, a monthly estimation of the turnover rate. Both components represent an improvement for the calculation of the change in inventories deflator.

In addition, the CBC is exploring the use of statistical techniques for automatic balancing. Their introduction would perform non-arbitrary adjustments in prices, volume and current prices values and would provide significant improvement in terms of the reliability of results. Furthermore a systematic process of balancing would allow implementing a wider breakdown in the SUTs, improving, as mentioned before, the quality and opportunity of its results.

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[12] The EMI is collected by INE. For more information see (Instituto Nacional de Estadísticas de Chile, 2014)

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