

The New Chilean CPI 2008

Eugenio Alviz, Liliana Barriga, Francisco Bilbao, Christian Hurtado, Pamela Inostroza, Paulina Lamatta, Claudia Matus, Carlos Saavedra, Cristóbal Videla-Hintze.

National Institute of Statistics

Technical Sub Direction

Consumer Prices Index, Studies Unit

September, 2007

Abstract

The New Chilean CPI will be a monthly sensor of the prices of a basket of usual consumption items for a typical consumer. Its main goal is to capture and register the monthly changes of the prices of this basket. The geographical scope of the CPI will be the 15 regional capital cities of the country; hence it will be only an urban CPI of large cities. The CPI must avoid medium and long term influences and inertias. It is a macroeconomic indicator. The CPI will be published together with some analytical indices, such as deseasonalized indices, cycle indicators and other indices: hedonic indices, core inflation indices and macroeconomic deflators.

A Household Budget Survey and the Point-of-Sales Survey will be conducted in order to estimate the structure of the basket and where the market prices are to be measured. The structure of the basket will be determined in order to fit international CPI standards.

Each product will be characterized through its varieties. Price changes will be calculated as the quotient of the price of a variety sold in an outlet at month m with the price of the same variety sold in the same outlet at month $m-1$. The price change of the variety will be calculated as the geometric mean of these quotients, especially because of the stability of this indicator.

The averages prices of the items will be published monthly. Strong seasonality cases will be solved through imputations algorithms. Quality adjustment will be applied to high tech commodities

1 Introduction

INE-Chile is currently updating the Chilean CPI, its latest methodological revision was undergone back in 1998. The New CPI is expected to be published on January 2009, with base December 2008.

The main issues to be discussed in this methodological revision of the Chilean CPI are:

1. Update of the CPI basket
2. Geographical scope of CPI
3. Sampling
4. Treatment of seasonal products
5. Quality adjustment
6. Analytical Indices
7. Special Cases: imputed rentals, health expenditure, finances services ,education
8. Method of calculation and formulae of New Chilean CPI

2 Update of the CPI basket

Currently, the Chilean CPI (Base December 1998) contains 8 Groups of goods and services not matching the ILO CPI Manual for COICOP¹ classification. Moreover, all the CPI basket weights are fixed, and were derived from the Household Budget Survey for 1996-97 and the Purchase Points Survey from 1997.

There are two problems to be addressed in relation to updating the CPI basket: firstly, the change in the basket classification schema in one hand, in order to make it similar to COICOP, and in the other hand for allowing enough flexibility for adapting the CPI to a changing market; secondly the way the weights are going to be treated, which ones are going to be held constant and which ones are going to be variable, and how they are going to change considering goods and services market researches.

2.1 *CPI Adaptation to COICOP classification.*

The classification structure of the current CPI (Base December 1998) goods and services (products) basket is oriented to distinguish two levels. The basic or elementary item level and the superior levels. On one hand, at the elementary level a product is represented by several "varieties", which is an item detailed description that allows the actual collection of prices; on the other hand, a set of varieties are the component of a "product", for which it is not possible to collect prices, because it is an abstract entity. For instance, it is not possible to buy the product "apple", and therefore has no price; what you buy is a variety, say, a "red", "green" or "yellow" apple; at this level (variety level) the prices are collected.

The 483 product weights were derived from the Household Budget Survey from 1996-1997; but the variety product weights were obtained from the Purchase Points Survey from 1997. All the product weights are held constant during the time from one to the next Household Budget Survey, i.e. ten years. Some of the variety product weights were changed after the results of market researches.

¹Classification of Individual Consumption according to Purpose

The hierarchical level of Chilean CPI (with numbers of item at each level in parenthesis), from button to top, is showed in Figure 1.

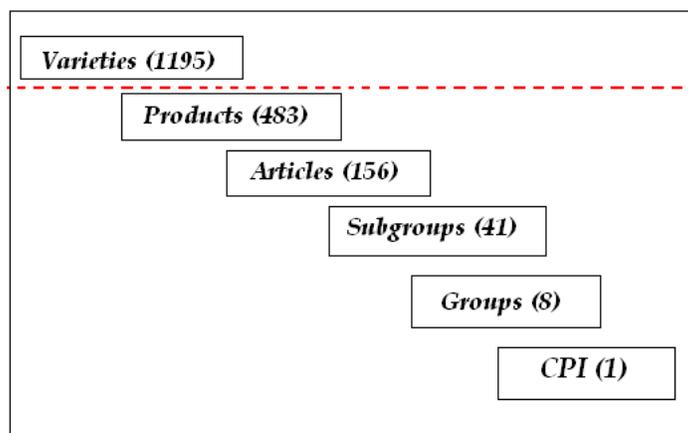


Figure 1: Hierarchical classification of Chilean 1998 CPI (in parenthesis are the number of items at each level)

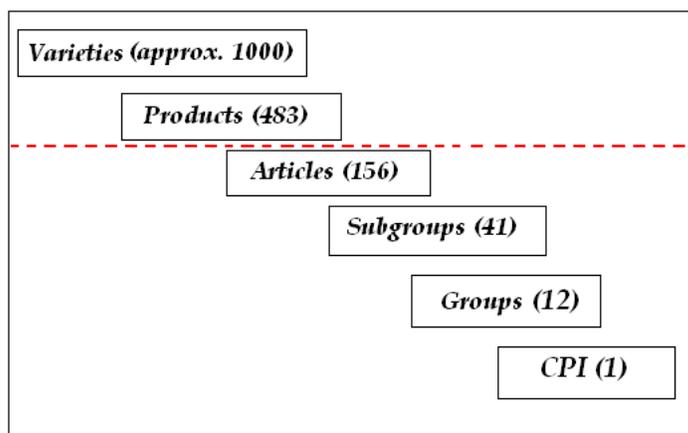


Figure 2: Hierarchical classification of Chilean 2008 CPI (in parenthesis are the number of items at each level)

There are two main changes in the structure of the CPI basket for this new updated CPI version: the number of groups increases from 8 to 12; and the level of publishable micro indices goes from product to article while its number decreases from 483 to approximately 200.

The adaptation to COICOP is a relevant step towards making the Chilean CPI internationally comparable.

The main changes in the CPI basket structure are:

The Food Group is divided into two groups: Group 1 'Food and Non-Alcoholic Beverages' and Group 2 'Alcoholic Beverages and Tobacco'. Besides, the item 'Food outside Home' is re-classified into Group 11 'Restaurants and Hotels'.

There is no place to the item 'Narcotics' in Group 2 'Alcoholic Beverages and Tobacco', because it would be impossible to collect those prices on a monthly base.

Group 3 'Clothing and Footwear' remains practically the same, except for the item 'Personal Effects' (belts, watches, etc.) which is re-classified into Group 12 'Miscellaneous Goods and Services'.

To Group 4 'Housing' is added an important item 'Imputed rentals of owners occupying their main residence' that currently is not computed. It is relevant because the proportion of home-owners in Chile is nearly 80%.

In Group 5 'Furnishings, Household Equipment and Routine Household Maintenance' the item 'Communication' is re-classified into Group 8 'Communication'.

In Group 6 'Health' the item 'Personal Care' is re-classified into Group 12 'Miscellaneous'.

The item 'Used Cars' is deleted from Group 7 'Transport'. In Chile it is forbidden to import used cars so the resale of used cars should be considered a transfer between households.

Group 8 'Communication' is added to the CPI basket. It contains the items 'Telephone Services' and 'Postal Services'. Those items were previously classified in Group 5 'Household Equipment and Maintenance'. In this Group precisely INE has a slight difference with COICOOP: the technological development makes very hazardous to separate telephone services, internet services and subscriptions to television networks; this is the reason INE classified all those services into this Group.

The item 'Information processing Equipment' is added to Group 9 'Recreation and Culture'. Currently the item is in Group 5 'Household Equipment'.

Following COICOP guidelines, in Group 10 'Education' only remains educational services. The items that currently are in this Group, like 'School Transport', 'Food at School', etc., are re-classified into their own Groups.

Group 11 'Restaurants and Hotels' receives item 'Food Outside Home' from former Group 'Food'.

As previously pointed out, the item 'Personal Care' from former Group 'Health' is re-classified into Group 12 'Miscellaneous Goods and Services' and the item 'Tobacco' is re-located into Group 2 'Alcoholic Beverages and Tobacco'.

2.2 The basket weights derivation

The basket product weights are mainly derived from the Households Budget Survey 2006-2007, the Point-of-Sale Survey 2007, and from others sources of information, such as some sectors of the economy (utilities, health, financial services, and other) that are regulated by governmental entities.

An interesting difference with the latest weight revision of year 1998, is the use of the Point-of-Sale Survey, instead of the Point-of-Purchase Survey. The household lack of objectivity answering the Point-of-Purchase Survey makes the latter less reliable than the former.

Another weight issue arose from "Financial Services" item. In this item only financial intermediation costs should be accounted for. Unfortunately in 1998 the Household Budget Survey did ask for financial service expenditure not distinguishing credit amortization from the cost of financial services. Consequently this item weights is presumed to be overestimated.

2.3 Constant and variable basket weights

Dot lines in Figures 1 and Figure 2 show the distinction between constant and variable CPI weights. In Figure 1 the line lies between varieties and products, indicating that variety weights can change from one period to the next while the product weights must be held constant until the next methodological revision.

There are three aspects or requirements to be considered: firstly, as previously said, the product/article weights must be held constant; secondly, the product/article micro indices are to be published; and thirdly, the product/article incidence on CPI of must be published.

The CPI face several problems satisfying those requirements

Firstly, in respect to the weights, the item introduction and/or deletion is only allowed at the variety level, from one revision to the other (approximately ten years). Technological changes in our society are far more dynamic. We need to have the possibility to delete and/or to introduce new products, not only varieties, at least on a yearly basis.

Secondly, it is questionable that the micro index publication for example of 'banana' has any sense at all; instead, it is surely relevant, at least for some economy sectors, to know the 'Fresh Fruits' micro index behavior (cf. Ducharme, 2007, p. 6)

Finally, incidences are the proportion in which an item accounts for the monthly CPI change. Again, the question is about the 'banana' incidence relevance in the monthly CPI change.

For these reasons, INE is moving the dot line from varieties/products to products/articles. This change gives appropriate solutions to the problems. With the New Chilean CPI there will be approximate 200 articles with constant weights during the life cycle of the December 2008 Base CPI, and INE will publish a maximum of 200 (instead of 483) microindices and incidences monthly.

The proposition for the New Chilean CPI considers that varieties and products will have dynamic weights in the basket, changing accordingly to market researches and studies. Those changes will be informed and published as relevant facts once a year, and before they are applied.

3 Geographical scope of CPI

The current CPI scope is restricted to the city of Santiago de Chile (cf. Schkolnik et al, 1998). The new Chilean CPI 2008 version will also include information from 15 regional capital cities besides Santiago de Chile. However there will be no regional CPI's, only a national one.

The regional capital cities to be considered are in south-bound order: Arica, Iquique, Antofagasta, Copiapó, La Serena and Coquimbo, Valparaíso and Viña del Mar, Santiago de Chile, Rancagua, Talca, Concepción and Talcahuano, Temuco and Padre Las Casas, Valdivia, Puerto Montt, Coyhaique, and finally Punta Arenas.

Several issues arise: methods of spatial aggregation; different regional expenditure weights, new consumption Chilean CPI basket.

In order to select outlets for CPI computation, the following procedure is applied. A pooled outlet set from Santiago de Chile and the 15 regional capital cities is formed. Then each element is classified by product line and sales. Two

sales cut-off points are calculated by product line. The outlets with sales above the highest cut-off point are selected for inclusion in the final outlet sample, a random sample of outlet is selected from the outlets with sales between the two cut-off points, finally the outlet with sales lesser than the lowest cut-off point are not considered for inclusion in the final outlet sample. By this procedure an outlet sample by product line is obtained representing only one big geographical unit: all the regional capital cities including Santiago de Chile.

With this methodology we can only obtain estimations at national level, and not at regional level. In other words, the national level is not an aggregation of regional levels, and we do not have estimations at regional levels.

4 Sampling

The prices used in CPI computation are collected from a probabilistic sample. The sample size will be defined in order to achieve a required precision for the overall CPI. Since the publication of micro-indices is also required, we will explore the possibility of defining an appropriate precision for those indices.

The CPI is formed by aggregation of the elementary variety indices to upper level (see section 7), since the prices are collected from a probabilistic sample of outlets, those elementary variety indices are in fact random variables with some underlying probability distribution which is determined by the sampling procedure used in the selection of outlets. The aggregation procedure for the variety indices also defines the probability distribution on the products, articles, subgroups and groups indices. So theoretically we can define an appropriate sample size to control the precision of the mentioned indices. However the usual required precision (5% error with 95% confidence), may indicate a prohibitive sample size. So we plan to control the precision only at the product level.

Since we plan to select the outlet sample using a geographical stratified procedure with probability proportional to sales, the indices probability distribution and therefore their variances will be complicated to obtain. We plan to use re-sampling strategies, as bootstrapping, to determine the appropriate variances and precision of our estimators.

5 Treatment of seasonal products

To calculate a monthly CPI with commodities that are not available in the marketplace during some seasons of the year, poses a significant challenge. Commodities with such behavior, are called strongly seasonal commodities (cf. ILO CPI Manual, 2004, chapter 22).

Obviously it is not possible to calculate a relative price for a commodity, which is present in one month but not the next, then, how can we compute the month-to-month amount of price change for that commodity.

Important seasonal commodities are: many food items; alcoholic beverages; many clothing and footwear items, water, electricity, vehicle purchase; air travel and tourism expenditures.

In the context of producing a monthly CPI, it must be recognized that there is no completely satisfactory way of dealing with strongly seasonal commodities.

In the Chilean CPI the treatment of seasonality is especially relevant for fresh fruits and fresh vegetables; it also

appears in clothing items. The main problem with seasonal products is their disappearance in some month along the year, including their prices. The method to be used has two stages:

First Stage: When a product disappears for a month, for example, the product 'peaches', then group index change is calculated (Food and Beverages, in this case) without that product, i.e. the weight of the product will transitorily annihilated; in this way, a first approximation is to the change in the Group Index is obtained.

Second Stage: The change of the group index calculated in the first stage is imputed to the product index, and a new group index is computed in a second iteration, reincorporating the transitorily annihilated weight of the product and the change imputed to the product index.

Two relevant hypothesis are assumed in applying this method; first, the method is convergent; and second, this approach is appropriate for calculating a monthly prices change, which a significant principle for the Chilean CPI.

The methods discussed in the ILO CPI Manual have an inertia that is not desirable for a CPI like the Chilean one, because in general they include yearly movement of prices that are contradictory with the short-term context of our CPI.

In any case, INE-Chile will continue investigating other methods for seasonality treatment for instance, Chapter 22 of CPI Manual, the works of Diewert et al (2004), Erdogan (2006), and Gudnason (2005).

6 Quality adjustment

6.1 Quality adjustments

The adjustment methods to be used in calculating new Chilean CPI are the following ones:

Implicit methods of quality adjustment: overlap, overall mean or targeted mean imputation and comparable replacement.

Explicit methods of quality adjustment: expert judgment, quantity adjustment, differences in production or option costs and hedonic approach.

6.2 Hedonics function

A price of an hedonic function describes the equilibrium relation between the characteristics of a product and its price. They are used to predict the new good prices, fitted by quality changes products in the prices indices, to measure and value the attributes by consumer and production associated costs.

In particular, the hedonic functions are necessary for two reasons:

When, in a price rise, a product become unavailable and there is a replacement product available, it may differs in quality terms respect to the original.

Since the hedonics regression coefficients are estimations of monetary value per unit of quality component, they can be used to fit price, for example, a previous product price, so that it is comparable to the price of new product.

When talking about quality adjustments by means of hedonics regressions, we must take into account that, depending on the amount and quality of the data, these regressions can be performed by means of diverse econometric techniques. Currently, these possibilities are under study.

6.3 Econometrics estimation

6.3.1 Panel Data

Panel Data will be used in those products where, the amount and quality of information is plentiful and includes a period of more than one year (monthly data).

The products that have the indicated characteristics are:

New cars

Desktop computers.

LCD-Shape TV sets

For new cars, the Chilean National Statistics Institute (INE) signed a commercial agreement with the National Automotive Association (ANAC A.G.), the latter institution has information of brands, models, versions, prices and other characteristics (for a total of forty five characteristics)for all the new cars sold in Chile since 1997.

For desktop computers and LCD-TV, INE is negotiating a commercial agreement with GfK Chile (Growth for Knowledge), study market company that has information referring to brands, monthly and characteristic models prices.

6.3.2 Cross sectional data

It will be used for products with few available information, ie, lesser than one year and where fast technological variation applies.

These products are:

Notebooks

Digital cameras

Mobile or Cell phones

Refrigerators

Washing machines

We will follow:

1. Monthly collection, of different brands, models, versions, prices and basic characteristics.
2. Quality adjustment corresponding facing disappearance and/or specific variety change.

6.3.3 Regression model election

1. The economic theory respect to demand and goods services of consumer and producer.
2. The hedonics coefficients generally reflect the user value, resource costs and different demand - supply equilibrium related situations (Rosen, 1974).

Assuming that:

k characteristic exist at period t, where the characteristics vector is $Z_i^t = [Z_{i1}^t, \dots, Z_{ik}^t]$

The price hedonic regression model is:

$$\ln p_i^t = \gamma_0 + \sum_{t=2}^T \gamma^t D^t + \sum_{k=1}^K \beta_k Z_{ik}^t + \varepsilon_{ik}^t \quad (1)$$

Where D^t is a qualitative variable. The coefficients γ^t are price change estimations, once quality variation effects are controlled, by means $\sum_{k=1}^K \beta_k Z_{ik}^t$.

7 Analytical Indices

This section describes analytical indices, derived from the calculation of CPI as: underlying inflation index, inertial component index, tradables and non-tradables index, durable and non-durable goods, among others. The procedure is based on the construction of price growth rates. The application of this methodology will require the construction of Transference Function Models and adjustment seasonal methods (ARIMA and TRAMO-SEAT), with the purpose of disturbing the behavior of the indices of prices.

The price stability is a fundamental Central Bank aim objective. Central Bank try to accomplish this objective by monetary policies and monitoring prices average variation rate or inflation rate.

To fulfill this objective, the pursuit and correct interpretation of the inflation temporary evolution, becomes an important point within the economic analysis, circumscribed in the analysis to the short, medium and long run.

7.1 Computing and analysis

In conjuncture analysis, especially in economic analysis, an interesting aspect is the growth rates measurement of selected economic variables; in the particular case of price level, this measurement is fundamental.

The analysis of different price indices, as the underlying CPI index, sales tradables and non-tradables goods index, durable and non-durable goods, emerge from necessity to Have/dispose of the analytical measurement evolution of the variable in study.

Other indices to calculate are the seasonal index, applicable not only to general CPI, but also to the different items that compose it, for these two procedures of adjustment will be used, in general:

- (a) Transference Function Models: they allow the incorporation of explanatory variables that bear relation with the dependent variable. The objective of those models is to explain and predict a time series denominated output by time series denominated inputs. Those models are characterized by rejecting the possibility of feedback.
- (b) The times series analysis has two basic objectives: First, it is to obtain a systematic description of fundamental characteristics of observed series. The second objective, is to obtain data about the probable future values of times series, from characterization of series properties. With respect to the immediate goal, a times series can be characterized by following components:
 - i. Long term Trend.
 - ii. Cyclical variation.
 - iii. Seasonal variation.
 - iv. Residual variation.

This decomposition, allows making a better economics analysis of phenomena, giving to analyst a tool to isolate the different causes from series variation.

7.2 Core Inflation Models

When assessing price developments, Central Banks generally make a distinction between permanent and transitory inflation change. Since the recorded consumer price index (CPI) may be subject to some items volatility , Central Banks resort to alternative inflation indicators, which intend to identify the "permanent" component of inflation, by eliminating the temporary price fluctuations. Such indicators are usually referred to in the literature as trend or core inflation indicators.

If ever was a time when inflation was not viewed as the serious problem it is now , it is long gone. Today inflation is associated with declining of real purchasing power of workers and businesses, and with the loss of the productivity trend.

This section presents a theoretical and quantitative analysis of the inflation process. It decomposes the inflation into:

- (a) The classic demand factor.
- (b) Shocks such as food, energy, and policies.
- (c) The core component which has gradually become deeply embedded in the cost trends for labour and capital.

However, the use of such an approach may be misleading. On the one hand, the introduction of these so-called "reference measures" for inflation, on the basis of which the other indicators are evaluated, has not been justified in a convincing way and so there is no guarantee that these indicators are useful references for evaluating core

inflation indicators. On the other hand, if it is the case that the "reference measure" is not the best proxy for the (unknown) "true" trend of inflation, this approach does not guarantee that the best indicator is selected, as the core inflation indicator that best approximates the "reference measure" is not necessarily the best approximates to the "true" trend of inflation.

In addition, in this section we introduce the measure of core inflation. Especially three measures of core inflation have attracted our attention:

- (a) The first type is the "ex. food and energy"-type, which simply excludes prices of certain articles considered to be particularly volatile.
- (b) The second type is a trimmed mean measure, which was proposed by Bryan and Cecchetti (1994). This measure trims away the components with the highest and lowest inflation rates.
- (c) The third type, proposed by Diewert (1995) and Dow (1994), is a variance weighted index called the Edgeworth index.

The definition applied must depend on the purpose of the analysis. In the present analysis we focus on the ability to measure and to describe underlying price movements.

Our purpose is to introduce testable conditions for a core inflation indicator and to use these conditions to evaluate three well-known trend inflation indicators: the 'excluding food and energy' indicator; the trimmed mean; and the weighted median. With the proposed conditions, we aim at testing to what extent specific measures suggested in the literature as core inflation indicators are useful instruments in the assessment of current price developments and in the anticipation of the likely future path of inflation.

In the US a typical measure of core inflation is calculated by the first indicator, the consumer prices (CPI) minus food and energy, while in the euro zone excludes energy and unprocessed food. These components are considered to be influenced by temporary large movements. Indeed, excluding the energy part of the prices does change the overall picture of the price development. Excluding the food components, however, does not seem to much change.

It is certainly relevant to discuss if it is the appropriate components, which are excluded in the "ex. food and energy" measures. Excluding the same components every time inflation rates are published has the advantage that it is easy to communicate to the public. But it might be more relevant at certain dates to exclude other components than food and energy, e.g. if indirect taxes.

The main contribution of the present section is the introduction of "Trim of Most Volatile Components (TMVC), which captures the essence of core inflation, namely cleaning the headline inflation rates from temporary noise. The approach most closely related to the one in this paper is that of Clark (2001), who systematically excludes the (same) eight most volatile components.

The central banks monitor development in prices thoroughly, especially those who have an inflation target as the anchor of the monetary policy. For this reason they have a natural interest in different indicators for the

underlying price development. The research on measures for core inflation has been growing for a number of years. Within central banks the interest of finding good measures of the underlying inflation has been especially pronounced.

8 Special cases

We plan to address several measurement problems for CPI. We describe four of them.

8.1 Imputed rentals of owner-occupiers

The International Labour Organization said, "The rental equivalent approach attempts to measure the change in the price of the housing service consumed by owner-occupiers by estimating the market value of those services. In other word, it is based on estimating how much owner-occupiers would have to pay the rent of their dwelling"²

Currently, we studied the incorporation of the rental equivalent as a replacement to the measurement to assurances and mortgages payments.

Additionally, ILO says "Under this approach, it would be inappropriate also to include those input costs normally borne by landlords such as dwelling insurance, major repair and maintenance, and property taxes as this would involve an element of double counting"³.

We have the following information from Household Budget Survey (HBS).

- (a) Housing type. (House, Department, Room, Basic House, Others).
- (b) Property Condition (Owner, Owner with mortgages debt, rental, services beneficiary, free-yielded, leasing, others).
- (c) Rental Equivalent. (For owners).
- (d) Room's number.

We will obtain information for about 10.000 national homes.

8.2 Health expenditures

In the Chilean health system the public and private sectors participate in financing, insuring and providing health services. Retired or active dependent workers contribute a mandatory 7% of their income to a health fund. The workers can choose between the private or the public sector to manage their fund.

²ILO, 2004, "Consumer Price Index Manual: Theory and Practice", Chapter 10.

³Ibid.

There is a public social health insurance managed by the "Fondo Nacional de Salud" (FONASA), financed with the worker mandatory contributions and by government funds. Independently of the premium or the family size all insured person receives the same benefits with this insurance.

The FONASA insured may choose between the institutional or free-choice mode. The hospitals and primary care centers form a close public network for the first case. And the insured pay a co-payment defined by their income level. There is no co-payment if the insured earn less than a previously set amount of money. The insured may choose private health provider (which agree to work with FONASA) for the free choice mode. In this case the co-payment amount depends on the level chosen by the health provider.

The ISAPRES⁴ and private health providers constitute the private health system. The ISAPRES are health insurance companies working with individual or collective policies, with benefits directly dependent on the collected premium. The insured may pay additional money besides the mandatory 7% in order to obtain better coverage and benefits. The ISAPRE insured choosing private providers may pay a co-payment dependent on their own health policy⁵. The policy price or premium vary accordingly to several factors: age, gender, number of family member, etc.

Currently three subgroups: Medical services, Medical Products and Personal Care constitute the CPI "Health" Group.

- (a) The "Medical Services" components are : Medical Consultation, Intervention costs and Urgency services.
- (b) The "Medical Products" components are Medicines, and Other Medical Product
- (c) The "Personal Care" components are Hairdressing, Bathroom articles and Other Bathroom articles.

As mentioned in section 1 the item Personal Care will change to the group "Other Goods and Services". At the same time the subgroup "Medical Services" will be divided into "Out Patient Services" and "Hospital Services" Measurement of Health service prices.

The price measurement for the subgroup Medical Services is hard to accomplish due to operational and conceptual difficulties. Firstly we have to decide whether the CPI should include the overall cost of medical services or the co-payment only. One reason for considering only the co-payment is the fact that as the main part of the population is insured by FONASA or ISAPRES, a high proportion of the health services are covered by insurance so the person's final price is the co-payment, that is a percentage of the actual full price. Moreover, since the proportion of the health service price covered by ISAPRE/FONASA is a transfer between household it should not be considered in CPI.

We face now an operational challenge for measuring de co-payment prices. In the public sector (FONASA) the co-payment for each health service price are fixed for a year and are public. In the private sector the co-payment depends on the health plan considered and on the health provider chosen. In Chile there are a lot of different

⁴ISAPRE (Instituciones de Salud) Provisional Health Assurance Company

⁵The health insurance is called "health plan"

health plans so we have a great number of possible co-payment prices accordingly to the health providers. For this reason we propose to measure the health consultation full price. This could be a good approximation since the percentage covered by the insurance company is held constant so the ratio of the health consultation full prices in two different times is the same as the ratio of the health services co-payment.

Since the health services co-payment price is what we want to measured, its weight should correspond to total amount spend in co-payment and the full health services price should be used only as approximation to the price variation.

Currently, the geometric mean is used to aggregate from variety to product for the "Health" Group. When substitution is feasible among varieties this type of aggregation is justified. However, in the Health Group some varieties are not substitute to each other like medical examination, medicines, etc. In such cases we will use the arithmetic mean.

8.3 Financial services

During the last years the consumer credits in Chile have greatly evolved, the number of credit offering institutions have increase along with the characteristics of those consumer credits. As result the consumer credit intermediation costs have increase its relevance. The Chilean economy evolution and national financial market development allowed that a bigger number of persons use the financial services for consumer and investment decisions. In ILO CPI Manual "Financial Services" item belongs to "Other Goods and Services" Group. Two articles are considered:

- (a) Financial Intermediation Services Indirectly Measured
- (b) Other Financial Services

Currently, the product Financial Services contains three varieties, which prices are faulty calculated, since the yearly nominal interest rate is multiply by the UF, duplicating the inflation effect. We propose to calculate financial services prices by the spread interest rate (which measure financial intermediation costs), carrying it in real terms (deleting so the inflationary effect).

We propose the following varieties for the new CPI.

i. Bank Personal credits

We choose the sub-varieties accordingly to its share on the financial market in terms of amount and payment period. The outlet-varieties are the financial institutions that lend consumer credits. The price will be calculated by a differential between selling and borrowing rates. We will obtain the spread interest rate that capture the credit intermediation cost. We will put it in national currency using the UF. Exact formula are given in Annex 1.

ii. Bank Credit Card

For the bank credit cards the outlet-varieties will be the financial institutions that provide this service accordingly to their share in the market (the overall transactions amount). We will aggregate the information by geometric mean. We will not distinguish among credit by amount or period.

For the price calculation we will use collect and investment interest rates with similar features, so we can obtain the spread interest rate, carrying it into national currency by means of the UF. We will add the commissions those credit card charges as they are part of the cost service.

iii. **Department Stores Credit Cards**

Since the department stores consumer credits has greatly increased, it should be included in CPI.

Sub-varieties will be considered by three different accounts accordingly to credit line. The outlet varieties are those credit cards with the biggest share of transactions for this market. We will use geometric mean for aggregating due to substitution.

The price will be calculated by means of the spread interest rate (a differential between selling and borrowing rates) carrying it into national currency by means of an account unit. Since the intermediation costs depend in this case of the purchased good, the account unit will not be the UF, but the sales level by department for each one of the department stores. We will add two commissions: Administration/management commissions and money advance commissions.

8.4 Education

The Chilean Educational System has the following categories:

Pre-primary education: Enrolls children aged 0 to 5 years. This level includes mainly infant's garden and kindergarteners.

Primary education: Enrolls boys and girls aged 5 to 13 years. It is divided in 8 grades.

Secondary education: Enrolls youngster aged 14 to 18 years. It is divided in 4 grades. It is mandatory for all Chilean citizens. There are different types of educational centers, for instance, scientific and vocational schools.

Tertiary education: In this level there are colleges, universities, professional centers. and technical centers. To obtain a diploma at colleges or universities requires at least 10 semesters; in professional and technical centers it requires at most 10 semesters.

Education not definable by level: This type of education includes languages, informatics and similar.

Pre-primary, primary and secondary education has three types of financing schemes, which can be described as follows:

- Private financing
- Private-Public financing
- Public financing

Tertiary education is mainly private, but there is some contribution of public financing in some cases. In this case, there is no link between public financing and a particular student.

In our educational system, the household educational expenditures include two financing sources: registration fee (paid once a year) and educational or tuition fee (paid on a monthly basis, normally 10 months).

Educational expenditures in CPI.

The educational services have a weight of 6.3 in the current CPI. They include pre-primary, school level (primary and secondary) and higher education (tertiary) expenditure. Each product is divided in registration fee and educational fee, which the households have to pay for educational services. To calculate the CPI we collect prices for registration fee and educational fee as different products. The description of each item follows:

Pre-primary Education: We collect only the educational or tuition fee of private kindergarten.

School Education/Registration Fee: We collect the registration fee for ninth grade students in private sector.

School Education/Educational Fee: We collect the educational or tuition fee for the ninth grade students in private sector

Higher Education/Registration Fee: We collect the registration fee for college/universities, professional and technical centers first year students.

Higher Education/Educational Fee: We collect the educational or tuition fee for college/universities, professional and technical centers first year students.

The principal problem found in current CPI is that it splits registration and educational/tuition fee as independent products, calculating the geometric mean, which assumes a possible substitution between them.

In the New Chilean CPI this is modified, because registration and educational fee are not at all substitutes, but they are compounded services. In some case, we added specific fees (parents associations and others).

Finally, for the universities fees, it is worth to mention that the Household Budget Survey have to be adjusted in case of expenditure for educational services, because the are students that finance public and private university and colleges with governmental credits, and they mention only that part of the fees that they pay, not the whole fee, as it should be done.

9 New Chilean CPI Calculation methods and formulae

When presenting the CPI basket structure in section 1 we showed two items levels: the elementary one, the variety level; and the higher ones, the product, article, subgroup and group levels.

We define the variety v index at month m by the ratio between the price of the variety v collected in one outlet at month m , and the price of the same variety collected in the same outlet in month $m-1$.

Currently, the elementary variety indices of a product are aggregated to product level with the geometric mean for all cases. The arithmetic mean is used to aggregate from product level to the superior levels, except for the Food Group where geometric mean is used (cf. Schkolnik et al, 1998).

The above mentioned method used today in CPI calculation, is based on the hypothesis that varieties are homogeneous goods and services. For instance, the product 'apple' varieties are 'green apple', 'red apple', and 'yellow apple'; the product 'electricity' varieties are the 'electricity supplied by company A' and 'electricity supplied by company B'. It is obvious that the varieties are homogeneous, but, from the consumer viewpoint, there is a relevant difference for both cases. For the 'apple', it is easy to understand that the varieties are each one substitute; but in the case of electricity, this is not true, because if you are connected to company A it will not be possible to substitute it by company B.

That is the reason, that at this elementary level, the aggregation of homogeneous varieties -that can be substitute one for the other- will be calculated in most cases through the geometric mean, but in few cases this is done with the arithmetic mean, when substitution is conceptually not possible.

The new CPI calculation will distinguish when substitution is or not feasible. Arithmetic mean is used to aggregate varieties to products for utilities (electricity, water, gas, and other) and pharmaceutical and drug products.

This distinction among the aggregation formulae from variety to product will add precision to the compilation of CPI.

Reference

- Aráosla, M., de Hevia J. An alternative measure of core inflation. *Economics Letters*. No 75, 2002.
- Bilke, L, Stracca, L. A persistence-weighted measure of core inflation in the Euro area. *Economic Modelling*. 2007. (in press)
- Diewert, W. E., Y. Finkel and Y. Artsev, 2004, "On the Treatment of Seasonal Commodities in CPI: the Israeli Experience", IMF Publishing.
- Ducharme, L. M., 2007, "IPC de Chile - Informe de Asesoría para el INE-Chile.
- Dullberger, E. R., 1989, "The Application of a Hedonic Model to a Quality-Adjustment Price Index for Computer Processors", in: D. W. Jorgensen and R. Landau (eds.), *Technology and Capital Formation*, Cambridge, MA: MIT Press.
- Kapetanios, G. A note on modelling core inflation for the UK using a new dynamic factor estimation method and a large disaggregated price index dataset. *Economics Letters*. No 85, 2004.
- Maki, A. The statistical price index as an approximation of the constant-utility price index: an empirical analysis using Japanese data sets. *Journal of Japanese International Economies*. No 19, 2005.
- Marques, C., Duarte, P. and Sarmiento L. Evaluating core inflation indicator. *Economic Modelling*. No 20. 2003.
- Pedersen, M. An alternative measure of core inflation. Working Papers. N° 366, June 2006. Central Bank of Chile
- Raja Sethu Durai, S., Ramachandran, M. Core inflation for India. *Journal of Asian Economics*. No 18, 2007.
- Reis, H., Santos, J.M.C. Hedonic prices indexes for new passenger cars in Portugal (1997-2001). *Economic Modelling*. No 23, 2006.
- Scholnik M., Ruiz F., Hintze G., Meneses F., Jara P., and Videla-Hintze C., 1998, "The New Chilean CPI", Fourth Meeting, Ottawa Group, Washington.

ILO/IMF/OECD/UNECE/Eurostat/The World Bank, 2004, "Consumer Price Index Manual: Theory and Practice", Geneva.

Triplett, J. "Handbook on Hedonic Indices and Quality Adjustments in Price Indices: Special Application to Information Technology Products", OECD Science and Industry Working Papers, 2004/9, OECD Publishing.

Wynne, M. Core inflation: a review of some conceptual issue. Working paper series. No 5. European Central Bank.

Annex 1

A. Prices calculations for financial Services

Personal credit price:

$$P(12, 1, 1, 1, v, e, t, m, sem) = \left[\frac{i^a - i^b}{1 - \prod} \right] * UF_{t,m,sem} \quad (2)$$

where i^a = Active interest rate

where i^p = Pasive interest rate

Weighted geometric mean is used for aggregation of consumer credits outlet-varieties. The weights are determined by market participation.

$$PPMSVAR(12, 1, 1, 1, 1, v, e, y, m) = \left(\prod_e PPSVE(12, 1, 1, 1, 1, v, t, m) \right)^{\frac{w_e}{\sum w_e}} \quad (3)$$

$$PPMVAR(12, 1, 1, 1, 1, y, m) = \left(\prod_v PPMVAR(12, 1, 1, 1, 1, v, y, m) \right)^{\frac{w_v}{\sum w_v}} \quad (4)$$

Bank credit card price:

$$P(12, 1, 1, 1, v, e, t, m, sem) = \left[\frac{r - \rho}{1 - \prod} \right] * UF_{t,m,sem} + C_{t,m,sem} \quad (5)$$

The aggregation is:

$$PPMVAR(12, 1, 1, 1, 2, v, y, m) = \left(\prod_v PPMVAR(12, 1, 1, 1, 1, v, y, m) \right)^{\frac{w_v}{\sum w_v}} \quad (6)$$

Department stores credit purchase.

$$P(12, 1, 1, 1, v, e, t, m, sem) = \left[\frac{r - \rho}{1 - \prod} \right] * AccountUnit_{t,m,sem} + C_{t,m,sem} \quad (7)$$

The aggregation is:

$$PPMSVAR(12, 1, 1, 1, 3, v, y, m) = \left(\prod_e PPSVE(12, 1, 1, 1, 3, v, y, m) \right)^{\frac{w_e}{\sum w_e}} \quad (8)$$

By sub-variety

$$PPMSVAR(12, 1, 1, 1, 3, y, m) = \left(\prod_y PPSVAR(12, 1, 1, 1, 3, v, y, m) \right)^{\frac{w_e}{\sum w_e}} \quad (9)$$

B. Definitions used in the formulae for calculation of New Chilean CPI:

$P(p, v, o, m, y)$ Price of variety v of product p in outlet o in month m in year y ;
 $v = 1, \dots, vp$.

$\omega(v, p)$ Weight of variety v in product p ; $\sum_{v=1}^{vp} \omega(v, p) = 1$.

$\omega(p, a)$ Weight of product p in article a ; $\sum_{p=1}^{pa} \omega(p, a) = 1$.

$\omega(a, s)$ Weight of article a in sub-group s ; $\sum_{s=1}^{as} \omega(a, s) = 1$.

$\omega(s, g)$ Weight of sub-group s in group g ; $\sum_{s=1}^{sg} \omega(s, g) = 1$.

$\omega(g, CPI)$ Weight of group g in CPI; $\sum_{g=1}^{12} \omega(g, CPI) = 1$.

$IVE(v, o, m, y)$ Index of variety-outlet for variety v sold at outlet o in month m of year y .

$IVAR(v, m, y)$ Index of variety v in month m of year y

$IPRO(p, m, y)$ Index of product p in month m of year y .

$IART(a, m, y)$ Index of article a in month m of year y .

$ISGR(s, m, y)$ Index of sub-group s in month m of year y .

$IGRU(g, m, y)$ Index of group g in month m of year y .

$CPI(m, y)$ Consumer Price Index in month m of year y .

$LCPI(m, y)$ Level of CPI in month m of year y ; $LCPI(12, 2008) = 100$

Calculation of index of variety-outlet: $IVE(v, o, m, y)$

$$IVE(v, o, m, y) = \frac{P(p, v, o, m, y)}{P(p, v, m - 1, y)} \quad (10)$$

Calculation of Index of Variety v in month m of year y : $IVAR(v, m, y)$

Geometric Mean / Arithmetic Mean:

$$IVAR(v, m, y) = \prod_{v=1}^{vp} IVE(v, o, m, y)^{\frac{1}{vp}} / IVAR(v, m, y) = \prod_{v=1}^{vp} \frac{1}{vp} IVE(v, o, m, y) \quad (11)$$

Calculation of Index of Product p in month m of year y : $IPRO(p, m, y)$

Geometric Mean / Arithmetic Mean:

$$IPRO(p, m, y) = \prod_{v=1}^{vp} IVAR(v, m, y)^{w(v,p)} / IPRO(p, m, y) = \sum_{v=1}^{vp} w(v, p) * IVAR(v, m, y) \quad (12)$$

Calculation of Index of Article a in month m of year y : $IART(a, m, y)$

Geometric Mean / Arithmetic Mean:

$$IART(a, m, y) = \prod_{p=1}^{pa} IPRO(p, m, y)^{w(p,a)} / IART(a, m, y) = \sum_{p=1}^{pa} w(p, a) * IPRO(p, m, y) \quad (13)$$

Calculation of Index of Sub-Group s in month m of year y : $ISGR(s, m, y)$

Geometric Mean / Arithmetic Mean:

$$ISGR(s, m, y) = \prod_{a=1}^{as} IART(a, m, y)^{w(a,s)} / ISGR(s, m, y) = \sum_{a=1}^{as} w(a, s) * IART(a, m, y) \quad (14)$$

Calculation of Index of Group g in month m of year y : $IGRU(g, m, y)$

Geometric Mean / Arithmetic Mean:

$$IGRU(g, m, y) = \prod_{s=1}^{sg} ISGR(s, m, y)^{w(s,g)} / IGRU(g, m, y) = \sum_{s=1}^{sg} w(s, g) * ISGR(s, m, y) \quad (15)$$

Calculation of Consumer Price Index in month m of year y : $CPI(m, y)$

$$CPI(m, y) = \prod_{g=1}^{12} IGRU(g, m, y)^{w(g,CPI)} \quad (16)$$

Calculation of Level of Consumer Price Index in month m of year y : $LCPI(m, y)$

$$LCPI(m, y) = LCPI(m - 1, y) * (1 + CPI(m, y)) \quad (17)$$