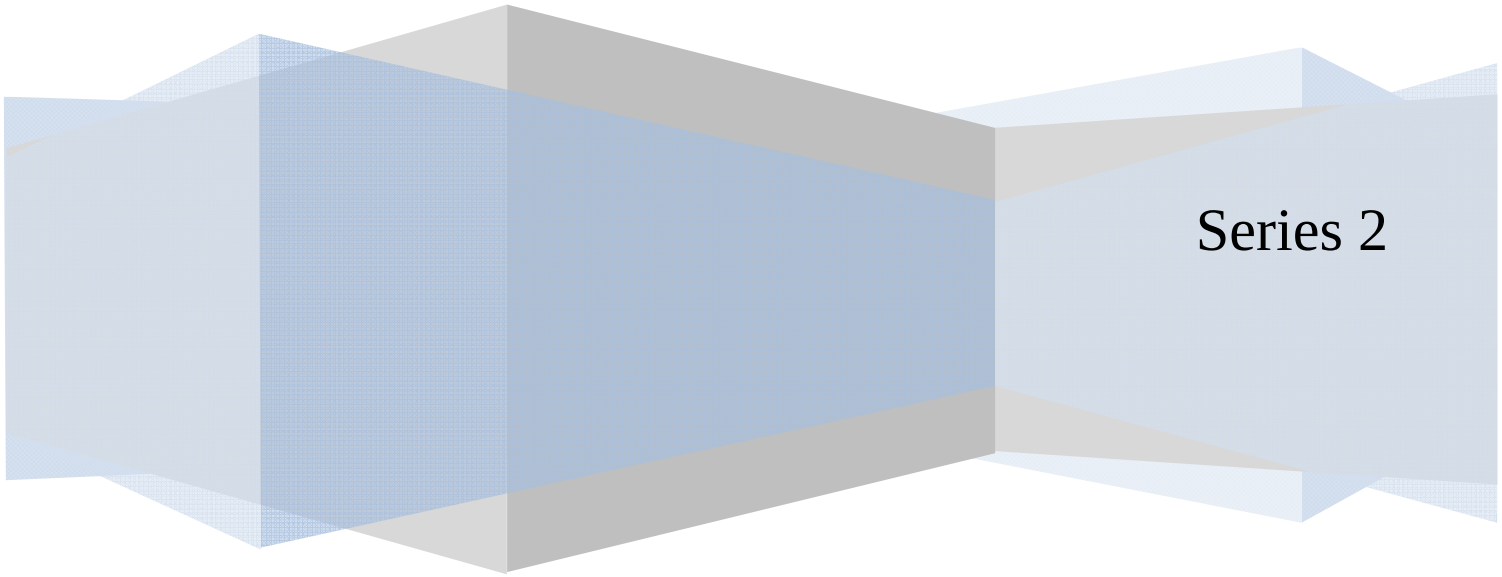
Direcção Geral de Estatística
Ministério de Finanças

A GUIDE TO THE TIMOR-LESTE CONSUMER PRICE INDEX



Series 2

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SECTION 1: INTRODUCTION

CPI is a widely used economic indicator released monthly

The Timor-Leste Consumer Price Index (CPI) is an important economic indicator. It provides a general measure of changes in prices of consumer goods and services purchased by Timorese households. The CPI is used for a variety of purposes, such as in the development and analysis of government economic policy.

CPI figures are produced by the National Statistics Directorate (NSD) for each month and are released within one month of the end of the reference period. CPI results are published on the NSD website, accessible at www.dne.mof.gov.tl .

CPI introduced in 2003. Now comprises 2 linked series

The National CPI was first compiled in 2003. The objective is to produce a series of short-term fixed-weighted indexes that are to be regularly linked together to provide a single continuous measure of price change. This strategy ensures that, at any point in time, the weighting patterns and item coverage of the CPI reflect contemporary consumer behaviour and remains relevant to users.

The Timor-Leste CPI now comprises two linked indexes with the link period being December 2012.

This guide

The purpose of this guide is to provide a broad overview of the CPI; how to use the CPI; and how the CPI is calculated. It takes into account changes made with the introduction of the Series 2 CPI in respect of January 2013 data. This guide is for general users.

SECTION 2: WHAT IS THE CPI?

Overview of SERIES 2 CPI

Similar to Series 1 CPI, Series 2 CPI has been designed as a general measure of price inflation for the household sector as a whole. The CPI measures changes in the price of a representative fixed basket of goods and services acquired by consumers in Timorese private households.

CPI measures price change of a fixed basket of goods and services

The simplest way of thinking about the CPI is to imagine a basket of goods and services comprising items bought by Timorese households. Now imagine the basket is purchased each month. As prices change from one month to the next, so too will the total price of the basket. The CPI is simply a measure of the changes in the price of this fixed basket as the prices of items in it change.

CPI reference group is all Timorese private households

The CPI measures price changes relating to the spending pattern of all Timorese private households. This group is termed 'the CPI reference group'. Private dwellings exclude prisons, non self-care units for the aged, defence establishments, hospitals and other communal dwellings.

Base period index number is 100.0

The price of the CPI basket in the reference base period is expressed as an index by assigning it a value of 100.0 and the prices in other periods are expressed as percentages of the price in the base period. For example, if the price of the basket had increased by 35% since the base year, then the index would be 135.0; similarly, if the price had fallen by 5% since the base year, the index would stand at 95.0. The CPI and all related series will be presented on a reference base of December 2012 = 100.0, commencing with the January 2013 CPI.

CPI does not measure price levels

It is important to remember that the CPI measures price movements (i.e. percentage changes) and not actual price levels (dollar amounts). For instance, the index for Rice of 103.9 and for Meat of 103.5 in January 2013 does not mean that Rice is more expensive than Meat. It simply means that the price of Rice has increased more than the price of Meat since the base period (Dec 2012).

CPI is not a purchasing power or cost-of-living measure

Although the CPI is also commonly referred to as a measure of changes in purchasing power or a cost-of-living index, in an economic context these terms are not strictly interchangeable with a measure of price inflation. Their measurement would require separate indexes built for this purpose. A single index cannot be expected to adequately fulfil all these roles.

An index designed to measure changes in the purchasing power of household incomes would need to be concerned with changes in the costs of all expenditures made from household income. Such a measure would include

items like income tax and interest payments.

A true cost-of-living index, among other things, would need to be concerned with changes in standards of living and with the substitutions that consumers make in order to maintain their standard of living when faced with changing market conditions (for instance, buying chicken rather than buffalo when buffalo prices are high).

The CPI on the other hand is constructed by reference to a fixed basket consisting only of actual goods and services acquired by households. Further, as the composition of this basket is held fixed from period to period, it cannot accurately reflect changing consumer preferences and substitutions made in response to changes in relative prices.

How is the CPI used?

The CPI is used as a macroeconomic indicator

The most common use of the CPI is as a macroeconomic indicator. The CPI, and other analytical index series derived from CPI data, is used by the Government and economists to monitor and evaluate levels of inflation in the Timor-Leste economy. Inflation (and inflationary expectations) plays a major role in determining various aspects of Government economic policy, and in the business and investment decisions of private firms and individuals.

The CPI basket of goods and services

CPI basket based on 2011 HIES data

The composition of the CPI basket is based on the pattern of household expenditure in the 'weight reference period', which is 2011 for Series 2 CPI. Information on the spending habits of Timorese households during 2011 was obtained from the Household Income and Expenditure Survey (HIES) conducted by the NSD. The HIES results provide the starting point for selecting the basket of goods and services to be priced for the new series CPI.

CPI basket includes items representative of all consumer goods and services

For practical reasons, the basket cannot include every item bought by households, but it does include the most significant items. It is not necessary to include all the items people buy since many related items are subject to similar price changes. The idea is to select representative items so that the index reflects price changes for a much wider range of goods and services than is actually priced. Examples of the types of items included in the CPI basket are shown in Appendix 2.

When determining what items are to be priced for the CPI basket, various factors are taken into consideration. Items:

- must be representative of purchases made by the CPI reference group;
- must have specifically identifiable characteristics that can be observed each period to price to constant quality (e.g. a 1 kg bag of imported rice, or purchase of a particular type of motor bike); and
- are not excluded on the basis of moral or social judgements. For example,

some people may regard the use of tobacco or alcohol as socially undesirable, but both are included in the CPI basket because they are significant items of household expenditure and their prices can be accurately measured.

Income-based taxes, however, are not included in the CPI because they cannot be clearly associated with the purchase or use of a specific good or service.

The CPI groups

The total basket is divided into 10 major groups, each representing a specific set of commodities:

Food and non-alcoholic beverages
Alcohol and tobacco
Clothing and footwear
Housing
Furnishings, household equipment & routine household maintenance
Health
Transport
Communication
Recreation and culture
Education

These groups are divided in turn into 35 expenditure classes. An expenditure class is a grouping of similar items, such as various types of motor vehicles.

See Appendix 1 for a full list of groups and expenditure classes that make up the Timor-Leste CPI.

The relative importance of CPI items

The overall (or All groups) CPI provides a measure of the average rate of price change. In calculating an average measure of this type it is necessary to recognise that some items are more important than others. Price changes for the more important items should have a greater influence on the average rate of price change than price changes for less important items. For example, if household expenditure on rice is four times as large as expenditure on clothing, then a 10% price increase for rice should have a similar impact on the CPI as a 40% price increase for clothing.

CPI weights

Measures of expenditure on each of the 35 CPI expenditure classes are obtained primarily from the HIES. However, adjustments are sometimes made to HIES data to account for any known anomalies. The adjusted HIES data are then used to derive a 'weight' for each expenditure class. The weights for Series 2 CPI expenditure classes at December 2012 prices are shown in Appendix 1.

The weights reflect the relative expenditures of the CPI reference group as a whole and not those of any particular type and size of household. As such, they are said to reflect expenditures of households on average and not the expenditures of an average household.

The description of the CPI as measuring the change in price of a fixed basket of goods and services requires some qualification.

Basket is fixed in terms of underlying quantities at the

Although the weights are expressed in terms of expenditure shares, it is not the expenditure shares that are fixed from period to period. What are held

expenditure class

constant are the quantities underpinning these expenditures (volume of products and services consumed). Weights are presented in expenditure terms because it is not possible to present quantity weights in a meaningful way. The relative expenditure shares of items will change over time in response to changes in relative prices. The weights in Series 2 CPI relate to expenditures in 2011, revalued using price movements in the CPI, to December 2012 (the 'link' period) prices to maintain fixed '2011 quantities'.

Update of fixed weights

The underlying quantity weights for CPI expenditure classes are updated at regular intervals with the timing generally linked to the availability of HIES data. The introduction of new weights results in the commencement of a new CPI series. Updating the weights is a key objective of the overall CPI review process. CPI reviews are discussed on page 7.

Collecting prices for the CPI

The collection of prices is largely carried out by trained field staff operating from Head office in Dili. The collection of prices in Districts beyond Dili are carried out by NSD staff operating out of various offices of the NSD, while some prices are collected by special surveys.

CPI goods and services priced at many different types of outlets

Prices are collected in retail outlets and other places where households purchase goods and services. This involves collecting prices from many sources such as open-air markets and informal markets, and formal markets such as supermarkets, and speciality stores. Prices are collected via personal visit, telephone or the internet as appropriate.

CPI based on over 800 price quotations each month

Each month prices are collected at regular intervals. Prices for items such as electricity and communication services are collected from the authorities concerned. In total, around 800 separate price quotations are collected each month across Timor-Leste.

There are a few items where prices change at infrequent intervals. For example, prices for school education services are often set each term. In these cases the frequency of price collection is modified accordingly.

Prices collected are what people actually pay

The prices used in the CPI are those that any member of the public would have to pay to purchase the specified good or service. Any taxes levied on goods or services are included in the CPI price. Similarly, prices include any subsidy or assistance provided directly by government. Sale prices, discount prices and 'specials' are reflected in the CPI so long as the items concerned are of normal quality (i.e. not damaged or shopsoiled), and are offered for sale in reasonable quantities.

To ensure that price movements are representative of the experiences of private households, the brands and varieties of the goods and services which are priced are generally those which sell in greatest volume.

Sometimes it is not possible to collect the price of an item in a particular period. This can be caused by various circumstances, with a common one being that the item is out of stock in the outlet sampled. The procedure most commonly used in the Timor-Leste CPI to deal with temporarily missing price observations is to repeat the previous price.

Changes in quality

In concept quality embraces all the attributes of an item which consumers would consider before making a purchase. For example, in the case of a packet of tea bags, it would include the volume or weight of the contents as well as the concentration and flavour.

Prices adjusted for changes in quality

As the CPI aims to measure price changes for a fixed basket of goods and services over time, identical or equivalent items must be priced in successive periods. However, products do change; their components or ingredients may change resulting in an improvement or degradation in quality. As the characteristics of products are altered, the statisticians responsible for the price index attempt to separate the effects of a quality change from any underlying price changes so that the CPI measures 'pure' price change. A simple example of quality adjustment is shown on page 9.

Quality change can be difficult to measure

The requirement to take account of changes in quality, to ensure that the index reflects only pure price change, often poses difficult measurement problems and in some cases is impossible to implement in practice. For example, while it is fairly easy to monitor changes in electricity prices, it is difficult to attach a dollar value to changes in the quality (e.g. reliability of the service).

Periodic reviews of the CPI

CPI reviewed at regular intervals

Like any other long-standing and important statistical series, the CPI is reviewed from time to time to ensure that it continues to meet community needs. The NSD undertakes these reviews at regular intervals with timing generally linked to the availability of results from the HIES.

An important objective of these reviews is to update item weights to reflect changes in the range of available goods and services and changes in household spending patterns. They also provide an opportunity to reassess the scope and coverage of the index and other methodological issues.

Following these reviews, the new CPI series is linked to the old to form a continuous series. This linking is carried out in such a way that the resulting continuous series reflects only pure price change and not differences in the cost of the old and new baskets. The CPI series is not revised as a result of this process.

The reference base period for the CPI is also updated, but at less frequent intervals. Changes in reference base periods have no effect (other than rounding) on percentage changes, which are calculated from the index numbers. The CPI and all related series are presented on a reference base of December 2012 = 100.0, commencing with the January 2013 CPI release (the first release of Series 2 CPI).

How does the CPI relate to me?

CPI unlikely to reflect the price experience of individual households

The CPI is designed to measure changes in prices of consumer goods and services purchased by Timorese households in aggregate. The composition of the basket and the relative importance of items priced in it relate to the reference population group as a whole - it represents the expenditures of all in-scope households, not the expenditure pattern of the average household or of any particular household type or size. The CPI basket therefore includes items acquired infrequently by an individual household (e.g. major electrical appliances), items that are acquired almost daily by all households (e.g. rice and vegetables) and items that are only available at certain times of the year. The basket includes, for example, both rent payments of renting households and the amounts paid by owner-occupier households for any structural improvements of their principal residence — clearly no individual household can incur both expenses at the same time.

The CPI does not measure those changes in living costs that may be experienced by individual households as a direct consequence of their progression through the life cycle. For example younger people may incur a higher proportion of their expenditure on mobile phones and motor bikes while those households entering the older age groups may incur increasing expenditure on medical services. However, changes in the demographic make-up of households in aggregate and differences in expenditure patterns will affect the pattern of total household expenditure recorded in the HIES. In turn, these changes will be incorporated in the weighting pattern in the CPI.

CPI cannot be used to measure price levels

The CPI is not designed to measure price levels; rather its purpose is to measure changes in prices over time. While price levels in regional districts often differ from those in urban areas, the factors influencing price movements generally tend to be similar. Therefore the CPI can be expected to provide a reasonable indication of the changes in prices in Timor-Leste as a whole in the longer term.

At the end of the day, the CPI is most useful as an *indicator* of price movements, whether it be for specific items, or the economy as a whole. The CPI is not a precise measure of individual household price experiences.

Example: adjusting for quality

A change in the size of a can of powdered milk illustrates the process used to adjust for changes in the quality of items priced in the CPI. In this example, a tin of powdered milk is priced in three periods (1, 2 and 3) and the size of the can is reduced from 440gms to 400gms between period 2 and period 3:

Period 1	Period 2	Period 3
440 grams	440 grams	400 grams
$1.50	$1.75	$1.70

The observed prices produce the following measures of price change:

Period 1 to Period 2	Period 2 to Period 3	Period 1 to Period 3
(1.75–1.50)/1.50 x100	(1.70–1.75)/1.75 x100	(1.70-1.50)/1.50 x100
= 16.7%	= –2.9%	= 13.3%

However, this does not provide a measure of 'pure price' change because the item priced in period 3 is not identical to the item priced in the previous periods. What is required for period 3 is the 'price that would have been paid for the item that was priced in period 2'. This price can be estimated by adjusting the period 3 price by the ratio of the item's weight in period 2 to its weight in period 3, giving a quality adjusted price of $1.87 ($1.70 x 440/400).

Using this adjusted price in period 3 results in the following correct measures of price change:

Period 1 to Period 2	Period 2 to Period 3	Period 1 to Period 3
(1.75–1.50)/1.50 x100	(1.87–1.75)/1.75 x100	(1.87-1.50)/1.50 x100
= 16.7%	= 6.9%	= 24.7%

After adjusting for the reduction in quality between periods 2 and 3, the fall in the observed price of 2.9% has been translated into a pure price increase of 6.9%. Similarly, the measure of price change between periods 1 and 3 has been increased from 13.3% to 24.7%.

SECTION 3: USING THE CPI

Interpreting Index numbers

Why use index numbers?

Deriving useful price measures for single, specific items such as red apples is a relatively straightforward exercise. An estimate of the average price per kilogram in each period is sufficient information to determine price change between periods.

However, if the requirement is for a price measure that covers a number of diverse items, the calculation of a 'true' average price is both complicated and of little real meaning. For example, consider the problem of calculating and interpreting an average price for two commodities as diverse as apples and automotive fuel. Because of this, price measures such as the CPI are typically presented in index number form.

Description of a price index

Price indexes provide a convenient and consistent way of presenting price information that overcomes problems associated with averaging across diverse items. The index number for a particular period represents the average price in that period relative to the average price in some base period for which, by convention, the average price has been set to equal 100.0.

A price index number on its own has little meaning. For example, the CPI All groups index number of 101.3 in January 2013 says nothing more than the average price in January 2013 was 1.3% higher than the average price in the base period – December 2012 (when the index was reset to 100.0). The value of index numbers stems from the fact that index numbers for any two periods can be used to directly calculate price change between the two periods.

Percentage change is different to a change in index points

Movements in indexes from one period to any other period can be expressed either as changes in index points or as percentage changes. The following example illustrates these calculations for the All groups CPI for the Dili analytical index between January 2012 and January 2013. The same procedure is applicable for any two periods.

Example

The following example illustrates the method of calculating changes in index points and percentage changes between any two periods:

All groups CPI:Dili index numbers:	
January 2013	101.3
less January 2012	90.7
Change in index points	10.6
Percentage change 10.6 / 90.7 x 100	= 11.7%

Movements in the CPI best measured using percentage changes

For most applications, movements in price indexes are best calculated and presented in terms of percentage change. Percentage change allows comparisons in movements that are independent of the level of the index. For

example, a change of 2 index points when the index number is 120 is equivalent to a percentage change of 1.7%, but if the index number was 80 a change of 2 index points would be equivalent to a percentage change of 2.5%—a different rate of price change. Only when evaluating change from the base period of the index will the points change be numerically identical to the percentage change.

Calculating index numbers for periods longer than single months.

Although the CPI is compiled and published as a series of monthly index numbers, its use is not restricted to the measurement of price change between months. Annual percentage changes are calculated on the basis of movements between corresponding months of consecutive years.

Because a monthly index number can be interpreted as representing the average price during the month, index numbers for periods spanning more than one month can be calculated as the simple (arithmetic) average of the relevant monthly indexes. For example, an index number for the first six months of 2013 would be calculated as the arithmetic average of the index numbers for January to June 2013.

This characteristic of index numbers is particularly useful. It allows for comparison of average prices over a specified time period with those in some prior comparable period (e.g. the first six months of 2014 compared to the first six months of 2013).

Analysing the CPI

The monthly change in the All groups CPI represents the weighted average price change of all the items included in the CPI. While publication of index numbers and percentage changes for components of the CPI are useful in their own right, these data are often not sufficient to enable important contributors to overall price change to be reliably identified. What is required is some measure that captures both an item's price change and its relative importance in the index.

Points contribution and points contribution change

If the All groups index number is thought of as being derived as the weighted average of indexes for all its component items, the index number for a component multiplied by its weight to the All groups index results in what is called its 'points contribution'. It follows that the change in a component item's points contribution from one period to the next provides a direct measure of the contribution to the change in the All groups index resulting from the change in that component's price.

Information on points contribution and points contribution change is of great value when analysing sources of price change. Consider the following data extracted from the January 2013 CPI publication:

Item	Index numbers		Percent change	Points contribution		Points change
	Dec 2012	January 2013		Dec 2012	January 2013	
All groups	100.0	101.3	1.3%	100.0	101.3	1.3
Meat	100.0	103.5	3.5%	8.00	8.28	0.28
Alcohol	100.0	99.9	-0.1%	1.35	1.35	0.00

Using points contributions

Using only the index numbers themselves, the most that can be said is that between Dec 2012 and January 2013, the price of Meat increased by more than the overall CPI (by 3.5% compared with an increase in the All groups of 1.3%). Below are two more examples where points contribution can be used to analyse CPI results:

a) **To calculate the effective weight for Meat in December 2012 and January 2013** (given by the points contribution for Meat divided by the All groups index). For December, the weight is calculated as 8.00/100.0 x 100 = 8.0% and for January, the weight is calculated as 8.28/101.3 x 100 = 8.2%. Although the underlying quantities are held fixed, the effective weight in expenditure terms has increased due to the prices of Meat increasing by more than the prices of all other items in the CPI basket (on average).

b) To estimate the effect on the All groups CPI of a forecast change in the prices of one of the items (given by applying the forecast percentage change to the item's points contribution and expressing the result as a percentage of the All groups index number). For example, if prices of Alcohol were forecast to increase by 25% in February 2013, then the points change for Alcohol would be 1.35 x 0.25 = 0.34, which would deliver an increase in the All groups index of 0.34/101.3 x 100 = 0.34%. In other words, a 25% increase in Alcohol prices in February 2013 would have the effect of increasing the CPI by 0.34%. Another way commonly used to express this impact is 'Alcohol' would contribute 0.34 percentage points to the change in the CPI All groups.

Rounding conventions

To ensure consistency in the data produced from the CPI, it is necessary for the NSD to adopt a set of consistent rounding conventions or rules for the calculation and presentation of data. The conventions strike a balance between maximising the usefulness of the data for analytical purposes and retaining a sense of the underlying precision of the estimates. These conventions need to be taken into account when using CPI data for analytical or other special purposes.

Index numbers are always published to a reference base of 100.0. Index numbers and percentage changes are always published to one decimal place, with the percentage changes being calculated from the rounded index numbers. Points contributions are published to two decimal places, with points contributions change being calculated from the rounded points contributions.

Use of CPI results

Often the only viable method of collecting and presenting information about economic activity is in the form of expenditure or income in monetary units (e.g. dollars). While monetary aggregates are useful in their own right, economists and other analysts are frequently concerned with questions related to volumes, for example, whether more goods and services have been produced in one period compared with another period. Comparing monetary aggregates alone is not sufficient for this purpose as dollar values can change from one period to another due to either changes in quantities or changes in prices (most often a combination).

Indexes used should be representative of specific items

To illustrate this, consider a simple example of expenditure on oranges in two periods. The product of the quantity and the price gives the expenditure in any period. Suppose that in the first period 10 oranges were purchased at a price of $1.00 each and in the second period 15 oranges were purchased at a price of $1.50 each. Expenditure in period one would be $10.00 and in period two it would be $22.50. Expenditure has increased by 125%, yet the volume (number of oranges) has only increased by 50% with the difference being accounted for by a price increase of 50%. In this example all the price and quantity data are known, so volumes can be compared directly. Similarly, if prices and expenditures are known, quantities can be derived.

But what if the actual prices and quantities are not known? If expenditures are known and a price index for oranges is available, the index numbers for the two periods can be used *as if they were prices* to adjust the expenditure for one period to remove the effect of price change. If the price index for oranges was equal to 100.0 in the first period, the index for the second period would equal 150.0. Dividing expenditure in the second period by the index number for the second period and multiplying this result by the index number for the first period provides an estimate of the expenditure that would have been observed in the second period had the prices remained as they were in the first period. This can easily be demonstrated by reference to the oranges example:

$22.50/150.0 x 100.0 = $15.00 = 15 x $1.00

So, without ever knowing the actual volumes (quantities) in the two periods, the adjusted second period expenditure ($15.00) can be compared with the expenditure in the first period ($10.00) to derive a measure of the proportional change in volumes $15/$10 = 1.50, which equals the ratio obtained directly from the comparison of the known quantities.

Forecasting impact of price changes on the CPI

It is possible to determine the impact of a price rise (or fall) of a single component on the All groups CPI.

For example, it can be determined what the impact of a 20% increase in tobacco prices would have on the All groups CPI in January 2013.

Two pieces of information are required to determine this; the All groups index number for *January 2013* (101.3), and the *January 2013* points contribution for Tobacco (3.52).

An increase in tobacco prices of 20% would increase the tobacco points contribution by 3.52 * 20/100 = 0.7 index points which would result in an All groups index number of 102.0, an increase of 0.7%.

SECTION 4: CALCULATING THE CPI

Overview

The CPI can be described in terms of a representative basket of goods and services which is priced each period. As prices change from one period to the next so too will the total cost (or price) of the basket.

Using this description, the construction of the CPI can be undertaken in four major steps:

1. subdividing the total expenditure into individual items for which price samples can be selected;
2. collecting price data;
3. estimating price movements for individual items; and
4. calculating the current period cost of the basket.

Subdividing the basket

Expenditure aggregates

HIES data is used to construct estimates for total annual expenditure of private households for each of the 35 expenditure classes in the CPI. As these estimates relate to the expenditure of households in aggregate, they are referred to as 'expenditure aggregates'.

While these expenditure aggregates are derived for well defined categories of household expenditure (e.g. rice), they are still too broad to be of direct use in selecting price samples. For this purpose, the CPI team determines the types of goods and services for which price samples should be constructed.

This is not as simple an exercise as might be imagined and relies heavily on the judgement of the prices statisticians. In reaching decisions about precisely which items to include in price samples, the prices statisticians need to strike a balance between the cost of data collection (and processing) and the accuracy of the index. Factors taken into account include the relative significance of individual items, the extent to which different items are likely to exhibit similar price behaviour, and any practical problems associated with measuring prices to constant quality.

Determining outlet types

Having settled on the items for which price samples are to be constructed, the next step is to determine the outlet types (respondents) from which prices will be collected. In order to accurately reflect changes in prices paid by households, prices need to be collected from the various types of outlets from which the representative items are purchased.

Collecting price data

Selecting respondents

When price samples have been determined, NSD field staff determines from which markets and other retail outlets the prices will be collected. The prices are collected each month from the same respondents for the same items.

Selecting items to price

When a respondent is first enrolled in the collection process the field staff will determine, in conjunction with the outlet management, which specific items are best representative of the broader expenditure class. For example, at one outlet it might be decided that a half loaf of white sliced bread is the best representative item for bread sold at a supermarket, while at another outlet such as an open market place, a small bread roll may be the best representative of bread purchased at such an outlet.

An important part of the ongoing price collection process is the monitoring of the items for quality change. A possible quality change would be a change in the size (weight) of the half loaf of bread. In this case prices would be adjusted to derive a pure price for the item along the lines illustrated in the example on page 9. Individual item prices are also compared with prices collected in the previous period to check their accuracy and to verify any large movements.

Estimation of price movements for elementary aggregates

Price samples are constructed for the sole purpose of estimating price movements for each elementary aggregate. These estimates of price movements are required to revalue the expenditure aggregates to current period prices. This is achieved by applying the period to period price movement to the previous period's expenditure aggregate for each elementary aggregate. It provides an estimate of the cost of acquiring the base period quantity of the elementary aggregate in the current period.

Two *options for calculating price movement*

There is no single correct method for calculating the price movement for a sample of observations. The two methods used in the Timor-Leste CPI are described below, using as an example price observations from two periods.

	Price observations in		
	Period 1	*Period 2*	*Price Relative*
	$	*$*	
	(a)	(b)	(b)/(a)
Outlet data			
Outlet A	**1.50**	**1.80**	1.200
Outlet B	**1.60**	**1.90**	1.188
Outlet C	**1.85**	**1.50**	0.811
Outlet D	**1.75**	**1.50**	0.857
Outlet E	**2.00**	**2.20**	1.100
Average of price relatives			
Arithmetic mean	1.74	1.78	1.031
Geometric mean	1.73	1.76	1.017

The two commonly used forms of average are the arithmetic mean and the geometric mean. For a sample of n price observations, the arithmetic mean is the sum of the individual prices divided by the number of observations, while

the geometric mean is the n^{th} root of the product of the prices. For example, the arithmetic mean of 4 and 9 is 6.5, while the geometric mean is 6 (the geometric mean is always less than or equal to the arithmetic mean).

Arithmetic mean of price relatives

One method is to calculate the price movement between periods for each individual item and then take the arithmetic average of these movements. The price movement for each item must be expressed in relative terms (i.e. period 2 price divided by period 1 price as shown in the second column from the right in the above table). In the example above the arithmetic average of the price relatives is 1.031, a price change of 3.1%. This method is called the 'arithmetic mean of price relatives' (APR), sometimes referred to as the 'Carli' index formula.

Geometric mean of price relatives

A more common method is to calculate the geometric mean of the price movements for each individual item. Again, the price movements must be in the form of price relatives. In the above example, the geometric mean of the price relatives is 1.017, indicating a price increase of 1.7%.

The geometric mean will always produce the same result whether the relative of mean prices or the mean of relative prices is used. These methods are simply referred to as the geometric mean (GM), sometimes called the 'Jevons' index formula.

Geometric mean is the preferred method

The method of calculating price change at the elementary aggregate level is important to the accuracy of the price index. The arithmetic average of price relatives (APR) approach has been shown to be more prone to (upward) bias than the geometric mean method. In line with various overseas countries, the NSD is using the geometric mean formula for calculating elementary aggregate index numbers where practical in the Series 2 CPI. Where the geometric mean is not appropriate, the arithmetic average of price relatives (APR) is used. The reasoning behind using geometric means is outlined below.

Geometric mean allows for substitution

At the elementary aggregate level of the index it is usually impractical to assign a specific weight to each individual price observation. The three formulas described above implicitly apply equal weights to each observation, although the bases of the weights differ. The geometric mean applies weights such that the expenditure shares of each observation are the same in each period. In other words the geometric mean formula implicitly assumes households buy less (more) of items that become more (less) expensive relative to the other items in the sample. The geometric mean therefore appears to provide a better representation of household purchasing behaviour than the alternative formula in those elementary aggregates where there is likely to be high substitutability in consumption within the price sample.

Geometric mean not appropriate for all elementary aggregates

The geometric mean cannot be used in all elementary aggregates. It cannot be used in cases where the price could be zero (i.e. the cost of a good or service is fully subsidised by the government). It is also not appropriate to use geometric means in elementary aggregates covering items between which consumers are unable to substitute.

Calculating the current cost of the basket

Once price movements are calculated for each elementary aggregate, they can be used to derive the expenditure aggregates that are then summed to derive the current cost of the basket. It is from the expenditure aggregates that index numbers are calculated at any level of the index.

Elementary Aggregate	*Expenditure aggregate Period 1*	*Price Movement Period 1 to Period 2*	*Expenditure aggregate Period 2*
	$million	*(a)*	*$million*
Imported rice	67.0	1.025	68.675
Local rice	23.0	1.015	23.345
Total rice	**90.0**	**—**	**92.020**

(a) Geometric mean of price relatives

The expenditure aggregates are revalued to period 2 prices by applying the movements between period 1 and period 2. The expenditure aggregate for the expenditure class 'Rice' is the sum of the expenditure aggregates for the elementary aggregates comprising the expenditure class (i.e. imported rice and local rice). Summing the elementary aggregates says that in period 2 it would cost $92.02m to buy the volume of Rice in period 1 that cost $90m. The price change for Rice between period 1 and 2 is simply the ratio of these expenditure aggregates, that is, a price increase of 2.2% (92.02/90.0). Thus if the price index for rice was 100.0 in period 1, it would be 102.2 in period 2.

The derivation of the expenditure class movement as shown above is mathematically equivalent to a weighted average of the price movements for the individual elementary aggregates, that is, a weighted version of the mean of price relatives formula discussed above. In this case period 1 expenditure aggregates are the weights. The same formula is used at higher levels of the index.

Similar procedures are used to derive price movements at higher levels of the CPI. For example, the current period cost of purchasing items in the 'Clothing and footwear' group of the CPI is obtained by summing the current period expenditure aggregates of the expenditure classes Garments for men, Garments for women, Garments for infants and children, and Footwear and clothing accessories. The ratio of the current and previous period expenditure aggregates for the 'Clothing and footwear' gives the price movement for the group.

Points contributions (see page 11) are also calculated using the expenditure aggregates. The current period points contribution of a CPI component, for example the expenditure class Rice, is the current period expenditure aggregate for Rice relative to the expenditure aggregate for the All groups CPI multiplied by the current period All Groups index number.

The CPI publication does not show the expenditure aggregates, but rather the index numbers derived from the expenditure aggregates. Expenditure aggregates vary considerably in size and showing them would make the publication difficult to read and interpret. The published index numbers and

points contributions are a convenient presentation of the information.

SECTION 5: FURTHER INFORMATION

Readers requiring further information should contact:

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The NSD website is the best place for data from our publications and information about the NDS.

All CPI statistics can be downloaded free of charge from the web site.
www.dne.mof.gov.tl

APPENDIX 1: SERIES 2 WEIGHTING PATTERN FOR THE CPI

Percentage contribution to the All Groups CPI in December 2012

	Group and Expenditure Class	Dili (Analytical series)	Ex-Dili (Analytical series)	National (Analytical series)
1	**FOOD AND NON-ALCOHOLIC BEVERAGES**	**61.89**	**75.43**	**64.32**
1.1	Bread and cereals (excluding rice)	4.29	5.23	4.46
1.2	Rice	15.08	26.79	17.18
1.3	Meat	8.36	6.34	8.00
1.4	Fish and seafood	3.00	1.15	2.67
1.5	Milk, cheese and eggs	1.78	0.69	1.59
1.6	Oils and fats	3.05	4.26	3.26
1.7	Fruit	2.41	1.62	2.27
1.8	Vegetables	14.74	18.67	15.45
1.9	Sugar, jam, honey, chocolate and confectionary	3.12	3.59	3.20
1.10	Food products n.e.c.	2.75	3.89	2.96
1.11	Coffee, tea and cocoa	1.90	2.87	2.07
1.12	Mineral waters, soft drinks, fruit and vegetable juices	0.76	0.23	0.66
1.13	Prepared food/meals	0.64	0.08	0.54
2	**ALCOHOL AND TOBACCO**	**4.44**	**6.88**	**4.88**
2.1	Alcohol	1.30	1.60	1.35
2.2	Tobacco	3.14	5.27	3.52
3	**CLOTHING AND FOOTWEAR**	**6.33**	**3.67**	**5.85**
3.1	Garments for men	1.26	0.89	1.20
3.2	Garments for women	0.94	0.62	0.88
3.3	Garments for infants and children	2.12	1.20	1.95
3.4	Footwear and clothing accessories	2.02	0.96	1.83
4	**HOUSING**	**6.38**	**2.45**	**5.68**
4.1	Actual rentals paid by tenants	0.84	0.00	0.69
4.2	Maintenance and repair of the dwelling	1.56	0.69	1.40
4.3	Water, electricity, gas and other fuels	3.99	1.76	3.59
5	**FURNISHINGS, HOUSEHOLD EQUIPMENT AND ROUTINE HOUSEHOLD MAINTENANCE**	**4.48**	**2.65**	**4.15**
5.1	Household furniture and textiles	0.37	0.08	0.32
5.2	Household appliances	0.40	0.20	0.36
5.3	Goods and services for routine household maintenance	3.71	2.37	3.47

	Group and Expenditure Class	Dili (Analytical series)	Ex-Dili (Analytical series)	National (Analytical series)
6	**HEALTH**	**0.84**	**0.33**	**0.75**
6.1	Medical products, appliances and equipment	0.52	0.27	0.48
6.2	Medical and Hospital services	0.32	0.06	0.27
7	**TRANSPORT**	**7.08**	**3.35**	**6.41**
7.1	Purchase of vehicles	0.65	0.30	0.59
7.2	Operation of personal transport equipment	3.43	1.40	3.07
7.3	Transport services	3.00	1.65	2.76
8	**COMMUNICATION**	**2.51**	**1.39**	**2.31**
8.1	Telecommunication equipment and services	2.51	1.39	2.31
9	**RECREATION AND CULTURE**	**3.39**	**2.98**	**3.32**
9.1	Audio-visual, photographic and information processing equipment	0.02	0.00	0.02
9.2	Recreational items and cultural services	2.12	2.22	2.14
9.3	Newspapers, books and stationery	1.25	0.76	1.16
10	**EDUCATION**	**2.65**	**0.87**	**2.34**
10.1	Education	2.65	0.87	2.34

Any discrepancies between totals and sums of components are due to rounding.

An electronic version of the full weighting pattern for both Series 1 and Series 2 can be found on the NSD website <www.dne.mof.gov.tl.>

APPENDIX 2: TYPES OF GOODS AND SERVICES PRICED IN THE SERIES 2 CPI

The mention of an item in the table does not necessarily mean that there is a specific price sample for that item, nor does it mean that all the price samples are specifically listed

LIST OF GOODS AND SERVICES PRICED FOR THE CPI

Group and Expenditure Class	*Examples of item coverage*
FOOD AND NON-ALCOHOLIC BEVERAGES	
Bread and cereals (excluding rice)	All types of bread, cakes, biscuits, maize, rice flour and wheat flour
Rice	Imported and local rice
Meat	Poultry, pork, buffalo meat, beef, dry meats
Fish and seafood	All seafoods; fresh, frozen, canned or processed
Milk, cheese and eggs	Fresh milk, powdered and condensed milk, chicken eggs, processed cheese
Oils and fats	Butter, margarine and cooking oils
Fruit	Various types of fresh fruit
Vegetables	Various types of fresh vegetables
Sugar, jam, honey, chocolate and confectionary	Snacks and confectionary, granulated sugar
Food products n.e.c.	Foods not classified elsewhere - Nuts, food additives & condiments , tofu, mung beans,
Coffee, tea and cocoa	Tea (leaves, bags etc.) and coffee (instant, ground etc.), takeaway coffee
Mineral waters, soft drinks, fruit and vegetable juices	Soft drinks, bottled water, fruit and vegetable juices
Prepared food/meals	Meals eaten in restaurants, cafes, and take away foods
ALCOHOL AND TOBACCO	
Alcohol	Various types of beer, red and white wines, palm brandy
Tobacco	Regular cigarettes, clove-flavoured cigarettes, betel leaves, areca nut
CLOTHING AND FOOTWEAR	
Garments for men	Men's jeans, trousers, casual shirts, T-shirts, underwear
Garments for women	Women's blouses, jeans, T-shirts, underwear, nightwear
Garments for infants and children	Children's pants, shorts, T-shirts, school uniform, baby clothes
Footwear and clothing accessories	Shoes, sandals, general sports shoes for men, women and children. Items complementary to clothing like belts
HOUSING	
Actual rentals paid by tenants	Rent paid to private landlords for various sized dwellings
Maintenance and repair of the dwelling	Materials and labour costs for repairs and maintenance to dwellings
Water, electricity, gas and other fuels	Water and electricity charges , Household fuels such as firewood, charcoal briquettes, gas bottles and kerosene

FURNISHINGS, HOUSEHOLD EQUIPMENT AND ROUTINE HOUSEHOLD MAINTENANCE	
Household furniture and textiles	Household furniture including major household appliances like kerosene stoves and fridges. Bedroom furniture and furnishings like beds, cupboards, and curtains. Also includes bathroom, bedroom, and kitchen linen.
Household appliances	Household utensils like cutlery, pans, drinking glasses, brooms and batteries
Goods and services for routine household maintenance	Personal care products - Cosmetics, toothpaste, shampoo, soaps and body deodorants. Cleaning and maintenance products like powder detergent, mosquito repellent, and domestic help services
HEALTH	
Medical products, appliances and equipment	Prescription medicines, cold-relief products, vitamins
Medical and Hospital services	Medical and practitioner fees and hospital charges, vaccines and treatments
TRANSPORT	
Purchase of vehicles	Purchase of new cars and new motor cycles
Operation of personal transport equipment	Automotive fuel (unleaded petrol and diesel). Separately purchased parts and accessories for motor vehicles including motorbike helmets, motor oils and tyres. Also routine servicing of motor vehicles is included
Transport services	Bus, microlet and ferry fares. Personal driver charges
COMMUNICATION	
Telecommunication equipment and services	Equipment - various types of mobile phones. Services - mobile phone call and text charges. International postage costs.
RECREATION and CULTURE	
Audio-visual, photographic and information processing equipment	Equipment including televisions and computers
Recreational items and cultural services	Cultural services include services like funerals. Recreation items include playing cards, and sporting equipment like soccer balls
Newspapers, books and stationery	Newspapers, magazines and school books
EDUCATION	
Education	Private school fees and university fees

GLOSSARY

Aggregation	The process of combining lower level price indexes to produce higher level indexes.
All groups	Highest level of the CPI, containing all the groups, subgroups and expenditure classes.
CPI	A general indicator of the rate of change in prices paid by households for consumer goods and services.
CPI basket	A commonly used term for the goods and services priced for the purpose of compiling the CPI.
CPI reference group	The subset of the population to which the CPI specifically relates - this is all Timorese private households.
Elementary aggregate	The lowest level of commodity classification in the CPI and the only level for which index numbers are constructed by direct reference to price data.
Expenditure class	A group of similar goods or services. The level at which weights are fixed for the life of an index series and the lowest level for which indexes are regularly published. There are 35 expenditure classes in Series 2 CPI.
Expenditure aggregate	The current cost in dollars per year of purchasing the same quantity of goods or services as was purchased in the weighting base period by the CPI reference group.
Group	The first level of disaggregation of the CPI. There are 10 groups in the Series 2 CPI.
Household Income and Expenditure Survey (HIES)	A sample survey conducted by the NSD to determine the expenditure patterns of private households. Data from the 2011 HIES were the primary source of information for the expenditure weights for the Series 2 CPI.
Inflation (deflation)	A term commonly used to refer to changes in price levels. A rise in prices is called inflation, while a fall is called deflation.
Link period	The period used to join a new index series to an old index series to form a continuous series.
Price index	A composite measure of the prices of items expressed relative to a defined base period.
Price levels	Actual money values in a particular period of time.
Price movements	Changes in price levels between two or more periods. Movements can be expressed in money values, as price relatives or as percentage changes.
Price update	A process where the quantities for the weighting base period are updated according to the link period prices.

Price relative	A measure of price movements; the ratio of the price level in one period to the price level in another.
Private households	Households living in private dwellings. Private dwellings exclude prisons, non self–care units for the aged, defence establishments, hospitals and other communal dwellings.
Quality Adjustment	The elimination of the effect that changes in the quality or composition of an item has on the price of that item in order to isolate the pure price change.
Reference base	The period in which the CPI is given a value of 100.0. The CPI and all related series are presented on a reference base of Dec 2012 = 100.0 commencing with the January 2013 CPI.
Transaction prices	The prices actually paid by consumers to acquire goods or services.
Utility	Often defined as the satisfaction derived from consumption of a good or service.
Weight	The measure of the relative importance of an item in the index regimen. Weights can be expressed in either quantity or value terms. Value weights are used in the CPI.
Weighting base period	The period to which the fixed quantity weights relate. The weighting base period for Series 2 CPI is 2011.