

## A GLOSSARY OF MAIN TERMS

The Annex to this Glossary gives the main aggregate index number formulae used for CPI purposes and also explains the interrelationships between them.

Acquisitions approach	An approach to CPIs in which consumption is identified with the consumption goods and services acquired by a household in some period (as distinct from those wholly or partially used up for purposes of consumption). Depending on the intended scope of the CPI, acquisitions may include not only goods and services purchased, but also those acquired by own account production or as social transfers in kind from government or non-profit institutions. A purchase is recorded at the time the obligation to pay is incurred, as distinct from the time payment is made.
Additivity	At current prices, the value of an aggregate is identical with the sum of the values of its components. Additivity requires this identity to be preserved for the extrapolated values of the aggregate and its components when their current values in some period are extrapolated using a set of interrelated quantity indices; or, alternatively, when the current values of an aggregate and its components in some period are deflated using a set of interrelated price indices.
Aggregate	A set of transactions relating to a specified flow of goods and services, such as the total purchases made by resident households on consumer goods and services in some period. The term 'aggregate' is also used to mean the value of the designated set of transactions.
Aggregation	The process of combining, or adding, different sets of transactions to obtain larger sets of transactions. The larger set is described as having a higher <i>level</i> of aggregation than the sets of which it is composed. The term 'aggregation' is also used to mean the process of adding the values of the lower level aggregates to obtain higher level aggregates. In the case of price indices, it means the process by which price indices for lower level aggregates are averaged, or other wise combined, to obtain price indices for higher level aggregates.
Axiomatic, or test approach	The approach to index number theory that determines the choice of index number formula on the basis of its mathematical properties. A list of 'tests' is drawn up, each test requiring an

index to possess a certain property or satisfy a certain axiom. The choice of index made on the basis of the number of tests satisfied. Not all tests may be considered to be equally important and the failure to satisfy key certain key tests may be considered sufficient grounds for rejecting an index.

#### Base period

The base period is a period which other periods are compared with. However, the 'base period' is not a precise concept in a CPI context and has different meanings in different contexts. Three types of 'base period' may be distinguished.

- The *price reference-period*, that is, the period with whose prices the prices in other periods are compared. Its prices appear in the denominators of the price relatives, or price ratios, used to calculate the index.
- The *weight reference period*; that is, the period, usually one or more years, whose expenditures serve as weights for the index. However, when hybrid expenditure weights are used, in which the quantities of one period are valued at the prices of some other period, there is no unique weight reference period.
- the *index reference period*; that is, the period for which the value of the index is set equal to 100.

It should be noted that, in practice, the duration of the weight reference period for a CPI is typically a year, or even two or more years, whereas the CPI is calculated monthly or quarterly, the duration of the price reference period being a month or quarter. The three reference periods do not coincide for CPIs, although the price reference and index reference period may coincide.

#### Basket

A specified set of quantities of goods and services. In a CPI context, they may be the actual quantities of consumption goods or services acquired or used by households in some period, or they could be hypothetical quantities.

#### Basket price index

A price index that measures the proportionate change in the total value of a basket of goods and services between two periods of time: that is,  $Sp^tq / Sp^0q$ , where  $t$  may be interpreted as the current period,  $0$  as the price reference period and the  $q$ 's are some specified set of quantities. See equation (1) in the Annex. A basket index is called here a *Lowe* index after the index number pioneer who first proposed this general type of index. Most indices compiled for CPI purposes are basket, or Lowe, indices. The general class of indices covered by this definition is very broad and includes, by appropriate specification of the  $q$ 's, the Laspeyres, Paasche, Edgeworth and Walsh indices, for example. Any basket index is algebraically equivalent to an appropriately

weighted arithmetic average of the price relatives using actual or hybrid expenditure shares as weights. See ‘weighted arithmetic average index’.

Bias	A systematic tendency for the calculated CPI to deviate from some ideal or preferred index that results from the method of data collection, processing or index formula used. See ‘cost of living bias’ and ‘representativity bias’.
Bouncing	A situation in which the set of prices for the second period is simply a re-ordering of the set of prices for the first period, the price relatives thus being obtained by matching each price in the first period with another price from the same set of prices. Prices appear to ‘bounce’ around between the two periods.
Carli price index	An elementary price index defined as a simple, or unweighted, arithmetic average of the sample price relatives.
Carry forward	A situation in which a missing price in some period is imputed as being equal to the last price observed for that item.
Chain index	An index number series for a long sequence of periods obtained by linking together index numbers spanning shorter sequences of periods. See ‘linking’ and also equation ( 6 ) of the Annex.
Characteristics	The physical and economic attributes of a good or service that serve to identify it and enable it to be classified.
Circularity, or transitivity	An index number property such that, if ${}_jI_k$ denotes a particular kind of price index that measures the change between periods $j$ and $k$ , then ${}_jI_l \equiv {}_jI_k \cdot {}_kI_l$ where the indices ${}_jI_l$ and ${}_kI_l$ are of the same type. When an index is transitive, the index that compares periods $j$ and $l$ indirectly through period $k$ is identical with the index that compares $j$ and $l$ directly. A possible test that might be required under the axiomatic approach is that the index number should be transitive.
Collective consumption	Goods and services that are consumed simultaneously by a group of consumers or by the community as a whole: for example, defence services provided by the state.
Commensurability	See “invariance to changes in the units of measurement”.
Commodity reversal	A test that might be used under the axiomatic approach which

test	requires that, for a given set of products, the price index should remain unchanged when the ordering of the products is changed.
Component	A sub-set of the goods and services that make up some defined aggregate.
Conditional cost of living index	A conditional cost of living index measures the change in the cost of maintaining a given utility level, or standard of living, on the assumption that all the factors, <i>except the prices covered by the index</i> , that influence the consumer's utility or welfare (e.g. the state of physical environment) remain constant. See 'cost of living index'.
Consistency in aggregation	An index is said to be consistent in aggregation when the index for some aggregate has the same value whether it is calculated directly in a single operation, without distinguishing its components, or whether it is calculated in two or more steps by first calculating separate indices, or sub-indices, for its components, or sub-components, and then aggregating them, the same formula being used at each step.
Continuity	The property whereby the price index is a continuous function of its price and quantity vectors
Consumer Price Index or CPI	A monthly or quarterly price index compiled and published by an official statistical agency that measures changes in the prices of goods and services consumed by households. Its exact definition may vary from country to country.
Consumers	Consumers are individual persons or groups of persons living together as households.
Consumption	<p>There are several types of consumption:</p> <ul style="list-style-type: none"> <li>• <i>intermediate consumption</i> consists of the goods and services used by enterprises as inputs into their processes of production; it is excluded from CPIs;</li> <li>• <i>collective consumption</i> consists mainly of the collective services provided by governments to the community as a whole; it is excluded from CPIs;</li> <li>• <i>final individual consumption</i> consists of goods and services that individual households may acquire in order to satisfy their own needs and wants.</li> </ul> <p>See also: 'households' consumption expenditures'</p>
Consumption of own	Goods or services that are consumed by the same household that

production	produces them. The housing services consumed by owner occupiers fall within this category. If goods and services produced and consumed within the same household are to be included in CPIs, prices must be imputed for them. Their inclusion or exclusion depends on the intended scope of the CPI.
Cost of living index, or COLI	An index that measures the change between two periods in the minimum expenditures that <i>would</i> be incurred by a utility maximising consumer, whose preferences or tastes remain unchanged, in order to maintain a given level of utility (or standard of living or welfare). As consumers may be expected to change the quantities they consume in response to changes in relative prices (see ‘substitution effect’) the COLI is not a basket index. The expenditures in one or other, or possibly both, periods cannot usually be observed. COLIs cannot be directly calculated but may be approximated by superlative indices. See ‘conditional cost of living index’.
Cost of living bias	An alternative term used to describe ‘substitution bias’.
Coverage	The set of goods and services whose prices are actually included in the index. For practical reasons, coverage may have to be less than the ideal scope of the index, that is the set of goods and services that the compilers of the index would prefer to include, if it were feasible.
Central product classification, or CPC.	An internationally agreed classification of goods and services based on the physical characteristics of goods or on the nature of the services rendered.
Current period, or comparison period	In principle, the ‘current’ period should refer to the most recent period for which index has been compiled, or is being compiled. However, the term is widely used to mean the ‘comparison period’: that is, the period that is compared with the ‘base period’, usually the price reference or index reference period. It is also widely used simply to mean the later of the two periods being compared. The exact meaning is usually clear in the context.
Current prices	The actual prices prevailing in the period in question.
Current value	The actual value of some aggregate in the period in question: the quantities in the period multiplied by the prices of the same period.
Cut-off sampling	A sampling procedure in which a predetermined threshold is

established with all units in the universe at or above the threshold being included in the sample and all units below the threshold being excluded. The threshold is usually specified in terms of the size of some relevant variable, the largest sampling units being included and the rest given a zero chance of inclusion. In the case of retail outlets, size may be defined in terms of sales.

Deflation	The division of the current value of some aggregate by a price index (described as a <i>deflator</i> ) in order to revalue its quantities at the prices of the price reference-period.
Democratic index	A form of CPI in which each household is given equal weight in the calculation of the index, irrespectively of the size of its expenditures.
Drift	A chain index is said to “drift” if it does not return to unity when prices in the current period return to their levels in the base period. Chain indices are liable to drift when prices fluctuate over the periods they cover.
Discount	A deduction from the list or advertised price of a good or a service that is available to specific customers under specific conditions. Examples include cash discounts, prompt payment discounts, volume discounts, trade discounts and advertising discounts.
Divisia index	A price or quantity index that treats both prices and quantities as continuous functions of time. By differentiating with respect to time, the rate of change in the value of the aggregate in question is partitioned into two components one of which is the price index and the other the quantity index. In practice, the indices cannot be calculated directly but it may be possible to approximate them by chain indices in which indices measuring the changes between consecutive periods are linked together.
Domain	An alternative term for the scope of an index.
Drobisch price index	The arithmetic average of the Laspeyres price index and the Paasche price index.
Durable good	A good that can be used repeatedly or continuously for purposes of consumption over a long period of time, typically several years.
Dutot index	An elementary price index defined as the ratio of the unweighted arithmetic averages of the prices in the two periods compared.

Economic approach	The economic approach to index number theory assumes that the quantities are functions of the prices, the observed data being generated as solutions to various economic optimization problems. In the CPI context, the economic approach usually requires the CPI to be some kind of cost of living index.
Edgeworth price index	A basket price index in which the quantities in the basket are simple arithmetic averages of the quantities consumed in the two periods.
Editing	The process of scrutinising and checking the prices reported by price collectors. Some checks may be carried out by computers using statistical programmes written for the purpose.
Elementary aggregate	The smallest aggregate for which expenditure data are available and used for CPI purposes. The values of the elementary aggregates are used to weight the price indices for elementary aggregates to obtain higher level indices. The range of goods and services covered by an elementary aggregate should be relatively narrow and may be further narrowed by confining the goods and services to those sold in particular types of outlet and/or in particular locations. Elementary aggregates also serve as strata for the sampling of prices.
Elementary price index	An elementary index is a price index for an elementary aggregate. As expenditure weights cannot be attached to the price relatives for the sampled items within an elementary aggregate, an elementary index is typically a more primitive kind of index than indices at higher levels of aggregation, although other kinds of weighting may be explicitly or implicitly introduced into the calculation of elementary indices. Three examples of elementary index number formulae are the Carli, the Dutot and the Jevons.
Expenditure weights	See 'weights'.
Explicit quality adjustment	A direct estimate of how much of the change in the price of a product is due to changes in its physical or economic characteristics. It requires an evaluation of the contributions of the differences in particular characteristics to the differences in the observed prices of two products. It includes quality adjustments based on hedonic methods. See also 'implicit quality adjustment'.
Factor reversal test	Suppose the prices and quantities in a price index are interchanged to yield a quantity index of exactly the same functional form as the price index. Under the axiomatic approach, the factor reversal test requires that the product of this quantity index and the original

price index should be identical with the proportionate change in the value of the aggregate in question.

Fisher price index	The geometric average of the Laspeyres price index and the Paasche price index. It is a symmetric index and a superlative index.
Fixed basket indices	A time series of basket indices that all use the same basket. See equation (4) of the Annex. In a CPI context, the fixed basket usually consists of the total quantities consumed by the designated set of households over a period of a year or more, whereas the price reference period is usually some later and shorter period, the indices being calculated monthly or quarterly. As shown in equation (8) of the Annex., fixed basket indices are algebraically equivalent to fixed weighted arithmetic averages of the price relatives and are calculated this way in practice: see 'fixed weight indices' below.
Fixed weight indices	An abbreviated description widely used for a series of weighted arithmetic averages of price relatives ( <i>i.e.</i> , <i>Young</i> indices) that all use the same weights. See equation (13) of the Annex. The weights are usually either actual or hybrid expenditure shares covering a period of a year or more, even though the indices are calculated monthly or quarterly. Although other forms of average might be used, in a CPI context the averages are almost invariably arithmetic, at least at an aggregate level.
Geometric Laspeyres index	A weighted geometric average of the price relatives using the expenditure shares of the price reference period as weights. Also called "logarithmic Laspeyres index". Although a possible form of index for CPI purposes, it is not used in practice.
Goods	Physical objects for which a demand exists, over which ownership rights can be established and whose ownership can be transferred between units by engaging in transactions on the market.
Hedonic method	A regression model in which the market prices of different products are expressed as a function of their characteristics. Non-numerical characteristics are represented by dummy variables. Each regression coefficient is treated as an estimate of the marginal contribution of that characteristic to the total price. The estimates may be used to predict the price of a new product whose mix of characteristics is different from that of any product already on the market. The hedonic method can therefore be used to

estimate the effects of quality changes on prices.

Higher level index	A term sometimes used to describe an aggregate index as distinct from an elementary index.
Households	Households may be either individual persons living alone or groups of persons living together who make common provision for food or other essentials for living. Most countries choose to exclude groups of person living in large institutional households (barracks, retirement homes, etc.) from the scope of their CPIs.
Households' consumption expenditures	Expenditures on final consumption goods and services incurred by individual households on their own behalf. They exclude expenditures incurred by governments or non-profit institutions on goods or services provided to households as free social transfers in kind.
Household consumption expenditure (or budget) surveys	Sample surveys of households in which the households are asked to provide data, or estimates, of the amounts they spend on consumption goods and services and for other purposes over a given period of time.
Hybrid values or expenditures	Hypothetical values, or expenditures, in which the quantities are valued at a different set of prices from those at which they were actually bought or sold: for example, when the quantities purchased in an earlier period are valued at the prices prevailing in a later period.
Hybrid weights	Weights defined as hybrid value, or hybrid expenditure, shares.
Identity test	A test which may be invoked under the axiomatic approach that requires that if each and every price remains unchanged between the two periods, the price index must equal unity.
Implicit quality adjustment	Inferring the change in the quality of a product whose characteristics change over time indirectly by estimating, or assuming, the 'pure' price change that has occurred. For example, if the pure price change is assumed to be equal to the average for some other group of products, the implied change in quality is equal to the actual observed price change divided by the assumed pure price change. If the whole of the observed price change is assumed to be pure price change, there is assumed to be no change in quality. See also 'explicit quality adjustment'.
Imputed price	The price assigned to an item whose price is missing in a particular period. The term 'imputed' price may also refer to the

price assigned to an item that is not sold on the market, such as a good or service produced for own consumption, including housing services produced by owner-occupiers, or one received as payment in kind or as a free transfer from government or non-profit institution.

Indexation	The periodic adjustment of the money values of some regular scheduled payments based on the movement of the CPI or some other price index. The payments may be wages or salaries, social security or other pensions, other social security benefits, rents, interest payments, etc.
Index reference-period	The period for which the value of the index is set at 100. See also 'base period'.
Institutional unit	A national accounts concept defined as an economic entity that is capable, in its own right, of owning assets, incurring liabilities and engaging in economic activities and transactions with other entities. Households are institutional units. Other kinds of units include enterprises and governments.
Invariance to changes in the units of measurement test	A test which may be invoked under the axiomatic approach that requires that the price index does not change when the units of quantity to which the prices refer are changed: for example, when the price of some drink is quoted per litre rather than per pint. This test is also described as the 'commensurability test'.
Invariance to proportional change in current or base quantities test	A test which may be invoked under the axiomatic approach that requires that the price index remains unchanged when all the base period quantities, or all the current period quantities, are multiplied by a positive scalar.
Inverse proportionality in base year prices test	A test which may be invoked under the axiomatic approach that requires that if all base period prices are multiplied by the positive scalar $\lambda$ the new price index is $1/\lambda$ times the old price index.
Item	A term commonly used to denote an individual good or service in the sample of products selected for pricing.
Item or product rotation	The deliberate replacement of a sampled item, or product, for which prices are being collected, by another product before the replaced product has disappeared from the market or individual outlet. It is designed to keep the sample of products up to date and reduce the need for forced replacements caused by the disappearance of products.

Jevons price index	An elementary price index defined as the unweighted geometric average of the sample price relatives.
Laspeyres price index	A basket index in which the basket is composed of the actual quantities of goods and services in the earlier of the two periods compared, the price reference period: see para. (1) and equation (3) of the annex. It can also be expressed as a weighted arithmetic average of the price relatives that uses the expenditure shares in the earlier period as weights: see equations (7) to (9) of the Annex. The earlier period serves as both the weight reference period and the price reference period.
Linking	Splicing together two consecutive sequences of price observations, or price indices, that overlap in one or more periods. When the two sequences overlap by a single period, the usual procedure is simply to rescale one or other sequence so that the value in the overlap period is the same in both sequences and the spliced sequences form one continuous series. See equation (6) of the Annex.
Loose specification	See ‘specification’.
Lowe index	The name used for a basket index.
Lower-level index	A term sometimes used to describe an ‘elementary index’ as distinct from an aggregate index.
Mean value test for prices	A test that may be invoked under the axiomatic approach which requires that the price index should lie between the smallest price relative and the largest price relative.
Matched products or models	A pair of identical products. The practice of pricing of matched, or identical, products in two or more consecutive periods is designed to ensure that the observed price changes cannot be affected by quality change. The change in price between two perfectly matched products is described as a ‘pure’ price change.
Modified Laspeyres index	An alternative name for a two-stage Laspeyres index.
Non-probability sampling	The deliberate, <i>i.e.</i> , non-random, selection of a sample of outlets and products on the basis of the knowledge or judgement of the person responsible. Also known as purposive sampling and

judgemental sampling.

Outlier	A term that is generally used to describe any extreme value in a set of survey data. In a CPI context, it is used for an extreme value of price or price relative that requires further investigation or that has been verified as being correct.
Owner occupied housing	Dwellings owned by the households that live in them. The dwellings are fixed assets that fall outside the scope of a CPI defined as price index for consumption goods and services. Owner occupiers use the dwellings to produce housing services for their own consumption and these services are usually included within the scope of the CPI. The imputed prices of the housing services may be difficult to estimate. They may be estimated by market rents payable on the market for equivalent accommodation or by user costs: see 'rental equivalence' and 'user cost'.
Paasche price index	A basket index in which the basket is composed of the actual quantities of goods and services in the later of the two periods compared. The later period serves as the weight reference period and the earlier period as the price reference period. The Paasche index is identical with a weighted harmonic average of the price relatives that uses the actual expenditure shares in the later period as weights. It is also identical with a weighted arithmetic average of the price relatives whose weights are the hybrid expenditure shares obtained by valuing the quantities of the later period at the prices of the earlier period. See para. (1) and equations (7) to (10) of the Annex.
Price reference-period	The period with whose prices the prices in the current period are compared. The period whose prices appear in the denominators of the price relatives. See also 'base period'.
Price relative	The ratio of the price of an individual product in one period to the price of that same product in some other period.
Price updating	A procedure whereby the quantities in an earlier period are revalued at the prices of a later period. The resulting expenditures are hybrid. In practice, the price updated expenditures are obtained by multiplying the original expenditures by price relatives or prices indices.
Probability sampling	The random selection of a sample of units, such as outlets or products, in such a way that each unit in the universe has a known

non-zero probability of selection.

Probability proportional to size sampling, or PPS	A sampling procedure whereby each unit in the universe has a probability of selection proportional to the size of some known variable, such as the value of the sales of an outlet.
Products	A generic term used to mean a good or a service. Individual sampled products selected for pricing are often described as 'items'.
Proportionality in current prices test	A test which may be invoked under the axiomatic approach that requires that if all current period prices are multiplied by the positive scalar $\lambda$ the new price index is $\lambda$ times the old price index.
Purchaser's price	The amount payable by the purchaser to acquire a good or service as distinct from the amount receivable by the producer or seller. The two may diverge because of product taxes or delivery charges. The purchaser's price includes any charges incurred in order in order to take delivery of a unit of a good or service at the time and place required by the purchaser.
Pure price change	The change in the price of a good or service whose characteristics do not change over time. When some characteristics do change, that is a change in quality occurs, the pure price change is the price change remaining after eliminating the contribution of the change in quality to the observed price change.
Quality adjustment	An adjustment to the change in the price of a product whose characteristics change over time that is designed to remove the contribution of the change in the characteristics to the observed price change. In a CPI context, the adjustment is needed when the price of a replacement item or product has to be compared with the price of the item it replaces. In practice, the required adjustment can only be estimated. Different methods of estimation, including hedonic methods, may be used in different circumstances. See 'explicit quality adjustment' and 'implicit quality adjustment'.
Quantity relative	The ratio of the quantity of a specific product in one period to the quantity of that same product in some other period.
Quantity weights	A term sometimes loosely used to describe the quantities in the basket. At an aggregate level, however, quantities cannot act as

weights for price relatives. See ‘weights’.

Rebasing	Rebasing may have different meanings in different contexts. It may mean <ul style="list-style-type: none"> <li>• changing the weights used for a series of indices, or</li> <li>• changing the price reference period used for a series of indices, or</li> <li>• changing the index reference-period for a series of indices.</li> </ul> The weights, price reference period and index reference period may be changed separately or at the same time.
Reference population	The set of households included within the scope of the index.
Rental equivalence	The estimation of the imputed rents payable by owner occupiers for the housing services they produce and consume on the basis of the rents payable on the market for accommodation of the same type. When the markets for rented accommodation are very thin, or even non-existent, for particular types of accommodation, the rents may be estimated by the user costs: see ‘user cost’.
Replacement item or product	An item chosen to replace an item for which prices have been previously collected, either because the previous item has disappeared altogether or accounts for a diminishing share of the sales of the outlet or the expenditures within the elementary aggregate.
Representative item or product	A product, or category of products, that accounts for a significant proportion of the total expenditures within an elementary aggregate and/or whose average price change is expected to be close to the average for all products within the aggregate. For each representative product, one or more individual items may be selected for pricing.
Representativity bias	Bias in a basket index that results from the use of an inappropriate basket. For example, if the index uses an old, out of date basket when users are interested in recent price movements based on an up to date basket, the calculated index may tend to have an upward bias from the users’ perspective. Such a bias results from the failure of an old basket to take account of the substitutions that occur in response to changes in relative prices. Representativity bias tends to be similar to the substitution bias that occurs when a basket index is used to estimate a cost of living index.
Reweighting	Replacing the weights used in an index by a new set of weights.
Sample augmentation	Maintaining and adding to the sample of outlets in the survey

panel to ensure that they continue to be representative of the population of outlets. A fixed sample of outlets tends to be depleted over time as outlets cease trading or stop responding. Including new outlets also tends to facilitate the inclusion of new products in the CPI.

Sample rotation	Limiting the length of time that outlets and/or products are included in the price surveys by dropping a proportion of them, or possibly all of them, after a certain period of time and selecting a new sample of outlets and/or products. Rotation is designed to keep the sample up to date.
Sampled price	The price collected for a sampled item or product, sometimes described as a price 'quote'.
Sampled item or product	An individual item or product that is included in the sample of products selected for pricing within an elementary aggregate.
Sampling frame	A term used in the literature on sampling surveys to denote a list of units in the universe from which a sample of units can be selected. The list may contain information about the units which may be used for PPS sampling. Examples of sampling frames that may be used for retail outlets are business registers, telephone directories ('yellow pages'), local authority records, trade directories, etc. Such sampling frames may not cover all the units in the designated universe and may also include units that do not form part of that universe.
Scanner data	Detailed data on sales of consumer goods obtained by 'scanning' the bar codes for individual products at electronic points of sale in retail outlets. The data can provide detailed information about quantities, characteristics and values of goods sold as well as their prices. Scanner data constitute a rapidly expanding source of data with considerable potential for CPI purposes. They are also being increasingly used for purposes of hedonic analysis.
Scope	The set of products whose price changes the index is supposed to measure. The scope of a CPI will generally be defined in terms of a designated set of consumption goods and services purchased by a designated set of households. In practice, certain goods and services or households may have to be excluded because it is too difficult, time consuming or costly to collect the relevant data on expenditures or prices: for example, illegal expenditures. The 'coverage' of an index denotes the actual set of products included as distinct from the intended scope of the index. Scope is

sometimes described as the 'domain' of the index.

Seasonal products	Seasonal products are products that either are not available on the market during certain seasons or periods of the year or are available throughout the year but with regular fluctuations in their quantities and prices that are linked to the season or time of the year.
Specification	A description or list of the characteristics that can be used to identify an item or individual sampled product to be selected for pricing. A 'tight' specification is a fairly precise description of an item intended to narrow the range of items from which a price collector might choose, possibly reducing it to a unique item, such as a particular brand of television set identified by a specific code number. A 'loose' specification is a generic description of a range of items that allows the price collector some discretion as to which particular item or model to select for pricing, such as colour television sets of a particular size.
Stochastic approach	The approach to index number theory treats the observed price relatives as if they were a random sample drawn from a defined universe whose mean can be interpreted as the general rate of inflation. The sample mean provides an estimate of the rate of inflation.
Substitute	A product whose characteristics are similar to those of another product and that can be used to meet the same kinds of consumer needs or wants.
Substitution	A type of consumer behaviour in which households choose to replace some of the products they consume by substitutes. Rational utility maximising consumers, as price takers, typically react to changes in relative prices by reducing, at least marginally, their consumption of goods and services that have become <i>relatively</i> dearer and increasing their consumption of substitutes that have become <i>relatively</i> cheaper. It results in a negative correlation between the quantity and price relatives.
Substitution effect	The effect of substitution on an index and the relative values of different kinds of price indices. For example, a Laspeyres price index tends to be greater than the corresponding cost of living index because of the substitution effect.
Substitution bias	This is generally understood to be the bias that results when a basket index (or weighted arithmetic average index) is used to

measure changes in the cost of living. As the quantities in a basket index are fixed, the index cannot take account of the effects on the cost of living of the substitutions made by consumers in response to changes in relative prices. When the basket is that of an earlier period than the current period, the index tends to be biased upwards as an estimate of the corresponding the cost of living index. See also 'representativity bias'.

- Superlative index      A type of index formula that can be expected to approximate to the cost of living index. An index is said to be 'exact' when it equals the true cost of living index for consumers whose preferences can be represented by a particular functional form. A superlative index is then defined as an index that is exact for a *flexible* functional form that can provide a second order approximation to other twice differentiable functions around the same point. The Fisher, the Törnqvist and the Walsh price index are examples of superlative indexes. Superlative indices are generally symmetric indices.
- Symmetric index      An index that treats both periods symmetrically by attaching equal importance, to the price and expenditure data in both periods. The price and expenditure data for both periods enter into the index formula in a symmetric way.
- System of national accounts, or SNA      A coherent, consistent and integrated set of macroeconomic accounts, balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules. Household income and consumption expenditure accounts form part of the SNA. The expenditure data are one of the sources that are used to estimate expenditure weights for CPI purposes.
- Tight specification      See 'specification'.
- Time reversal      An index number property such that, if  ${}_jI_k$  denotes a particular kind of price index formula that measures the change from period  $j$  to period  $k$ , then
 
$${}_jI_k \equiv 1 / {}_kI_j$$
 where  ${}_kI_j$  measures the change from period  $k$  to period  $j$ . When an index has this property, the same result is obtained whether the direction of change is measured forwards in time from the first to the second period or backwards from the second to the first period. Under the axiomatic approach, the time reversal test requires an index to have this property.

Törnqvist price index	A symmetric index defined as the weighted geometric average of the price relatives in which the weights are simple arithmetic averages of the expenditure shares in the two periods. It is a superlative index. Also known as the “Törnqvist Theil” price index.
Transitivity	See ‘circularity’.
Two stage index	A basket index calculated as the product of two component indexes into which it has been factored. All basket indices can be decomposed, or factored, into two, or more, indices of the same type: see para. (2) of the Annex.
Two stage Laspeyres price index, or ‘modified Laspeyres index’	A Laspeyres index measuring the change between period $0$ and period $t$ that has been factored into two component basket indices. One component is the Laspeyres index between periods $0$ and $t-1$ , while the other is the Lowe index between $t-1$ and $t$ that uses the quantities of $0$ . See equation (3) in the Annex. A series of fixed weight Laspeyres indices can be calculated incrementally by multiplying the Laspeyres index for $t-1$ already calculated by a Lowe index measuring the change between $t-1$ and $t$ . In practice, the Lowe index is calculated as a weighted arithmetic average of the price relatives for $t$ on $t-1$ using hybrid ‘price up-dated’ expenditure weights in which the quantities of period $0$ are valued at the prices of $t-1$ .
Unit value or average value	For a set of homogeneous products, the total value of the purchases/sales divided by the sum of the quantities. It is therefore a quantity weighted average of the different prices at which the product is purchased/sold. Unit values are often calculated for sets of products that are very similar, even though not perfectly homogeneous, provided that they are all measured in the same quantity units. Unit values may change over time as result of a change in the mix of the products sold at different prices even if the prices do not change.
User cost	The cost incurred over a period of time by the owner of a fixed asset or consumer durable as a consequence of using it to provide a flow of capital or consumption services. User cost consists of the depreciation on the asset or durable (measured at current prices and not at historic cost) plus the capital, or interest, cost.
Uses approach	An approach to CPIs in which the consumption in some period is identified with the consumption goods and services actually used

up by a household to satisfy their need and wants (as distinct from the consumption goods and services acquired by the household). On this approach, the consumption of consumer durables in a given period is measured by the values of the flows of services provided by the stocks of durables owned by households and not by their acquisitions of, or expenditures on, durables in that period. The values of the flows of services may be estimated by their user costs.

Value	Price times quantity. The value of the expenditures on a set of homogeneous products can be factored uniquely into its price and quantity components. Similarly, the change over time in the value of a set of homogeneous products can be factored uniquely into the change in the unit value and the change in the total quantities. However, there are many different ways of factoring the change over time in the value of a set of heterogeneous products into its price and quantity components, a phenomenon that gives rise to the 'index number' problem.
Walsh price index	A basket index in which the quantities are geometric averages of the quantities in the two periods: see para. (1) of the Annex. It is a symmetric index and a superlative index
Weights	A set of numbers summing to unity that are used to calculate averages. In a CPI context, the weights are generally actual or hybrid expenditure shares that sum to unity by definition. They are used to average price relatives, or elementary price indices. See para. (5) of the Annex. Quantities of different kinds of products cannot serve as weights because they are not commensurate and not additive. The quantities that make up a basket should not be described 'quantity weights'.
Weight reference period	The period whose expenditure shares serve as the weights for a weighted arithmetic average price index. In practice, the duration of the weight reference period for a CPI is typically a year, or even two or more years, whereas the duration of the price reference period and index reference period is a month or quarter. When the expenditures are hybrid and the prices and quantities refer to different periods, there is no weight reference period, although the period to which the quantities refer is sometimes described as the weight reference period in these circumstances. Similarly, there may be no weight reference period when the shares for two different periods are averaged, as in the Törnqvist index. See also 'base period'.

Weighted arithmetic average index	A weighted arithmetic average of the price relatives: namely, $\sum w (p^t / p^0)$ where the $w$ 's, the weights, are typically actual or hybrid expenditure shares in a CPI context. This type of index is called here a <i>Young</i> index after an index number pioneer. Most CPIs are actually calculated as <i>Young</i> indices. The general class of indices covered by this definition is very broad and includes the Laspeyres, Paasche and Walsh indices. When the weights are actual or hybrid expenditure shares, the resulting indices can, in most cases, also be expressed as basket indices, so that Lowe and Young indices often coincide.
Young index	An index defined as a weighted arithmetic average of the price relatives: see the previous heading.

## Annex to the CPI Glossary

### Some basic index number formulae and terminology

1. A *basket(-type)* price index (called here a *Lowe* price index after the index number pioneer who first proposed this general type of index) is an index of the form<sup>1</sup>

$$\frac{\sum p_n^t q_n}{\sum p_n^0 q_n}, \quad (1)$$

which compares the prices of period  $t$  with those of (an earlier) period 0, using a certain specified quantity basket. The family of Lowe indices includes some well known indices as special cases:

- when  $q_n = q_n^0$ , we get the Laspeyres index;
- when  $q_n = q_n^t$ , we get the Paasche index;
- when  $q_n = (q_n^0 + q_n^1) / 2$ , we get the Marshall-Edgeworth index;
- and when  $q_n = (q_n^0 q_n^t)^{1/2}$ , we get the Walsh index.

In practice, statistical offices frequently work with a Lowe index in which  $q_n = q_n^b$ , where  $b$  denotes some period prior to 0.

2. A useful feature of a basket price index for period  $t$  relative to period 0 is that it can be decomposed, or factored, into the product of two, or more, indices of the same

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<sup>1</sup> The sums are understood to be running over all items  $n$ .

type: for instance, as the product of an index for period  $t-1$  relative to period 0 and an index for period  $t$  relative to period  $t-1$ . Formally,

$$\frac{\sum p_n^t q_n}{\sum p_n^0 q_n} = \frac{\sum p_n^{t-1} q_n}{\sum p_n^0 q_n} \frac{\sum p_n^t q_n}{\sum p_n^{t-1} q_n}. \quad (2)$$

The index on the right side of (2) is described as a ‘two-stage index’. It is identical with the single basket index that compares period  $t$  directly with period 0, provided the same set of prices is available and used in all three periods 0,  $t-1$  and  $t$ .

In particular, when  $q_n = q_n^0$ , expression (2) turns into

$$\frac{\sum p_n^t q_n^0}{\sum p_n^0 q_n^0} = \frac{\sum p_n^{t-1} q_n^0}{\sum p_n^0 q_n^0} \frac{\sum p_n^t q_n^0}{\sum p_n^{t-1} q_n^0}. \quad (3)$$

The left side of (3) is a direct Laspeyres index. Note that only the first of the indices that make up the ‘two stage Laspeyres’ index on the right side is itself a Laspeyres index, the second being a Lowe index for period  $t$  relative to period  $t-1$  that uses the quantity basket of period 0 (not  $t-1$ ). Some statistical offices describe the two stage Laspeyres index given in (3) as a ‘modified Laspeyres’ index.

3. In a time series context, say when  $t$  runs from 1 to  $T$ , the series

$$\frac{\sum p_n^1 q_n}{\sum p_n^0 q_n}, \frac{\sum p_n^2 q_n}{\sum p_n^0 q_n}, \dots, \frac{\sum p_n^T q_n}{\sum p_n^0 q_n} \quad (4)$$

is termed a series of *fixed* basket price indexes. In particular, when  $q_n = q_n^0$ , we get a series of Laspeyres indexes.

4. At period  $T$  one could change to a new quantity basket  $q'$ , and calculate from this period onwards

$$\frac{\sum p_n^{T+1} q'_n}{\sum p_n^T q'_n}, \frac{\sum p_n^{T+2} q'_n}{\sum p_n^T q'_n}, \frac{\sum p_n^{T+3} q'_n}{\sum p_n^T q'_n}, \dots \quad (5)$$

To relate the prices of periods  $T+1$ ,  $T+2$ ,  $T+3$ , .... to those of period 0, *chain linking* can be used to transform (5) into a series of the form

$$\frac{\sum p_n^T q_n}{\sum p_n^0 q_n} \frac{\sum p_n^{T+1} q'_n}{\sum p_n^T q'_n}, \frac{\sum p_n^T q_n}{\sum p_n^0 q_n} \frac{\sum p_n^{T+2} q'_n}{\sum p_n^T q'_n}, \frac{\sum p_n^T q_n}{\sum p_n^0 q_n} \frac{\sum p_n^{T+3} q'_n}{\sum p_n^T q'_n}, \dots \quad (6)$$

This could be termed a series of *chain linked* fixed basket price indexes. In particular, when  $q_n = q_n^0$  and  $q'_n = q_n^T$ , we get a series of chain linked Laspeyres indexes. Since the basket was changed at period  $T$ , the adjective ‘fixed’ applies literally only over a certain number of time intervals. The basket was fixed from period 1 to period  $T$ , and is again fixed from period  $T+1$  onwards. When the time intervals during which the basket is kept fixed are of the same length, such as one, two or five years, this feature can be made explicit by describing the index as an annual, bi-annual or five-yearly chain linked fixed basket price index.

5. A *weighted arithmetic<sup>2</sup>-average(-type)* price index (called here a *Young* price index after another index number pioneer) is an index of the form

$$\sum w_n (p_n^t / p_n^0), \quad (7)$$

which compares the prices of period  $t$  with those of period 0, using a certain set of weights adding up to 1. Note that any basket price index (1) can be expressed in the form (7), since

$$\frac{\sum p_n^t q_n}{\sum p_n^0 q_n} = \sum \frac{p_n^0 q_n}{\sum p_n^0 q_n} \frac{p_n^t}{p_n^0}. \quad (8)$$

In particular, when

$$\bullet \quad w_n = s_n^0 \equiv p_n^0 q_n^0 / \sum p_n^0 q_n^0, \quad (9)$$

that is, period 0 value shares, (7) turns into the Laspeyres index. When

$$\bullet \quad w_n = p_n^0 q_n^t / \sum p_n^0 q_n^t, \quad (10)$$

that is, hybrid period  $(0,t)$  value shares, we get the Paasche index. One could also think of setting

$$\bullet \quad w_n = s_n^b \equiv p_n^b q_n^b / \sum p_n^b q_n^b, \quad (11)$$

that is, period  $b$  value shares. In practice, however, one frequently works instead of (11) with

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<sup>2</sup> To distinguish from geometric or other kinds of average.

$$\bullet \quad w_n = s_n^b(p_n^0 / p_n^b) / \sum s_n^b(p_n^0 / p_n^b) = p_n^0 q_n^b / \sum p_n^0 q_n^b, \quad (12)$$

that is, *price-updated* period  $b$  value shares.

Note that hybrid value shares, such as (10) or (12), are not observable but must be constructed.

6. In a time series context, when  $t$  runs from 1 to  $T$ , the series

$$\sum w_n(p_n^1 / p_n^0), \sum w_n(p_n^2 / p_n^0), \dots, \sum w_n(p_n^T / p_n^0) \quad (13)$$

is termed a series of *fixed* weighted arithmetic-average price indexes. In particular, when the weights are equal to the period 0 expenditure shares, we get a series of Laspeyres indexes, and when the weights are equal to the price-updated period  $b$  expenditure shares, we get a series of Lowe indices in which the quantities in the basket are those of period  $b$ .

7. In period  $T$  one could change to a new set of weights  $w'$ , and calculate from this period onwards

$$\sum w'_n(p_n^{T+1} / p_n^T), \sum w'_n(p_n^{T+2} / p_n^T), \sum w'_n(p_n^{T+3} / p_n^T), \dots \quad (14)$$

or, using chain linking to relate the prices of periods  $T+1$ ,  $T+2$ ,  $T+3$ , .... to those of period 0,

$$\sum w_n(p_n^T / p_n^0) \sum w'_n(p_n^{T+1} / p_n^T), \sum w_n(p_n^T / p_n^0) \sum w'_n(p_n^{T+2} / p_n^T), \dots \quad (15)$$

This could be termed a series of *chain linked* fixed weighted arithmetic-average price indexes. In particular, when  $w_n = s_n^0$  and  $w'_n = s_n^T$ , we get a series of chain linked

Laspeyres indexes. When  $w_n = s_n^b(p_n^0 / p_n^b) / \sum s_n^b(p_n^0 / p_n^b)$  and

$w'_n = s_n^{b'}(p_n^T / p_n^{b'}) / \sum s_n^{b'}(p_n^T / p_n^{b'})$  for some later period  $b'$ , we get a series of chain linked Lowe indices.

8. Again, since the weights were changed at period  $T$ , the adjective 'fixed' applies literally only over certain number of time intervals. The weights were fixed from period 1 to period  $T$ , and are again fixed from period  $T+1$  onwards. When the time intervals during which the weights are kept fixed are of the same length, this feature can be made explicit by adding a temporal adjective such as annual, bi-annual or five-yearly.