Title of the paper

Fixed basket Laspeyres' method compared to modified Laspeyres' method in computing Consumer Price Indices[1]

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Abstract

This paper reviews Consumer Price Index (CPI) computation formula (Laspeyres'). The paper, specifically, compares two Laspeyres' methods (the fixed basket and the modified one). It starts with the price index practical and economic theory point of view; and, simulates the formulae with some data to find out their behavior. The paper reviews various CPI documents from ILO, IMF and countries' practices (specifically SADC countries) in computing their CPIs. It is found that the two formulae behave differently in relation to the underlying economic theories. The economic theory indicates that if the price of a current period is the same as that of a base period, the index number of this period will be equal to that of the base price period (100). In this case the inflation figure for such a period compared to the base period will be equal to zero, that is, there is no inflation. Additionally, index numbers computed for items with the same prices in two different current periods, results to the same index number. Such results are not obtained using the modified Laspeyres' method (systematic price updated eights). This may lead to wrong monetary and economic policies by applying wrongly computed price index numbers and inflation figures. The paper concludes that consumer price index numbers computed from modified Laspeyres' formula do not conform to the index and economic theories; and thus, lead to wrong inflation figures.

Key words: Index base (reference) period, base period prices, prices, quantities, values, CPI basket weights

1. INTRODUCTION TO CONSUMER PRICE INDEX (CPI)

At the international level the International Labor Office (ILO) is the agency responsible for the subject of consumer price indices within the United Nations system so as to ensure that international standards on the subject reflect best current practices and methodological advances. To this effect, the first ILO resolution on Consumer Price Index (CPI) was adopted in 1925 by the Second International Conference of Labor Statisticians (ICLS); and subsequent revised resolutions were adopted by the Sixth (1947), Tenth (1962), Fourteenth (1987), and Seventeenth (2003) ICLS.

At the time of the 1925 resolution, the main reason for compiling a CPI was its use in adjusting wages to compensate for changes in the cost of living. The first set of standards was therefore referred to "cost-of-living" indices (COLI) rather than CPI. The terms "cost-of-living index" and "consumer price index" were then usually used interchangeably as synonyms. Later on, a distinction was drawn between the concept of a "cost-of-living index", designed to measure the change in the cost of maintaining a given standard of living, and the concept of a "pure price index" designed to measure the change in the cost of purchasing a specific set (basket) of consumer goods and services (ILO 2003).

Even with the distinction that was made between the two concepts, contemporary practices tend to take them as representing the same thing. It has to be noted that while CPI intends to measure a price change of an item or group of items (known as a fixed basket of goods and services) from one period to another, COLI intends to measure the cost of maintaining a certain standard of living (welfare) from one time to another. The major difference between the two is that while CPI has a **fixed basket**, COLI on the other hand has a **fixed welfare**. For CPI, welfare may be changing from time to time; while for COLI, a basket may be changing from time to time. Such are the issues that have to be critically thought of at the beginning on deciding on the purpose(s) of the index number.

The same distinction was made by (Triplett, 1999 and ILO, 2004) that a conceptual distinction needs to be drawn between a basket index and a cost of living index. A CPI measures the change between two time periods in a total expenditure needed to purchase a given set or basket of consumption goods and services. A COLI is an index that measures the change in maintaining a given standard of living. Practically, CPI maintains the same basket for a given period of time while COLI uses different baskets every time but maintains a certain standard of living: How can these be the same? Given that there has not been any index that is specifically compiled to measures the cost of living, CPI is used as an approximation to COLI (ILO 2003).

In a report, "Towards a more accurate measure of the Cost of living"; the Boskin Commission (1996), elaborated very clearly the distinction of the CPI and COLI by stating that a cost of living index is a comparison of the minimum expenditure required to achieve the same level of well-being (also known as welfare, utility or standard of living) across two different sets of prices. The commission acknowledged that with any practical application of the theory of index number production, estimating a cost of living index required assumptions, a methodology, data gathering processes and index number construction.

Unfortunately the commission did not come up with a suggestion on how this could be done; probably this was not among the terms of reference given to them. However, the commission went on to highlight two types of potential biases in the CPI relative to an ideal cost of living index.

One of the biases mentioned was the use of fixed but representative market basket of goods and services over time. The report pointed out that, the fixed basked becomes less and less representative over time as consumers respond to price changes and new choices. The other bias mentioned was on the appearance and disappearance of some goods in the basket when the substitution for both goods and outlets are instituted.

A key point to note here is that the Commission understood that CPI was not really a measure of the cost of living and it will never become one because of its theoretical and methodological background, rather it can be taken only as a proxy to it. All the observations and recommendations that were made by the Commission seems as if the intention was to change the CPI methodology so that it measures the cost of living and not the price change over time. We are of the opinion that let CPI stand as CPI and specific methodology for measuring cost of living be devised. Moreover, the concept of “a cost of living” has to be agreed upon by relevant stakeholders since a certain level of standard of living needs more variables beyond the ones that can be measured in monetary form. As in its simplicity form, the purpose of CPI is very clear as it is and it should not be tempered with. Any temptations to try to change CPI methodology such that it measured the cost of living may end up having the index numbers which neither measure the price change over time nor the cost of living.

Uses of CPI

The main uses of CPI as stated in the ILO document are as follows:

(a) To compute an average measure of price inflation for the household sector as a whole;
(b) To adjust wages as well as social security and other benefits to compensate for the changes, normally rising, consumer prices;
(c) Used as one of the macro-economic indicators;
(d) CPI sub-indices are used to deflate components of household final consumption expenditure in the national accounts and the value of retail sales to obtain estimates of changes in their volumes;
(e) It is used compute inflation that acts as a proxy for the overall rate of price inflation for all sectors of the economy; and
(f) The resulting inflation figures are used to adjust government fees and charges, adjustment of payments in commercial contracts; and for formulation, assessing fiscal and monetary policies and trade and exchange rate policies. (ILO 2003).

Given that many countries compute only CPI, the index may be used for many purposes. It is unlikely that one index can perform equally satisfactorily in all applications. This calls for the construction of a number of alternative price indices for specific purposes, if the requirements of the users justify the extra expense. Should that happen, each index should be properly defined and named to avoid confusion. In the absence of other indices in many countries, CPI is suitable as it may be used for many purposes.

2. OBJECTIVE OF THE PAPER

The main objective of the paper is to look at and compare two methods; the Laspeyres' fixed weight method and the modified Laspeyres' method that are currently being used by many countries in compiling their national CPIs. There has been a growing argument on which method, between the two, either yields reliable results or should be preferred. In most cases, the discussions are based on how flexible the method is in accommodating different issues other than how sensible the results are in relation to either the reality or economic theory. The operations of these methods will be compared with some underlining economic theories. It should be noted that price index numbers have background economic theories on which they are built.

3. LASPEYRES' METHODS

3.1 Standard Laspeyres' method

Theoretically the standard Laspeyres' formula is expressed as

$$I_{STD} = \frac{\sum_{i=1}^{n} p_{it} q_{i0}}{\sum_{i=1}^{n} p_{i0} q_{i0}} \times 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(i)}$$

Where p_{it} is the price of an item *i* at current period
p_{i0} is the price of an item *i* at period *o* (base period)
q_{i0} is the quantity of an item *i* at period *o* (base period)

q_{i0} in equation (i) acts as weight to the prices in both periods. This implies that the denominator in the equation remains constant for a period of time until a new $q_{i0}s$ are found. What keeps on changing is the figure (value) of the numerator that is affected by changes of $p_{it}s$ from one period to another. This enables the indices that are computed from time to time to be comparable because they use the same weight and the same denominator. In other words, the index formula keeps memory of the reference period value. However, this formula is not used directly in the computation of CPI because in practice consumers do not fix the quantities they purchase from time to time rather they keep a certain amount of money (expenditure) to purchase certain goods. This leads to different quantities of goods may be purchased from a certain fixed amount of money in different periods of time. This is what brought up the fixed basket Laspeyres method.

3.2 Fixed Basket Laspeyres' method

It has been pointed out that consumers do not keep the quantities of commodities they consume (q_{i0s}) constant for many years after the reference period due to the fact that they do demand/purchase different quantities of the same item from time to time. It is in line with (UN 2009) that because of sampling issues and the use of expenditure rather than quantities, standard Laspeyres' formula is transformed to accommodate expenditure data from Household Budget Surveys (HBS). The underlying reason is that HBS do not seek information from household about quantities of commodities that they purchase but rather asks about the expenditures of products. For example, a household is not asked how many mangoes were purchased during a reference period; but rather, how much it spent on mangoes. An additional advantage of using proportions of weights as opposed to quantities as weights in the compilation of the CPI is that it is more convenient because with some products, particularly some services, such as education tuition fee or transport fare for which no tractable quantities or unit values are available. Equation (i) is then transformed to either

$$I_{FW} = \sum_{i=1}^{n} w_{i0} \frac{p_{it}}{p_{i0}} \times 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(ii)}$$

When $\sum_{i=1}^{n} w_{i0} = 1$, or

$$I_{FW} = \frac{\sum_{i=1}^{n} w_{i0} \frac{p_{it}}{p_{i0}}}{\sum_{i=1}^{n} w_{i0}} \times 100, \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(iii)}$$

When $\sum_{i=1}^{n} w_{i0} = 100 \; or \; 1{,}000 \; or \; 10{,}000$, the mostly applied versions after re-scaling the expenditure proportions

Where w_{i0} is the fixed weight of the i^{th} item at the base or weight reference period which is obtained as a proportion (share) of private households' expenditure value ($p_{i0}q_{i0}$) of the i^{th} item over the total private households' expenditure value of the country ($\sum_{i=1}^{n} p_{i0}q_{i0}$) of all items (goods and services) in a weight reference period , that is, $w_{i0} = \frac{p_{i0}q_{i0}}{\sum_{i=1}^{n} p_{i0}q_{i0}}$. Data that are used to compute these weights are obtained from Household Budget Surveys (HBS) or Household Income and Expenditure Surveys (HIES) as it is called in some countries. It is recommended that new CPI basket weights should be obtained after every five years (ILO, 2003) or a periodicity shorter than five years.

Formula (ii) indicates that the index weight w_{i0} and p_{i0} (base period price) are fixed (constant) for a certain period of time until new sets are obtained; which is, for almost African countries, mainly after undertaking a new HBS. This formula is called the fixed basket Laspeyres' formula.

3.3 Modified Laspeyres' method

In recent years, there has been a further modification of formula (iii) to suit items replacements in the index basket from time to time due to a number of reasons, including the smooth substitution of new items and frequent weight updates every month. The modification (of formula (iii)) yields the so called modified Laspeyres' formula which is expressed as

$$I_{MD} = \frac{\sum_{i=1}^{n} w_{it-1} \frac{p_{it}}{p_{it-1}}}{\sum_{i=1}^{n} w_{it-1}} \times 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(iv)}$$

When $\sum_{i=1}^{n} w_{it-1} \rangle 1$, mostly normalized to 100 or 1000 or 10000, and

$$I_{MD} = \sum_{i=1}^{n} \left(w_{it-1} \frac{p_{it}}{p_{it-1}} \right) \times 100$$

When $\sum_{i=1}^{n} w_{it-1} = 1$

Where; $w_{it-1} = w_{it-2} \frac{p_{it-1}}{p_{it-2}}$, and $t \geq 2$

The interpretation of this formula is that weights are being updated every month using the price relatives of the subsequent prices. At the beginning of the price index series (that is, after new weights have been obtained from the HBS, when w_{i0} s are obtained) the first period after base period (the following month after the base month in this case), every item in the index will use w_{i0} as its weight. In the second month after the base period the w_{i0} s have to be updated using the price ratios $\frac{p_{i1}}{p_{i0}}$ to obtain $w_{i2} = w_{i0} \frac{p_{i1}}{p_{i0}}$, for the third month all w_{i2} s have to be updated by $\frac{p_{i2}}{p_{i1}}$ to obtain $w_{i3} = w_{i2} \frac{p_{i2}}{p_{i1}}$, the process continues in this manner until new weights are obtained from the new HBS.

(When $t = 1$ Modified Laspeyres' is equal to fixed basket Laspeyres' method).

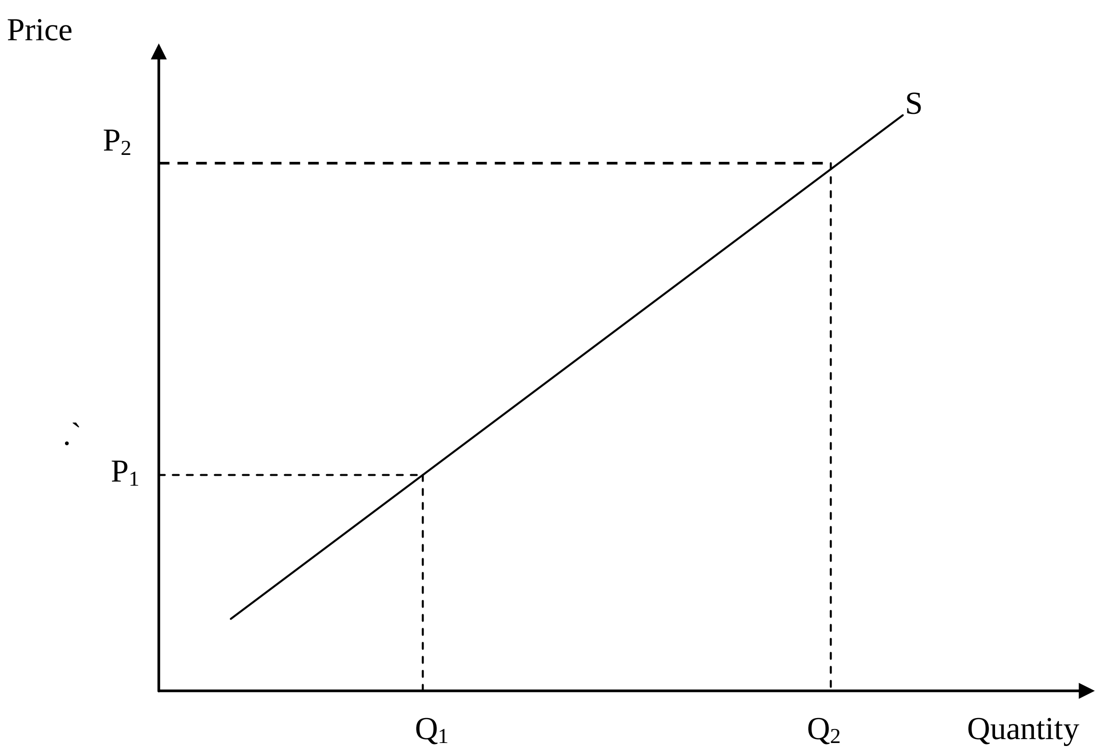
In the modified Laspeyres' formula, weights are price updated monthly as is indicated in formula (iv) above. In this case the *weight* of any particular item changes from one period (month) to another, not constant as for fixed weight baskets.

4. PRICE LEVELS IN RELATION TO QUANTITY SUPPLY, DEMAND AND VALUES

At this juncture, it suffices to point out that economic theory tells us that, assuming other things constant, suppliers would wish to supply more of the goods at higher prices and vice versa. Conversely, assuming other things constant as well, consumers would wish to purchase more of the goods whose prices fall or consumers are likely to buy more of goods at lower prices and vice versa. These can be illustrated graphically in Figure 4.1 and Figure 4.2 respectively.

4.1 The supply curve

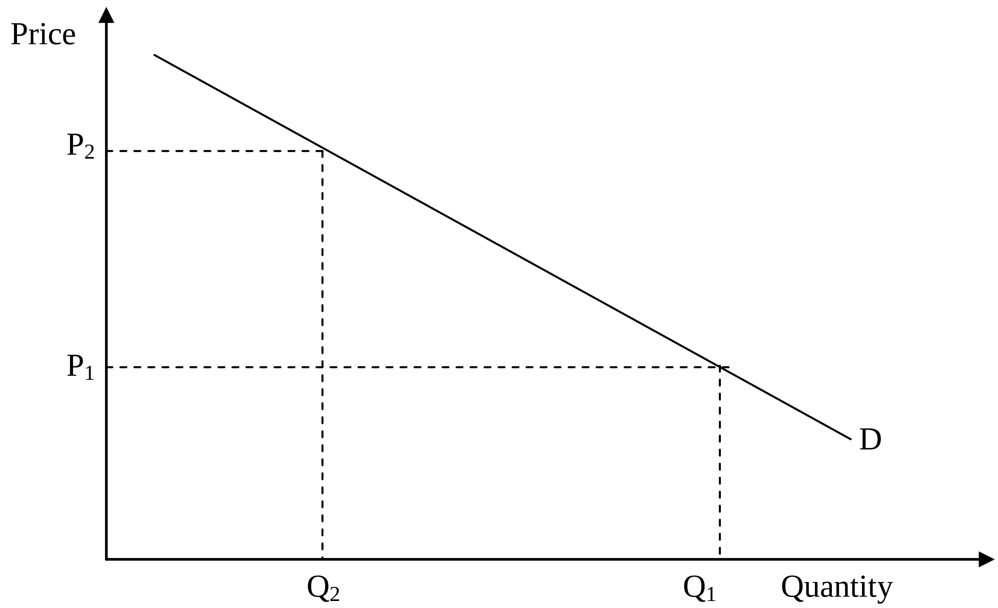
Figure 4.1 The supply curve



The supply curve S simply indicates that the quantities supplied for a commodity have direct relationships with their prices. It is observed that when the price rise from P_1 to P_2, where, $P_1 < P_2$. The quantity supplied responds in a similar manner by rising from Q1 to Q_2, where $Q_1 < Q_2$ and vice versa.

4.2 The demand curve

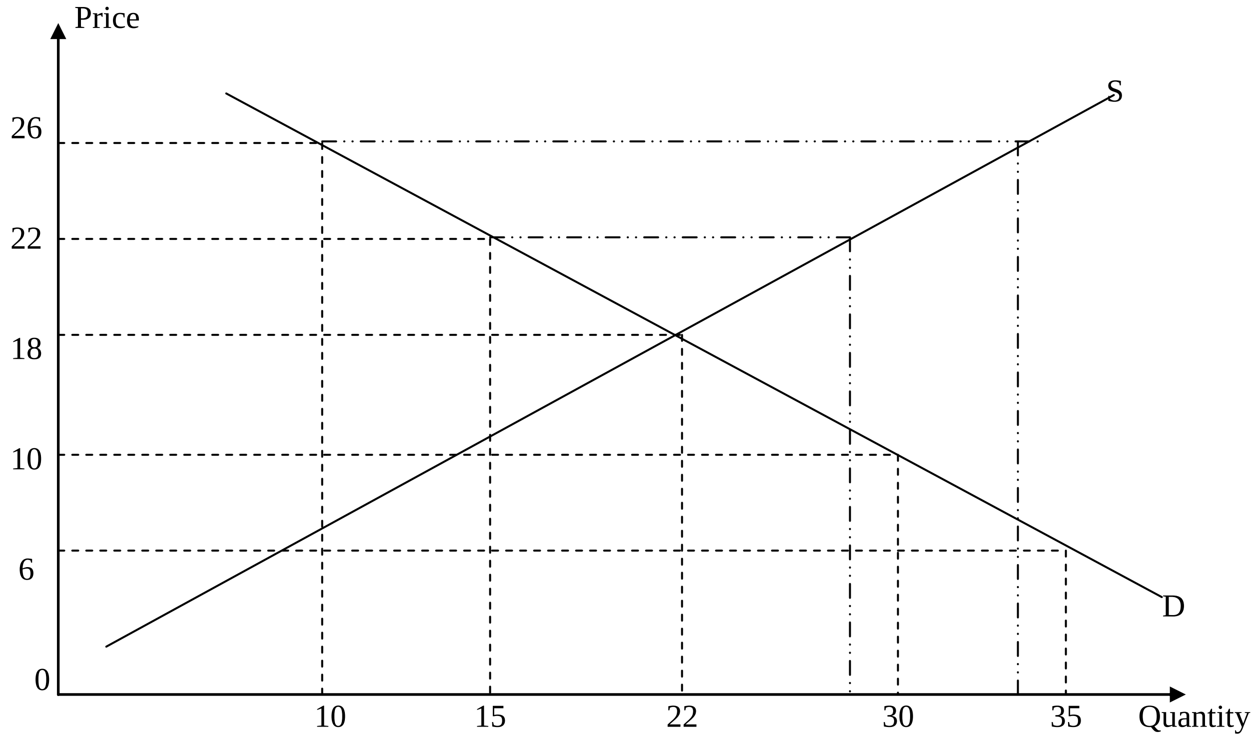
Figure 4.2 The demand curve



The demand curve D depicts a different scenario, where, the rise in prices has a negative effect on the quantities demanded (except for some very special goods). As it is seen from Figure 4.2, the rise of price from P_1 to P_2, where, $P_1 < P_2$, is associated with a fall in quantity demanded from Q_1 to Q_2, where, $Q_1 > Q_2$. The movement of price on the price axis from the lower price to the higher price leads to the opposite movement on the quantity axis where it will move from the higher to the lower quantities, and vice versa. Let us now see what happens when these two curves are drawn together (combined) with some hypothetical data.

4.3 Combined supply and demand curves

Figure 4.3 Supply and demand curve combined using simulation data



The supply and demand curves can be drawn in the same graph in order to show the relationship of the two curves on prices and quantities. As we can see in Figure 4.3 above, moving along the demand curve D from the left top corner, that is, prices falling, the quantity demanded increases. The reverse is the case on the supply side. Moving from the left lower part of the supply curve to the right, that is, lower prices are associated with lower quantity supplied. As the price rises there seem to be more supply of the product in question. Using our hypothetical data, suppliers are willing to bring to the market about 34 units of the commodity when the price was at, 26 and would be willing to supply about 28 units when the prices are at 22 but consumers are actually able to purchase only 10 and 15 units at these prices respectively. This is a typical relationship between the supply and demand on quantities and related prices. Furthermore, it should be noted that a product (multiplication) of a price and quantity of a good gives a value of a good, that is, price multiplied by quantity equals value. Using the information (figures) from Figure 4.3 and presenting them in a table, results as in Table 4.1.

Table 4.1 Prices and quantities in Figure 3.3 presented in a table

Price (p)	Quantity (q)	Value (pq)	
26	10	260	
22	15	330	

18	22	396	Equilibrium level
10	30	300	
6	35	210	

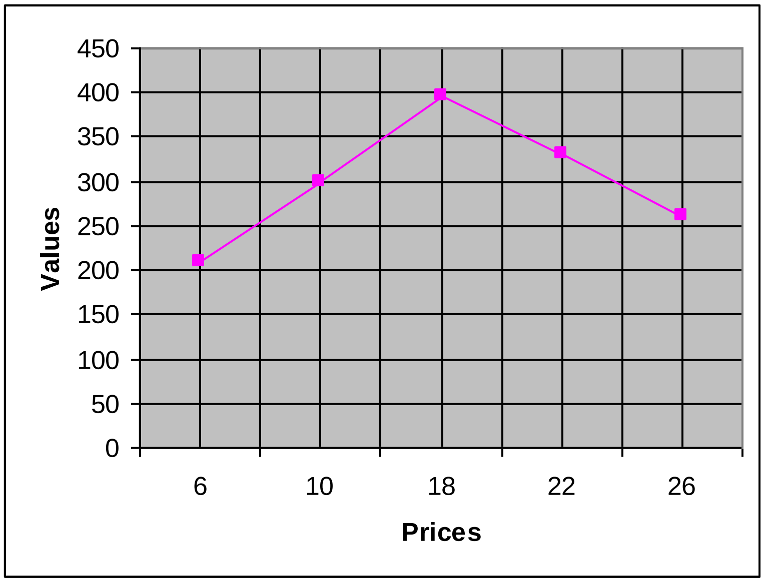
Source: Figure 4.3

The interest is to look at the relationship among the three variables; price, quantity, and value. The relationship of these variables is such that value is a product of price and quantity. In other words, from the economic theory point of view, it can be stated that the quantity purchased by a consumer for any particular product (item) at any point in time depends on the price level, other factors assumed to be constant. The total payment made for that purchase is the value. This can symbolically be expressed as:

$$value = pq = p \times q \text{ ....(v)}$$

Drawing some knowledge from Figure 4.3 and Table 4.1 above, it can be seen that there is some relationship between the prices and quantities demanded/supplied of any commodity, and therefore values. It is noted that the quantity demanded decreases when prices are rising and vice versa. On the contrary, the quantity supplied increases with the rise in prices. This kind of movement has a direct impact on the value in a sense that the value tends to increase with the rise in prices up to a point (at equilibrium) when any further price rise leads to a decrease in value, viz Figure 4.4

Figure 4.4 Plot of prices against values for figures from Table 4.1



5. FIXED BASKET LASPEYRES' METHOD COMPARED TO MODIFIED LASPEYRES' METHOD

Given that items' CPI weights are obtained as proportions of their expenditures to the total expenditure, $w_{i0} = \frac{p_{i0}q_{i0}}{\sum_{i=1}^{n} p_{i0}q_{i0}}$, (ILO, 2003), (UN 2009), (ILO,2004), after undertaking HBS, it is not necessary that a price rise will automatically lead to the rise of w_{i0} or a fall in price lead to the fall of w_{i0}.

Looking at the modified Laspeyres' formula, taking note of three main issues:

(i) The formula assumes that prices alone have effect on changing item weights in the CPI basket after the base period;
(ii) Rising prices always lead to rise in the weight of an item; and
(iii) Fall in prices always lead to a fall in the weight of an item.

The computation of CPI using fixed basket Laspeyres' formula can be done directly by taking a ratio of current price to the price of the base period; or by linking the two end prices with intermediate ones. Assume that p_{it} *and* p_{i0} are current and base period prices of an item with weight w_{i0}, the computation of an index can be expressed as shown in equation (vi), (the i_s are implied in the subsequent equations)

$$\frac{\sum w_0 \frac{p_t}{p_0}}{\sum w_0} = \frac{\sum w_0 \left(\frac{p_1}{p_0} \times \frac{p_2}{p1} \times \frac{p_3}{p_2} \times ... \times \frac{p_{t-1}}{p_{t-2}} \times \frac{p_t}{p_{t-1}} \right)}{\sum w_0} \quad \text{.................. (vi)}$$

Employing normal mathematical operations, price linkages in the numerator on the right hand side of equation (vi) reduces to the numerator in the left hand side of the equation. There is no change for the denominator on both sides. Given some data the two sides will yield the same result.

It is, however, not clear on the interpretation of the results obtained after applying the modified Laspeyres' formula. The matter is further complicated when some items are substituted sometime after the base period. The linking of prices will not cancel out as they do in equation (vi). Additionally, the belief that item weights always increases as the price rises leaves some doubt, as it was demonstrated by Table 4.1 and Figure 4.4 above.

Let us expand formula (iv) of a modified Laspeyres' as follows;

$$\frac{\sum w_{t-1} \frac{p_t}{p_{t-1}}}{\sum w_{t-1}} \times 100, \text{ the i}^{\text{th}} \text{ are implied...(vii)}$$

The expansion of the formula for different months yields different results as follows;

Looking at the first four months of the index after new weights have been developed, results will be as follows;

First month: $\frac{\sum w_0 \frac{p_1}{p_0}}{\sum w_0} \times 100$ …………………………………………………………………. (viii)

Second month: $\frac{\sum w_1 \frac{p_2}{p_1}}{\sum w_1} \times 100$, where $w_1 = w_0 \frac{p_1}{p_0}$, for each item in the index..….………….(ix)

Third month: $\frac{\sum w_2 \frac{p_3}{p_2}}{\sum w_2} \times 100$, where $w_2 = w_1 \frac{p_2}{p_1}$, for each item in the index ……………..(x)

Forth month: $\frac{\sum w_3 \frac{p_4}{p_3}}{\sum w_3} \times 100$, where $w_3 = w_2 \frac{p_3}{p_2}$, for each item in the index ……….........(xi)

And so on. This means that every month the weight of each item is price updated (changed) from the previous month. After every update they are normalized to 1 or 100 or any figure that was agreed.

The modified Laspeyres' formula has both weights and prices changing from time to time, then the resulting indices do not only measure that changes in prices over time but the changes are influenced by both price and weight changes.

It is wonder if formula (iv) really qualifies to be called Laspeyres' type formula at all since it directly violates two key principles of the Laspeyres' formula. First, the computed index number does not bounce back to that of the base price period (100) when current prices are equal to that of the base. The second one is that when it happens that two current periods have the same prices the computed indices for these periods results to the same index for the case of Laspeyres' formula but they are different for the modified Laspeyres' one. Examples are shown in Table A1.2 Annex 1 and Table A2.4 Annex 2 for the months of September and October respectively.

6. RELATIONSHIP BETWEEN LASPEYRES' FIXED BASKET WEIGHT AND MODIFIED LASPEYRES' METHOD

In computing price index numbers using Laspeyres' formula, one starts with elementary (un-weighted) indices, where only price ratios are used. Weights are employed to show the relative importance of different goods and services in the index. However, in the absence of any kinds of weights, it is possible to compute the index either using the arithmetic mean (AM) of the price relatives or a geometric mean (GM) of the same. The resulting indices would not differ significantly from each other.

The comparison exercise was carried out by using hypothetical data in Annex 1. Results show that indices obtained using three approaches namely: the fixed basket weights Laspeyres methods, the Arithmetic Mean of the price relatives, and the Geometric Mean of price relatives (with January prices as bases) seem to be very comparable. Results are presented in Annex 3

Indices obtained by using Modified Laspeyres' method and those of the Arithmetic Mean of the month to month price ratios seem to be comparable. Annex 4 but very different from those of fixed weights method.

7. INTERPRETATION OF THE COMPUTED INDICES

Results from the simulated results when using a fixed weight basket show that the computed indices for the months of May and August were 100, same as that of January (the price base period). This is because the prices of all items in these two months were the same as those of January. The indices for the months of September and October were the same (127.58), again the reason being that prices of all items in these two months were the same thus yielding the same index number. (Table A1.2 in Annex 1)

The results were different when using the modified method (on normalised price updated weights) on the same figures; the following were the result; for the month of May the index was 66.35 less than 100 and for the month of August the index was 109.26 more than 100, though the prices for all items were the same as January in both months. When it happened that the prices for September and October were same for all items, the computed indices, however, were different with 127.58 and 78.39 respectively. (Table A2.3 in Annex 2)

These results indicates that fixed basket weight Laspeyres' method yields results that are consistent with the economic and index number theories while modified Laspeyres' method does not. The most striking part is that when prices of the current period happen to be the same as the base period ones the index number computed by the modified Laspeyres' formula does not yield to 100 (the base period price index). This shows that modified Laspeyres' method has no memory of the base price period while the fixed basket formula does. Additionally, the modified Laspeyres' formula does not yield to the same index number for the same prices in different current periods.

8. CONCLUSIONS

Fixed weight Laspeyres' price index method yields index numbers that are consistent with the economic theory of index numbers while modified Laspeyres' method does not.

9. RECOMMENDATIONS

1. Fixed weight Laspeyres' method should be adapted in the computation of consumer price indices by countries. The only thing that countries should watch is of regularly updating weight (by undertaking Household Budget Surveys) to match with the socio-economic changes. This can even be done every year (using national accounts figure to derive weights) so that the prevailing economic realities are not missed or lost for a long period.
2. Countries using modified Laspeyres' formula may wish to revist their indices and inflations thereof to see if resulting figures do justice to the reality of their economies.

3. Empirical research in this field needs to be undertaken to address the situation before further damage is done to the economies that use the modified Laspeyres' method in computing their CPIs.

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Annex 1

Table A1.1 Worked example on fixed weight Laspeyres method using hypothetical data

Item	Weight	Prices											
	wo	Jan (Po)	Feb	March	April	May	June	July	August	Sept	Oct.	Nov	Dec
A	15	120	125	140	146	120	150	110	120	165	165	167	170
B	35	300	310	342	348	300	310	290	300	351	351	354	360
C	20	405	450	455	464	405	475	400	405	486	486	490	500
D	30	90	96	115	123	90	96	85	90	126	126	130	135
	100												

Table A1.2 Fixed basked Laspeyres' computed index numbers

A	15		15.63	17.50	18.25	15.00	18.75	13.75	15.00	20.63	20.63	20.88	21.25
B	35		36.17	39.90	40.60	35.00	36.17	33.83	35.00	40.95	40.95	41.30	42.00
C	20		22.22	22.47	22.91	20.00	23.46	19.75	20.00	24.00	24.00	24.20	24.69
D	30		32.00	38.33	41.00	30.00	32.00	28.33	30.00	42.00	42.00	43.33	45.00
	100		106.01	118.20	122.76	100	110.37	95.67	100	127.58	127.58	129.71	132.94
Overall Index		**100.00**	**106.01**	**118.20**	**122.76**	**100.00**	**110.37**	**95.67**	**100.00**	**127.58**	**127.58**	**129.71**	**132.94**

Annex 2

Table A2.1 Modified Laspyres computation method

Item	Weight						Prices						
	wo	Jan (Po)	Feb	March	April	May	June	July	August	Sept	Oct.	Nov	Dec
A	15	120	125	140	146	120	150	110	120	165	165	167	170
B	35	300	310	342	348	300	310	290	300	351	351	354	360
C	20	405	450	455	464	405	475	400	405	486	486	490	500
D	30	90	96	115	123	90	96	85	90	126	126	130	135
	100												

Table A2.2 Monthly price updated weights (before normalising)

		Jan (Po)	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
A	15	120	15	15.63	17.50	18.25	15.00	18.75	13.75	15.00	20.63	20.63	20.88
B	35	300	35	36.17	39.90	40.60	35.00	36.17	33.83	35.00	40.95	40.95	41.30
C	20	405	20	22.22	22.47	22.91	20.00	23.46	19.75	20.00	24.00	24.00	24.20
D	30	90	30	32.00	38.33	41.00	30.00	32.00	28.33	30.00	42.00	42.00	43.33
	100		100	106.01	118.20	122.76	100.00	110.37	95.67	100.00	127.58	127.58	129.71

The weights are price updated each month as from the index formula. Before they are normalized.

Table A2.3 Normalised (to 100) monthly updated weights

		Jan (Po)	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
A	15	120	15	14.74	14.81	14.87	15.00	16.99	14.37	15.00	16.17	16.17	16.09
B	35	300	35	34.12	33.76	33.07	35.00	32.77	35.36	35.00	32.10	32.10	31.84
C	20	405	20	20.96	19.01	18.66	20.00	21.25	20.65	20.00	18.81	18.81	18.66
D	30	90	30	30.18	32.43	33.40	30.00	28.99	29.62	30.00	32.92	32.92	33.41
	100		100	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

This shows that individual item's weight is changing from month to month

Table A2.4 Modified Laspeyres' computed index numbers after normalising the price updated weights

Index		Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
A			15.63	16.51	15.44	12.22	18.75	12.46	15.68	20.63	16.17	16.36	16.38
B			36.17	37.64	34.35	28.51	36.17	30.65	36.58	40.95	32.10	32.37	32.38
C			22.22	21.19	19.39	16.29	23.46	17.90	20.91	24.00	18.81	18.97	19.04
D			32.00	36.16	34.69	24.44	32.00	25.67	31.36	42.00	32.92	33.97	34.69
Totals			106.01	111.50	103.86	81.46	110.37	86.68	104.53	127.58	100.00	101.67	102.49
Overall Index		**100.00**	**106.01**	**105.17**	**87.87**	**66.35**	**110.37**	**78.53**	**109.26**	**127.58**	**78.39**	**79.69**	**79.02**

Annex 3 Monthly price ratios with January as Base

Item	Weight	Prices											
	wo	Jan (Po)	Feb	March	April	May	June	July	August	Sept	Oct.	Nov	Dec
A	15	120	125	140	146	120	150	110	120	165	165	167	170
B	35	300	310	342	348	300	310	290	300	351	351	354	360
C	20	405	450	455	464	405	475	400	405	486	486	490	500
D	30	90	96	115	123	90	96	85	90	126	126	130	135
	100												

A			104.17	116.67	121.67	100.00	125.00	91.67	100.00	137.50	137.50	139.17	141.67	
B			103.33	114.00	116.00	100.00	103.33	96.67	100.00	117.00	117.00	118.00	120.00	
C			111.11	112.35	114.57	100.00	117.28	98.77	100.00	120.00	120.00	120.99	123.46	
D			106.67	127.78	136.67	100.00	106.67	94.44	100.00	140.00	140.00	144.44	150.00	
Total		**100.00**	**106.32**	**117.70**	**122.23**	**100.00**	**113.07**	**95.39**	**100.00**	**128.63**	**128.63**	**130.65**	**133.78**	AM
		100.00	**106.08**	**117.55**	**121,92**	**100.00**	**112.95**	**95.35**	**100.00**	**128.22**	**128.22**	**130.16**	**133.20**	GM

Fixed Basket Laspeyres

Overall Index	**100.00**	**106.08**	**119.40**	**124.57**	**100.00**	**110.74**	**95.32**	**100.00**	**129.78**	**129.78**	**132.20**	**135.71**

Annex 4 Month to month price ratios

		January	February	March	April	May	June	July	August	Sept	October	Nov	Dec
A			104.17	112.00	104.29	82.19	125.00	73.33	109.09	137.50	100.00	101.21	101.80
B			103.33	110.32	101.75	86.21	103.33	93.55	103.45	117.00	100.00	100.85	101.69
C			111.11	101.11	101.98	87.28	117.28	84.21	101.25	120.00	100.00	100.82	102.04
D			106.67	119.79	106.96	73.17	106.67	88.54	105.88	140.00	100.00	103.17	103.85
Total		**100**	**106.32**	**110.81**	**103.74**	**82.21**	**113.07**	**84.91**	**104.92**	**128.63**	**100.00**	**101.52**	**102.34**

AM

Index numbers computed by Modified Laspeyres (using un-normalised price updated weights)

Overall Index	**100.00**	**106.08**	**112.55**	**104.33**	**80.28**	**110.74**	**86.08**	**104.91**	**129.78**	**100.00**	**101.86**	**102.66**

Annex 5

Plot of the price indices resulting from the computations above for fixed basket Laspeyres' method, monthly price ratios with January as base, Modified Laspeyres' method (using un-normalised price updated weights) and month to month price