**First Steps for Introducing New Weights in the CPI**

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Abstract

The CPI is one of the most important indicators of economic performance that a country produces and a key indicator for measuring inflation and economic policymaking. As such the accuracy and relevance of the CPI is of critical importance, and must not only reflect current price movements, but also include an up-to-date basket of items. It is important that the agencies producing a CPI revise and update the market basket on a regular basis. In so doing, there are several steps that NSOs must take before revising the weight structure. This paper discusses the first steps and decisions that need to be made in introducing the new weights. Of primary importance is whether the weights should be introduced directly into the CPI or adjusted for price change between the weight reference and price reference periods.

# Introduction

1. The CPI is one of the most important indicators of economic performance that a country produces. It is the key element for measuring inflation and is monitored by government, the business community, and the general public. As such the accuracy and relevance of the CPI is of critical importance. In this regard, the CPI must not only reflect current price movements, but also include an up-to-date basket of those important items that households purchase for day-to-day living. The basket, in turn, should reflect the current structure and distribution of goods and services that households are buying. Therefore, it is important that the agencies producing a CPI revise and update the market basket on a regular basis. This paper discusses various methods to introduce new weights for the CPI to keep it up-to-date and relevant in today’s economy.

## Background

1. The accuracy of the CPI depends upon representative samples for measuring price movements and that the methods and procedures for estimating and aggregating price changes in the CPI reflect the best available techniques. Regarding relevance, the CPI should include all the important products that are purchased as well as reflect the current structure of those purchases in the economy.
2. The speed with which the structure of consumer expenditures shift will vary over different time periods. During periods of rapid price change, the types and amounts of expenditure often change quickly. In such cases, the basket of items and their relative importance will shift quickly as well. It becomes important for the CPI to be able to capture these shifts in order for it to maintain its relevancy and representativity. National Statistical Offices (NSOs) need technical advice on internationally accepted methods and procedures for updating CPI baskets and their weights. There are several steps that NSOs must take before revising the weighting structure using a the most recent household expenditure survey (HES). This paper discusses the first steps and decisions that need to be made in introducing the new weights. Of primary importance is whether the weights should be introduced directly into the CPI or adjusted for price change between the weight reference and price reference periods.
3. Some NSOs, particularly in lower capacity countries, undertake weight updates infrequently and, in a few cases, every 10 years or so. Such a long interval between updates raises serious concerns about the relevance of the CPI. An example can provide a better understanding as to why NSOs need to have more frequent weight updates. Consider an item that has significant importance, such as potatoes. Assume potatoes become limited in supply and hard to find following a potato blight. The price of potatoes will rise rapidly due to their scarcity, but because the quantity of potatoes in the basket remains fixed, as prices rise, the share (importance) of potatoes in the basket will also rise. Review the following example for prices and weights for a CPI component called “tubers”.

**Table 1: Average Price, Expenditure Weights, and Expenditure Shares for CPI Tubers**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **HES Quantity in Kg** | **Avg. Price** | **HES Weight** | **Share (percent)** | **Avg. Price** | **Cost Weight** | **Share (percent)** | **Avg. Price** | **Cost Weight** | **Share (percent)** |
| **Tuber Items** | **2017** | **2017** | **2017** | **2017** | **2018** | **2018** | **2018** | **2019** | **2019** | **2019** |
| Potatoes | 32.5 | 3.08 | 100 | 50.0 | 6.16 | 200 | 64.7 | 9.24 | 300 | 69.9  |
| Yams | 32.5 | 2.05 | 50 | 25.0 | 2.18 | 53 | 17.2 | 2.75 | 67 | 15.6 |
| Taro | 9.1 | 2.75 | 25 | 12.5 | 3.06 | 28 | 9.0 | 3.17 | 29 | 6.8  |
| Plantains | 6.5 | 3.86 | 25 | 12.5 | 4.31 | 28 | 9.0 | 5.10 | 33 | 7.7 |
| Total |  |   | 200 |   |   | 309 |   |   | 429 |   |

1. In 2017, the annual expenditures from the HES for potatoes are 100 out of a total expenditure of 200 for all tubers. This represents a share of 50.0 percent. The other tubers that are important in the 2017 basket are yams, taro, and plantains. In 2018, prices for each item rise, and if households purchased the same amount of potatoes, the expenditure on each item would also increase. The cost (cost weight) for purchasing the same amount of potatoes, as is the case with a fixed quantity basket index, would be (6.16/3.08\*100=) 200 and the total basket would cost 309. However, the share of expenditure on potatoes for the tuber basket has risen to (200/309\*100=) 64.7 percent. The reason for this large shift in the share of potatoes is that their prices have increased by 100 percent while the price changes for the others have been more modest (6.6, 11.3, and 11.7 percent). Similarly, in 2019, the price for potatoes continues to rise much faster than the other items, having increased by 200 percent from 2017 compared to 34, 15, and 32 percent, respectively for the other tubers. This results in a further rise in the share for potatoes to almost 70 percent of the basket.
2. This example demonstrates one of the important facets of using fixed quantity weights. As relative prices change, those items with the larger than average price change will gain in importance in the index while those with smaller than average price change will lose importance. This will usually result in the basket being unrepresentative of current household expenditure patterns because of normal consumer behavior to purchase less of those items with relatively high increases in prices and more of those items with relatively lower price increases.
3. For instance, in Table 1, the quantity of potatoes purchased in 2017 was 32.5 kilograms. Our widely used fixed basket indexes assume that this quantity will continue to be purchased. Households, however, will most likely substitute some purchases of potatoes to a tuber with a lower price increase and the quantity of potatoes purchased will decline while the quantity of another tuber, perhaps yams, will increase. In this way households will try to economize by not overspending on potatoes and still maintain a certain level of needed nutrients in their consumption of tubers.
4. As is seen from this example, changes in the pattern of household spending can take place relatively quickly; however, a fixed quantity index will provide more importance to items contributing to rising prices than are warranted by current market conditions.

## International guidance on weight updates

1. Previously, the primary sources on weight updates have been the *Consumer Price Index Manual: Theory and Practice,* 2004, (*CPI Manual*, 2004) and the *Practical Guide to Producing Consumer Price Indices*, 2009, (*CPI Practical Guide*). Both provided some advice on updating weights but did not provide detailed examples for NSOs to follow. The updated *Consumer Price Index Manual: Concepts and Methods*, 2020, includes a new chapter on these issues, Chapter 9 – “Updating CPI Weights and Linking New to Previous CPI Series,” and gives more guidance to NSOs about the methods and procedures for introducing the new weights. The companion publication*, Consumer Price Index Theory* (forthcoming), will provide the theoretical underpinnings for CPI compilation methods.
2. Each of these publications note that the Laspeyres price index will be an upper bound to the true cost of living index (COLI) and the Paasche price index will be a lower bound.[[2]](#footnote-2) They also discuss that there are three target indices—Fisher, Törnqvist, and Walsh— and they are very close approximations to one another and to the true COLI. These target indices, however, are difficult to compile in real time because they require weights for both the current and previous period. In reality, NSOs only have weights from some period in the past which are often one to two years out of date.
3. In addition, the introduction of new weights is complex because it provides the opportunity to introduce new classifications, new items, new samples, new data sources, new compilation practices, and a new aggregation structure. These tasks are often undertaken simultaneously at the time of reweighting to minimize overall disruption to the time series and any resulting inconvenience to users of the indices.
4. The NSOs should first conduct an HES and use the results to develop the new basket of items.[[3]](#footnote-3) Then they will usually allocate a share weight to each item in the weight reference period, *b.* The NSOs must then decide whether to keep these expenditure weights fixed at their reference period levels or to keep the quantities fixed at the reference period levels. Keeping the expenditure shares fixed at the weight reference period means the NSOs do not have to take any additional actions. If the NSOs want to keep the quantities fixed at their level in the weight reference period, they must update the weights for price change from the weight reference period, *b*, to their introduction in the index in the price reference period, *0*. This requires the use of a series of update factors that measures price movements for each item between *b* and *0*.

### *CPI Manual: Concepts and Methods* (2020)

1. Given that the new weights are from a period *b* that generally precedes their introduction into the index in period *0*, the NSOs usually chose one of two methods for introducing the new weights. If the NSO is trying to mimic a Laspeyres index in which the quantity weights remain fixed, they would update the weights for price change between periods *b* and *0*. By price updating the weights, the NSO will produce a Lowe price index. On the other hand, if there is reason to believe that the quantities may have shifted between the two periods, it may be more reasonable to assume that the expenditure shares have remained fixed as the quantities shifted. In this case the NSOs could simply introduce the new share weights and produce a Young price index. The new manual provides the following advice

“**9.13** The recent research cited suggests that price updating weights before introducing them in the CPI may not be the best approach for the CPI based on the performance of the resulting index formula when compared to the preferred target indices. Price-updating the expenditure shares does not imply that the resulting weights are necessarily more up to date. When there is a strong inverse relation between movements of price and quantities, price-updating on its own could produce unreliable results….”

“**9.16** By keeping the expenditure shares constant from the weight reference period to the price reference period the underlying quantities are assumed to vary in response to changes in relative prices. Hence, if households tend to keep constant expenditure shares by substituting from goods or services with relative price increases to goods or services with relative price decreases, the period b expenditure shares will be good estimates of the expenditure shares in the price reference period when the weights are introduced in the index. In turn, if expenditure shares stay unchanged, the Young index will be a good estimate of a target superlative index. However, if quantities tend to remain constant, (i.e. the households do not substitute between goods and services in response to relative price changes), the Young index will be biased downwards compared to a superlative target index.”

1. The guidance in the primary sources noted above is helpful to NSOs in understanding the principles and reasons for conducting periodic CPI weight updates. The new *CPI Manual* (2020) provides more information on the concepts and detailed methods for updating the expenditure weights. However, it leaves the decision up to the best judgment of the NSOs whether to price update or not. Section 2 of this paper provides additional information that NSOs could use to make this decision. Section 3 provides concluding remarks.

# Updating Weights for Price Change: Pros and Cons

## The target index formula for the CPI

1. In the past, the target index for the CPI was a Laspeyres price index that was easy to explain to users. It is a fixed quantity basket price index, with quantities held fixed in the price reference period. The CPI manuals have helped to clarify that the target index for the CPI should be the Fisher, Törnqvist, or Walsh price indexes, not the Laspeyres index. The *CPI Manual* (2004) showed in Chapter 17 that these three indexes produce essentially the same results in practice. The Laspeyres index formula, however, is not generally used in practice. This is because the weight reference period of a CPI, the period during which the HES took place, is generally earlier than the price reference period of the index. To derive an index that begins from its index reference period (where the index is equal to 100) but keeps quantity weights fixed in the earlier weight reference (survey) period, many NSOs would price update the earlier weights. In this way, the resulting Lowe index was often referred to as a “Laspeyres-type index.” This raises the issue as to which index currently produced by NSOs would best approximate the target indices: the Lowe index with price updated weights or the Young index that simply uses the weights from the weight reference period.

## Recent research on the whether or not to price-update weights

1. Normal consumer behavior based on observation and economic theory posits that in response to relative price change consumers will adjust the quantities of goods and services they purchase. As prices of products purchased rise relative to other similar products, consumers tend to purchase more of the similar product with the relatively lower price increase and reduce purchases of the other. As relative prices fall, consumers will buy more of the relatively less expensive product and less of the more expensive product. The downward sloping demand curve in economic theory reflects this consumer reaction to price movements.
2. The mew *CPI Theory* publication (forthcoming) notes in Chapter 5 that this inverse relationship between price and quantity movements is why the Laspeyres price index will be an upper bound to the true cost of living index and the Paasche price index will be a lower bound. The three target indexes—Fisher, Törnqvist, and Walsh—that fall numerically between these indices are very close approximations with each other and with the true cost of living index.
3. The Lowe index, like Laspeyres, assumes that consumers do not substitute and the relative quantities are fixed at the weight reference period. As shown in Table 1, items with relatively large increases in price gain an unduly large expenditure share in 2019 relative to 2017. Chapter 9 of the *CPI Manual* notes that the Lowe index has an upward substitution bias compared to the true cost of living index, and this bias increases the longer the period between the weight reference (*b*) and the price reference (*0*) periods. Also, the Lowe index is upwardly biased relative to the Laspeyres index. Thus, price updating the weights results in an index number that is upward biased relative to the target indices as well as the Laspeyres index. Assuming prices are moving upward and there is normal consumer substitution behavior, the longer the period between *b* and *0*, the larger the bias will become.
4. An alternative approach discussed in Chapter 9 would be to use the weights from the weight reference period directly so that the expenditure shares are fixed at the weight reference period level. This approach assumes that there has been no change in shares between *b* and *0*. Unchanging expenditure shares imply that consumer shifts in reducing the quantities purchased are in the same proportion as the increase in prices.
5. Whether the Young index is biased relative to the target indexes will depend on the whether the relative change in prices is offset by a relative change in quantities that keeps the expenditure share fixed (elasticity of substitution equal to one). The Young index will have a downward bias compared to the target indices if the elasticity is lower than one (inelastic) because consumers, on average, do not necessarily substitute as much in response to price changes as the Young index implies. The Young index will have an upward bias if the elasticity is greater than one (elastic) because consumers tend to substitute more than assumed.
6. Empirical studies cited in Chapter 9 indicate that the potential bias in the Lowe price index generally exceeds that of the Young index and that both exceed the target indices. This result can also be demonstrated empirically by using alternative price change scenarios. When the weight reference period precedes the price reference period and there has been general inflation and normal consumer substitution activity between the two periods, the Lowe price index will always exceed the Young index. On the other hand, if the weight reference period precedes the price reference period and there has been general deflation and normal consumer substitution activity between the two periods, the Young price index will exceed the Lowe index.
7. This relationship can also be derived algebraically by analyzing the differences between the Lowe price index () and the Young price index ().

1. where
2. and
3. where
4. , i.e., the weights are updated for price change between *b* and *0* and.

By substituting equation (4) into equation (3), the following is derived:

1. .
2. When comparing equation (5) with equation (1) for period *0* when the new weights are introduced, note that:

If there is no inflation between *b* and *0*, i.e.,

If inflation has occurred between *b* and *0*, i.e.,

If deflation has occurred between *b* and *0*, i.e., .

1. In the case of inflation between *b* and *0*, the Lowe will exceed the Young and in the case of deflation between *b* and *0*, the Young will exceed the Lowe. Thus, the advice on whether to price update or not partially depends on the rate of general inflation between *b* and *0*. Another consideration is the expected inflation rate from period *0* to *t*. The *CPI Manual* (Table 9.3 and paragraph 9.44) notes that price updated weights give greater relative importance to items with higher-than-average relative price change and less importance to items with lower-than-average price change. This, along with consumer substitution behavior, argues in favor of choosing the Young index over the Lowe index.

## Should NSOs Use the Lowe or the Young index (to price update of not)?

1. This evidence suggests that price updating weights before introducing them in the CPI may not be the best approach for the CPI. Consumer theory indicates that if prices have risen between *b* and 0, there should be some shift in the structure of the quantities purchased. If it is clear that consumer substitution is taking place, then the appropriate formula for an NSO depends on the nature and extent of the substitution. If no such shifts take place, the NSO should consider price-updating the weights, thus holding quantities constant in period *b*, and compile a Lowe index. However, if overall inflation has occurred in the recent past and is expected for the future, then the Lowe price index will exceed the Young index. In this case no price updating would be warranted and the Young price index should be used instead of the Lowe index.
2. There are two additional approaches that can be employed: (i) estimate or make some judgment about the elasticity of substitution and use it to determine the appropriate formula; or (ii) use superlative index number formulas—such formulas can to an extent accommodate different degrees of substitution behavior—or an approximation to it, as discussed below.
3. A good measure of the degree of substitution is the elasticity of substitution. If no or very little substitution is taking place, the elasticity will be equal to or close to zero. In this case, the NSO could price-update the weights for price changes from *b* to 0 and compile a Lowe index. If consumer substitution is taking place and the changes in quantities (downward) are about the same proportion as the changes in prices (upward) leaving expenditure shares roughly constant, then the elasticity is unitary. In this case, the NSO should use the weight reference period shares directly and compile a Young index.
4. The NSO usually will not have information on the elasticity of substitution (η). Feenstra and Reinsdorf (2007), provide a relatively straightforward method, albeit with limitations, for estimating η by using the change in the expenditure shares over a period of time along with the change in prices. The NSO should have both sets of data available to them. The Feenstra-Reinsdorf approach (their equation 12) is to estimate η from a linear regression where the change in the natural logarithms of the shares () is regressed on the change in the natural logarithm of prices ():

The coefficient from the change in the natural logarithm of prices in the linear regression is then used to estimate η. The Appendix shows the type of information needed for estimating this regression equation. With these data, the NSO can estimate η using the regression approach. The Appendix also provides the Excel formulas for calculating the slope and intercept for the regression. The slope is used to derive the estimate of η. For the data in the Appendix, the estimated slope of the regression equation is 0.0129. We derive the value for η as follows.

= 0.0129

= –0.0129

η = 0.9871

1. Because the value of η is very close to 1.0, the NSO would conclude that consumers of this product group have unitary elasticity of substitution. In this case, they would want to use the Young index rather than the Lowe index. This means the NSO should use the weights for 2017 rather than price-updating the weights before introducing them. Of course, an NSO deciding on whether to change their higher-level formula in, say 2020, is basing the judgment on evidence from 2010 to 2017 expenditure patterns.
2. Greenlees (2011) in a study of substitution elasticity for the United States found that they were highly volatile in successive years. He found the elasticity not being statistically significant when tested against null hypotheses of zero in one year and unity in the next. Should regular expenditure surveys be available, the NSO should also undertake estimates for sub-periods. The implication of such volatility is that a more flexible, albeit retrospective, formula should be used in addition to the headline CPI.
3. Many NSOs may not able to estimate η and they will need to evaluate other data. We know that, on the one hand, if the CPI has been increasing over the 24 to 36-month period between *b* and 0 with price increases (e.g. 2 percent or more per year), the Lowe index will most likely be biased upward. If prices are changing at 2 percent or more per year, it is likely that consumers are substituting away from the higher priced items. We know, on the other hand, if the elasticity of substitution is less than unitary, the Young index also has an upward bias. However, the NSO cannot know for certain whether this activity is closer to unitary elasticity or zero elasticity.
4. In such a case, the NSO has other options to consider. It can price update the weights and calculate both a Lowe and geometric Lowe. Also, it can calculate a Young and a geometric Young. With these four indexes available the NSO can use a formula that is the geometric average of the Lowe (upward biased) and geometric Young (downward biased) or the Young (upward biased) and geometric Lowe (downward biased) to approximate the target indexes. The NSO should test this approach using historical data.
5. If the NSO is able to conduct an HES on a more frequent basis, for example annually or biannually, it could calculate the superlative Törnqvist index on a retrospective basis. As the new weights become available, the NSO can compile the Törnqvist index using the weights from the previous HES and current HES with the price data for the interim period. They can continue to use these weights until the next HES is available and revise the index for the new interim period.
6. It may be that more pragmatic factors influence the decision as to whether or not to price update the weights. Major changes to a classification system, addition and deletion of new and old representative products, extension of the geographical areas, and change in methodology from a previously biased one, at the time of reweighting make it problematic to reliably price-update the weights.

# Concluding Remarks

1. The CPI is one of the most watched indicators of economic performance in modern economies. It is used by policy makers in government, business, and private institutions to gauge the general movement of prices and determine the presence of inflationary conditions. Because of the CPI’s importance, it is critical to users that it remains both accurate and relevant. In this regard, the CPI must both reflect current price movements as well as an up-to-date basket of those important items that households purchase. The basket must reflect the current structure and distribution of goods and services that households are buying. Therefore, it is important that the agencies producing a CPI revise and update the market basket on a regular basis.
2. Consumer theory indicates that as prices change, there should be some shift in the structure of the quantities of goods and services purchased. If no such shifts take place and there is no substitution in consumer purchases, updating the weights for price change could be appropriate to produce an index that holds quantities fixed at the weight reference period levels (Lowe index). In theory and practice, however, consumers do make substitutions in their basket in response to relative price changes and the quantities of goods and services in the basket shift through time. In the case where inflation is occurring and quantities will change, the NSO should not update the weights for price change and, thus, use an index that keeps expenditure shares fixed at the weight reference period level (Young index). Also, if there has been inflation between the weight reference period and the price reference period, the Lowe price index will have an upward bias versus the Young price index.
3. It is clear that when consumer substitution is taking place and the CPI basket is changing, then appropriate steps must be taken to update the basket more frequently. Such updating should be a standard practice for CPI compilers, but the details for conducting updates are not always clear.

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## Appendix: Estimation of Elasticity of Substitution with Linear Regression

The NSO can estimate η using the regression approach by taking the following steps:

1. Calculate the natural logarithm (ln) of the item shares present in both 2019 (ln 2019 shares) and 2010 (ln 2010 shares). There are 90 in this example.
2. Subtract the 2010 natural log from the 2019 natural log (**Δ ln of Shares)**.
3. Convert the price indexes to price relatives by dividing by 100.
4. Calculate the natural log of the price relatives (**ln Price Rel**). (Note: Price Rel in 2010 = 1 for all indexes and ln Price Rel in 2010 = 0. Thus, the **Δln Price Rel = ln Price Rel 2019 – ln Price Rel 2010 = ln Price Rel 2019.)**
5. Calculate the weights for each observation as **Δ Share / Δ ln of Shares.**
6. Sum the column of weights.
7. Calculate normalized **Weights** (i.e., weights that sum to 1.0 by dividing by the sum of the weights in the previous step).
8. Calculate a weighted linear regression with the **Δ ln of Shares** as the left hand variable and **ln Price Rel** and **Weights** as the right hand variables.

The calculations formulas appear below following the table.

These should work if there is no missing data. With missing data, the NSO must insure that the averages do not include unmatched data.

| **COICOP Code** | **Item Name** | **Expenditure Share 2010** | **Expenditure Share 2019** | **Avg. CPI 2019/100** | **ΔShare** | **ln Share 2010** | **ln Share 2019** | **Δln of Share** | **ln PriceRel** | **Initial Weights** | **Weights** |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Original Data | Step iii |  | Step i | Step i | Step ii | Step iv | Step v&vi | Step vii |  |
| 01.1.101 | Rice (white) | 5.759 | 1.406 | 1.5070 | -4.352 | 1.7508 | 0.3411 | -1.4097 | 0.4101 | 3.0876 | 0.0322 |  |
| 01.1.102 | Rice (Brown) | 0.381 | 3.361 | 1.5173 | 2.981 | -0.9661 | 1.2123 | 2.1784 | 0.4169 | 1.3682 | 0.0143 |  |
| 01.1.103 | Flour | 4.356 | 2.578 | 1.3484 | -1.778 | 1.4716 | 0.9470 | -0.5245 | 0.2989 | 3.3896 | 0.0354 |  |
| 01.1.104 | Bread | 6.167 | 6.864 | 1.2718 | 0.697 | 1.8193 | 1.9263 | 0.1071 | 0.2405 | 6.5097 | 0.0679 |  |
| 01.1.105 | Biscuits (Salted) | 1.083 | 0.813 | 1.1305 | -0.270 | 0.0800 | -0.2071 | -0.2871 | 0.1226 | 0.9416 | 0.0098 |  |
| 01.1.106 | Cakes, Pastry, etc. | 0.375 | 1.034 | 1.3121 | 0.659 | -0.9796 | 0.0338 | 1.0133 | 0.2716 | 0.6502 | 0.0068 |  |
| 01.1.107 | Chow Mein | 1.370 | 1.716 | 1.2513 | 0.346 | 0.3148 | 0.5397 | 0.2249 | 0.2242 | 1.5363 | 0.0160 |  |
| 01.1.109 | Macaroni | 0.426 | 1.284 | 1.0585 | 0.857 | -0.8528 | 0.2496 | 1.1025 | 0.0568 | 0.7777 | 0.0081 |  |
| 01.1.110 | Oat flakes | 0.751 | 0.450 | 1.0056 | -0.301 | -0.2864 | -0.7987 | -0.5122 | 0.0055 | 0.5876 | 0.0061 |  |
| 01.1.111 | Sago | 0.535 | 0.341 | 1.0347 | -0.194 | -0.6249 | -1.0761 | -0.4512 | 0.0341 | 0.4308 | 0.0045 |  |
| 01.1.112 | Tennis Rolls | 0.589 | 1.392 | 1.2598 | 0.803 | -0.5300 | 0.3307 | 0.8607 | 0.2310 | 0.9333 | 0.0097 |  |
| 01.1.113 | Whole Wheat Bread\* | 0.622 | 0.180 | 1.2718 | -0.442 | -0.4755 | -1.7150 | -1.2394 | 0.2405 | 0.3563 | 0.0037 |  |
| 01.1.201 | Stew Beef | 4.499 | 1.940 | 1.1052 | -2.559 | 1.5039 | 0.6628 | -0.8411 | 0.1000 | 3.0425 | 0.0317 |  |
| 01.1.205 | Chicken (live) | 1.577 | 1.038 | 1.1258 | -0.539 | 0.4553 | 0.0369 | -0.4184 | 0.1185 | 1.2884 | 0.0134 |  |
| 01.1.206 | Chicken (frozen) | 8.904 | 10.202 | 1.1023 | 1.298 | 2.1865 | 2.3226 | 0.1361 | 0.0974 | 9.5386 | 0.0995 |  |
| 01.1.207 | Pork Leg | 0.473 | 0.610 | 1.3878 | 0.136 | -0.7480 | -0.4951 | 0.2530 | 0.3277 | 0.5385 | 0.0056 |  |
| 01.1.211 | Duck | 0.291 | 0.217 | 1.0730 | -0.074 | -1.2350 | -1.5268 | -0.2917 | 0.0705 | 0.2522 | 0.0026 |  |
| 01.1.212 | Liver | 0.245 | 0.207 | 1.1544 | -0.038 | -1.4057 | -1.5754 | -0.1697 | 0.1436 | 0.2255 | 0.0024 |  |
| 01.1.213 | Mutton | 0.319 | 0.271 | 1.0680 | -0.048 | -1.1415 | -1.3060 | -0.1645 | 0.0658 | 0.2944 | 0.0031 |  |
| 01.1.214 | Sausages (pork & chicken) | 1.049 | 1.823 | 1.2027 | 0.774 | 0.0481 | 0.6005 | 0.5524 | 0.1846 | 1.4007 | 0.0146 |  |
| 01.1.301 | Grouper | 1.142 | 1.822 | 0.9454 | 0.679 | 0.1329 | 0.5997 | 0.4668 | -0.0561 | 1.4555 | 0.0152 |  |
| 01.1.302 | Sea Trout | 0.785 | 0.989 | 1.0978 | 0.203 | -0.2416 | -0.0115 | 0.2300 | 0.0933 | 0.8831 | 0.0092 |  |
| 01.1.303 | Salted fish | 0.431 | 0.986 | 1.1624 | 0.555 | -0.8407 | -0.0140 | 0.8267 | 0.1505 | 0.6710 | 0.0070 |  |
| 01.1.304 | Butter fish | 0.503 | 0.256 | 0.9882 | -0.248 | -0.6865 | -1.3637 | -0.6771 | -0.0119 | 0.3657 | 0.0038 |  |
| 01.1.305 | Shrimp, fresh | 0.426 | 0.454 | 1.4015 | 0.028 | -0.8536 | -0.7907 | 0.0629 | 0.3375 | 0.4396 | 0.0046 |  |
| 01.1.307 | Grey snapper | 0.581 | 0.366 | 1.0085 | -0.215 | -0.5434 | -1.0051 | -0.4617 | 0.0085 | 0.4651 | 0.0049 |  |
| 01.1.308 | Red snapper | 0.393 | 0.259 | 1.0085 | -0.134 | -0.9347 | -1.3513 | -0.4165 | 0.0085 | 0.3212 | 0.0034 |  |
| 01.1.309 | Sardines | 0.221 | 0.851 | 1.1772 | 0.630 | -1.5085 | -0.1608 | 1.3477 | 0.1631 | 0.4676 | 0.0049 |  |
| 01.1.401 | Eggs | 2.442 | 1.618 | 1.1654 | -0.824 | 0.8926 | 0.4812 | -0.4114 | 0.1530 | 2.0016 | 0.0209 |  |
| 01.1.402 | Fresh milk | 1.209 | 0.331 | 1.1143 | -0.878 | 0.1898 | -1.1064 | -1.2962 | 0.1082 | 0.6775 | 0.0071 |  |
| 01.1.404 | Evaporated milk | 0.622 | 0.445 | 1.0578 | -0.176 | -0.4756 | -0.8093 | -0.3337 | 0.0562 | 0.5285 | 0.0055 |  |
| 01.1.405 | Powdered milk | 6.603 | 6.348 | 1.0152 | -0.255 | 1.8876 | 1.8482 | -0.0394 | 0.0150 | 6.4749 | 0.0675 |  |
| 01.1.406 | Cheese | 2.507 | 2.223 | 1.0570 | -0.284 | 0.9191 | 0.7988 | -0.1203 | 0.0554 | 2.3621 | 0.0246 |  |
| 01.1.501 | Butter, fresh | 0.307 | 0.269 | 1.1394 | -0.038 | -1.1813 | -1.3120 | -0.1308 | 0.1305 | 0.2877 | 0.0030 |  |
| 01.1.503 | Margarine | 2.669 | 1.435 | 1.0683 | -1.233 | 0.9816 | 0.3614 | -0.6202 | 0.0661 | 1.9887 | 0.0207 |  |
| 01.1.504 | Peanut butter | 1.155 | 1.194 | 1.0318 | 0.039 | 0.1444 | 0.1772 | 0.0328 | 0.0313 | 1.1745 | 0.0123 |  |
| 01.1.506 | Fry Oil/Vegetable Oil | 2.600 | 2.674 | 1.2056 | 0.075 | 0.9553 | 0.9836 | 0.0283 | 0.1870 | 2.6367 | 0.0275 |  |
| 01.1.601 | Oranges | 1.398 | 0.990 | 0.6827 | -0.408 | 0.3350 | -0.0099 | -0.3448 | -0.3817 | 1.1823 | 0.0123 |  |
| 01.1.602 | Pineapple | 0.304 | 0.731 | 1.7028 | 0.427 | -1.1893 | -0.3132 | 0.8761 | 0.5323 | 0.4870 | 0.0051 |  |
| 01.1.603 | Bananas | 1.284 | 1.370 | 1.3547 | 0.086 | 0.2498 | 0.3147 | 0.0649 | 0.3036 | 1.3263 | 0.0138 |  |
| 01.1.605 | Coconut-dry | 0.180 | 0.317 | 1.0853 | 0.137 | -1.7141 | -1.1484 | 0.5657 | 0.0818 | 0.2422 | 0.0025 |  |
| 01.1.606 | Water melon | 0.644 | 0.555 | 1.1246 | -0.090 | -0.4394 | -0.5890 | -0.1496 | 0.1174 | 0.5985 | 0.0062 |  |
| 01.1.607 | Apple | 0.195 | 0.207 | 1.4572 | 0.012 | -1.6330 | -1.5727 | 0.0602 | 0.3765 | 0.2014 | 0.0021 |  |
| 01.1.608 | Cherry | 0.391 | 0.257 | 0.7540 | -0.134 | -0.9398 | -1.3598 | -0.4200 | -0.2824 | 0.3190 | 0.0033 |  |
| 01.1.609 | Grapes | 0.188 | 0.178 | 1.1904 | -0.010 | -1.6727 | -1.7283 | -0.0555 | 0.1743 | 0.1826 | 0.0019 |  |
| 01.1.610 | Limes | 0.122 | 0.480 | 0.6362 | 0.358 | -2.1056 | -0.7337 | 1.3719 | -0.4522 | 0.2612 | 0.0027 |  |
| 01.1.611 | Papaya | 0.393 | 0.176 | 0.6660 | -0.217 | -0.9334 | -1.7359 | -0.8026 | -0.4064 | 0.2704 | 0.0028 |  |
| 01.1.612 | Mango\* | 0.104 | 0.445 | 0.6660 | 0.341 | -2.2632 | -0.8101 | 1.4532 | -0.4064 | 0.2345 | 0.0024 |  |
| 01.1.701 | Black-eyed peas | 1.111 | 1.236 | 1.0209 | 0.125 | 0.1054 | 0.2122 | 0.1067 | 0.0207 | 1.1727 | 0.0122 |  |
| 01.1.702 | Split peas | 1.208 | 0.575 | 0.8670 | -0.632 | 0.1886 | -0.5530 | -0.7416 | -0.1427 | 0.8527 | 0.0089 |  |
| 01.1.703 | Turnip greens | 0.736 | 0.855 | 1.7099 | 0.119 | -0.3069 | -0.1566 | 0.1503 | 0.5365 | 0.7939 | 0.0083 |  |
| 01.1.704 | Red beans | 0.479 | 0.593 | 1.1058 | 0.113 | -0.7350 | -0.5228 | 0.2123 | 0.1006 | 0.5342 | 0.0056 |  |
| 01.1.705 | Garlic | 0.934 | 0.853 | 0.7948 | -0.081 | -0.0687 | -0.1590 | -0.0903 | -0.2297 | 0.8927 | 0.0093 |  |
| 01.1.706 | Onion | 0.726 | 0.664 | 1.4474 | -0.061 | -0.3208 | -0.4092 | -0.0884 | 0.3697 | 0.6944 | 0.0072 |  |
| 01.1.707 | Egg plant | 0.944 | 0.888 | 2.3344 | -0.055 | -0.0579 | -0.1184 | -0.0605 | 0.8478 | 0.9158 | 0.0096 |  |
| 01.1.708 | Spinach | 1.172 | 1.058 | 0.7878 | -0.114 | 0.1588 | 0.0562 | -0.1026 | -0.2385 | 1.1139 | 0.0116 |  |
| 01.1.709 | Shallot | 0.525 | 0.506 | 1.1231 | -0.020 | -0.6441 | -0.6821 | -0.0381 | 0.1161 | 0.5153 | 0.0054 |  |
| 01.1.710 | Ochre | 0.746 | 0.694 | 1.3458 | -0.052 | -0.2932 | -0.3652 | -0.0720 | 0.2970 | 0.7197 | 0.0075 |  |
| 01.1.711 | Pumpkin | 0.525 | 0.809 | 1.2033 | 0.283 | -0.6441 | -0.2126 | 0.4315 | 0.1851 | 0.6567 | 0.0069 |  |
| 01.1.712 | Tomatoes | 0.545 | 0.771 | 2.2518 | 0.226 | -0.6061 | -0.2599 | 0.3463 | 0.8117 | 0.6518 | 0.0068 |  |
| 01.1.713 | Squash | 0.246 | 0.339 | 1.8135 | 0.093 | -1.4021 | -1.0819 | 0.3202 | 0.5953 | 0.2900 | 0.0030 |  |
| 01.1.714 | Plantains | 0.863 | 1.337 | 1.4753 | 0.474 | -0.1478 | 0.2901 | 0.4379 | 0.3889 | 1.0823 | 0.0113 |  |
| 01.1.715 | Long beans | 1.360 | 1.143 | 1.1958 | -0.217 | 0.3074 | 0.1336 | -0.1737 | 0.1788 | 1.2483 | 0.0130 |  |
| 01.1.716 | Cabbage | 0.578 | 0.828 | 1.1446 | 0.249 | -0.5474 | -0.1889 | 0.3585 | 0.1350 | 0.6957 | 0.0073 |  |
| 01.1.717 | Carrots | 0.261 | 0.838 | 0.8745 | 0.577 | -1.3421 | -0.1763 | 1.1658 | -0.1341 | 0.4950 | 0.0052 |  |
| 01.1.718 | Cucumber | 0.193 | 0.324 | 1.1595 | 0.131 | -1.6460 | -1.1275 | 0.5186 | 0.1480 | 0.2527 | 0.0026 |  |
| 01.1.719 | Cassava | 0.373 | 0.474 | 1.4207 | 0.101 | -0.9863 | -0.7465 | 0.2399 | 0.3512 | 0.4215 | 0.0044 |  |
| 01.1.720 | Eddoes | 0.627 | 0.678 | 1.2815 | 0.051 | -0.4674 | -0.3884 | 0.0790 | 0.2480 | 0.6520 | 0.0068 |  |
| 01.1.721 | White potatoes | 1.816 | 1.541 | 2.1072 | -0.276 | 0.5969 | 0.4322 | -0.1647 | 0.7454 | 1.6748 | 0.0175 |  |
| 01.1.801 | Sugar (dark ) | 4.627 | 2.569 | 1.0136 | -2.058 | 1.5320 | 0.9436 | -0.5884 | 0.0135 | 3.4980 | 0.0365 |  |
| 01.1.802 | Sweets | 0.198 | 0.163 | 1.1201 | -0.035 | -1.6201 | -1.8140 | -0.1940 | 0.1134 | 0.1799 | 0.0019 |  |
| 01.1.803 | Chocolates | 0.287 | 0.333 | 1.0049 | 0.047 | -1.2494 | -1.0982 | 0.1512 | 0.0049 | 0.3095 | 0.0032 |  |
| 01.1.804 | Ice cream | 0.277 | 0.774 | 1.2643 | 0.498 | -1.2854 | -0.2559 | 1.0295 | 0.2346 | 0.4834 | 0.0050 |  |
| 01.1.901 | Baby food (mainly milk) | 0.152 | 0.634 | 1.1502 | 0.482 | -1.8824 | -0.4559 | 1.4266 | 0.1400 | 0.3376 | 0.0035 |  |
| 01.1.904 | Salt | 0.434 | 0.230 | 1.0152 | -0.204 | -0.8351 | -1.4716 | -0.6365 | 0.0151 | 0.3209 | 0.0033 |  |
| 01.1.903 | Curry powder | 0.591 | 0.584 | 1.1492 | -0.007 | -0.5257 | -0.5383 | -0.0126 | 0.1391 | 0.5874 | 0.0061 |  |
| 01.1.910 | Black pepper | 0.228 | 0.307 | 1.1059 | 0.079 | -1.4770 | -1.1799 | 0.2971 | 0.1007 | 0.2659 | 0.0028 |  |
| 01.1.911 | Masala | 0.170 | 0.258 | 0.6062 | 0.088 | -1.7721 | -1.3558 | 0.4163 | -0.5006 | 0.2108 | 0.0022 |  |
| 01.1.902 | Tomato paste | 0.956 | 0.673 | 1.2719 | -0.283 | -0.0445 | -0.3955 | -0.3509 | 0.2405 | 0.8066 | 0.0084 |  |
| 01.1.908 | Vinegar | 0.241 | 0.443 | 1.2120 | 0.202 | -1.4229 | -0.8139 | 0.6090 | 0.1923 | 0.3319 | 0.0035 |  |
| 01.1.906 | Celery | 0.287 | 0.497 | 1.0222 | 0.210 | -1.2494 | -0.6996 | 0.5498 | 0.0220 | 0.3822 | 0.0040 |  |
| 01.1.905 | Red pepper | 0.348 | 0.192 | 3.2345 | -0.155 | -1.0568 | -1.6492 | -0.5924 | 1.1739 | 0.2623 | 0.0027 |  |
| 01.1.909 | Baking powder (prepd.) | 0.238 | 0.189 | 1.2120 | -0.049 | -1.4335 | -1.6635 | -0.2300 | 0.1923 | 0.2130 | 0.0022 |  |
| 01.1.907 | Ketchup | 0.256 | 0.636 | 1.0150 | 0.379 | -1.3617 | -0.4531 | 0.9086 | 0.0149 | 0.4176 | 0.0044 |  |
| 01.2.102 | Coffee - extract | 0.741 | 0.507 | 1.2334 | -0.234 | -0.3000 | -0.6795 | -0.3795 | 0.2098 | 0.6164 | 0.0064 |  |
| 01.2.103 | Tea | 0.502 | 0.740 | 1.0408 | 0.238 | -0.6885 | -0.3010 | 0.3875 | 0.0400 | 0.6135 | 0.0064 |  |
| 01.2.104 | Milo | 1.243 | 1.102 | 1.2716 | -0.141 | 0.2176 | 0.0969 | -0.1207 | 0.2403 | 1.1710 | 0.0122 |  |
| 01.2.105 | Ovaltine | 0.249 | 0.372 | 1.0826 | 0.124 | -1.3918 | -0.9880 | 0.4038 | 0.0793 | 0.3063 | 0.0032 |  |
| 01.2.202 | Malt  | 0.454 | 0.366 | 1.6667 | -0.088 | -0.7894 | -1.0053 | -0.2159 | 0.5108 | 0.4084 | 0.0043 |  |
| 01.2.203 | Soft drink | 1.246 | 3.428 | 1.0826 | 2.183 | 0.2197 | 1.2321 | 1.0124 | 0.0793 | 2.1559 | 0.0225 |  |
|  | Totals |  |  |  |  |  |  |  |  | 95.8610 | 1.0000 |  |

**Procedures for calculating a weighted regression (**Step viii**)**

*Calculate a weighted average for each variable:*

**avg\_Δln of Share** = -0.013670396

Formula: SUMPRODUCT(<Δln of Share-data>,<Weights>)/SUM(<Weights>)

**avg\_ln PriceRel** = 0.078093397

Formula: SUMPRODUCT(<ln PriceRel-data>,<Weights>)/SUM(<Weights>)

*The slope of the weighted linear regression is:*

Formula: SUMPRODUCT(<Δln of Share-data>–<avg\_Δln of Share->,<ln PriceRel-data>–<avg\_ln PriceRel>,<Weights>)/

 SUMPRODUCT((<ln PriceRel-data>–<avg\_ln PriceRel>)^2,<Weights>)

**Slope of Wgt Regr** = 0.012887372

 –(η-1) = 0.012887372

 η= 0.987112628

*The intercept of weighted linear regression is:*

**Intercept** =-0.014676815

Formula: <avg\_Δln of Share> - <avg\_ln PriceRel>\*<slope\_of\_wgt\_regr>

1. The author thanks Brian Graf (IMF) for his review and comments on this version of the paper and thanks to Erwin Diewert (UBC) and Yuri Dikhanov (WB) for comments on the first draft of Section II of this paper. [↑](#footnote-ref-1)
2. The same bounding property would hold true for a cost of goods CPI as well, assuming normal consumer substitution behavior is occurring. [↑](#footnote-ref-2)
3. An alternative would be to use Household Final Consumption Expenditures from the National Accounts as weights. [↑](#footnote-ref-3)