INDEX OF FOREIGN PRICES / UNIT VALUES OF ALBANIAN IMPORTS*

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RISAN SHLLAKU

CONTENTS

INTRODUCTION

Economic data and statistics are a key element for successful economic analysis and economic policy formulation, by both the public and the private sector. Actually, economic data and statistics fulfill all the requirements to be considered a public good. Unfortunately, the state of economic data and statistics in Albania is not very satisfactory at the moment. Recognizing the importance of the economic data and statistics, the Bank of Albania has taken concrete steps in the improvement of the construction, reliability, availability and dissemination of such data.

In this respect, the Index of Foreign Unit Values/Prices of Imports marks yet another effort by the Bank of Albania to contribute to the improvement of the economic data and statistics. The original index is focused on capturing only the movements of the prices of the Albanian imports in the markets where they are imported from, but not the effect of the exchange rate. This would allow the effects that import price movements in the foreign markets and exchange rate movements have on different macroeconomic indicators of interest, as for instance on inflation rate, to be analyzed and quantified separately. The importance of the index at hand for Albania is quite high, taking into consideration the fact that Albania is a small open economy.

Obviously, calculating a sort of weighted-average of the CPI movements in the main countries from where Albania imports – weighted by the share of imports from each of these countries – can also serve as a proxy for the purpose at hand. However, such a proxy can be quite vague and largely unrepresentative of the movements of the prices of the Albanian imports in the foreign countries. Other attempts to construct more representative proxy indices can potentially satisfy the cost/benefit criteria.

The paper is organized in the following sections. Section 2 offers a brief discussion of index number theory and of the main issues related to price indices. Section 3 presents an approach based on the indices of export unit values/export prices of the main countries from where Albania imports. Because of data availability reasons,

the indices of export unit values are used for some of the foreign countries and the indices of export prices are used for other foreign countries. The advantages and disadvantages of this approach are obviously elaborated. Finally, section 4 offers a brief conclusion.

GENERAL DISCUSSION OF PRICE INDICES

Purpose of Price Indices

A price index intends to serve as a single aggregated measure of all the individual relative changes in the prices of a domain set of commodities. The necessity of a price index results from the fact that prices of many individual commodities change at different rates and that it is obviously not feasible to analyze all of these individual price changes separately. Thus, price indices are constructed by taking a weighted-average of the different rates of the individual price changes, in order to obtain a single measure. In general, price indices take a base value of 100 in the base period, whereas the values in the other periods represent a weighted-average of the individual price changes relative to the base period, multiplied by 100[1].

Although, the majority of price indices are constructed to capture relative changes in price with respect to different periods of time, it is also possible to construct price indices that capture relative changes in prices with respect to different regions/markets at the same time. The three most widely used price indices are the Consumer Price Index, the Producer Price Index, and the Export and Import Price Indices. However, many more price indices are constructed for different purposes and focus on different sets of commodities or transactions.

Price Index Formulas

The construction of a price index is characterized by a number of difficulties and requires dealing with different issues, the most relevant of which I will try to discuss along the coming paragraphs in this section. However, it seems quite convenient to mention at the very beginning that the main two questions that need to be answered while constructing a price index are:

1) Which commodity or transactions prices should be included in the domain set of the price index, - meaning what should be the representative basket?
2) Which index formula or technique should be used to aggregate all the individual price changes into a single measure?

Theoretically, the answers to these two questions depend largely on the precise focus of the index and on the desired economic and statistical properties. Quite importantly, in practice the answers to both questions depend on the availability of price and quantity data, as well as their method of collection. However, first let us briefly look at some of the main price index formulas. Please, be aware that there exist too many price index formulas, but considering the scope of this discussion paper only the main ones are discussed here.

The first attempts at constructing price indices date back to very early times and different studies seem to mention different such attempts. However, it is generally agreed that the first sophisticated and detailed attempt has been undertaken by Lowe (1823). The Lowe price index formula is based on a fixed quantity vector q_i (q_1, q_2,...q_n) that basically serves for assigning the weights. The functional form of the Lowe price index is the following:

$$P_{t,0} = \frac{\sum_{i=1}^{n} p_i^t \cdot q_i}{\sum_{i=1}^{n} p_i^0 \cdot q_i} \cdot 100$$

where q_i is the fixed quantity vector and p_i^t is the price vector at time t.

Furthermore, if the fixed quantity vector q_i is determined from the base period (meaning, q_i^0), then the index becomes a Laspeyres price index - P_L. Instead, if the fixed quantity vector q_i is determined from the current period (meaning, q_i^t), then the index becomes a Paasche price index - P_P. From the theoretical point of view, these two price indices seem to be equivalent and as good as each

other. However, the results obtained from these two price indices, - the Laspeyeres and the Paasche -, can be considerably different in reality. This has led economists and statisticians to explore the causes of such a discrepancy between these two indices and to propose different solutions.

The literature on index number theory recognizes that if individual prices exhibit *smooth monotonic trends* and rational substitution reactions occur, then the Laspeyres price index can be proved to be higher than the Paasche price index. This is attributed to the substitution bias, which is explained in Box 1 because of its importance to index number theory. Instead, if individual prices do not reveal monotonic trends, but bounce up and down continuously, then the differences between the Laspeyres and Paasche price indices are quite difficult to explain. In any case, it is obvious that the final price index results are affected a lot by the choice of the weights and the way the quantity vectors enter the price index formula or technique.

Economists and statisticians have proposed three main ways to deal with the discrepancy between the Laspeyres and Paasche price indices:

- By treating the Laspeyres and Paasche indices in a symmetrical manner;
- By treating the quantity vectors of the two periods – that of the base period and that of the current period – in a symmetrical manner;
- By chaining the Laspeyres and Paasche indices.

Box 1 – The Substitution Bias

The substitution bias results from the fact that rational buyers tend to substitute away from commodities that become more expensive. Even if we assume that all commodities become more expensive but not at the same rate, then rational buyers eventually substitute away from those commodities that become more expensive at a higher rate. Actually, short-term fluctuations and

oscillations in prices do not provoke "true" substitution reactions by rational buyers, since prices turn back to their origin after a short time, - it might be even before buyers have had time to decide about and engage in substitution reactions. Instead, long-term monotonic trends in prices can provoke "true" substitution reactions, since in this case rational buyers do have a strong basis to become convinced about their substitution reactions. This is why, monotonic trends in prices constitute a very crucial condition and assumption.

Let's turn back to the effect of substitution on the Laspeyres and Paasche price indices. Obviously, from the rational buyers' point of view, the Laspeyres price index that is based on base-period quantities, might overstate/understate the true increase/decrease in the prices of the commodities purchased by them, since after a certain time they should have substituted away from commodities that became relatively more expensive and at a higher rate. On the other hand, the Paasche price index, which is based on the current-period quantities, might understate/overstate the true increase/decrease in the prices of the commodities purchased by the rational buyers.

The first way consists in other index formulas, which are constructed as averages of the Laspeyres and Paasche price indices. The second way also consists in other index formulas, which after all have the functional form of a Lowe price index, but the final quantity vector is a form of average of the base and current period's quantities. The main formulas are described immediately below. Instead, the third way consists in a different technique and it is explained in a different sub-section. Chaining can be applied to the Laspeyres and Paasche formulas as well as to all these other formulas. However, the consequences of chaining are stronger when applied to Laspeyres and Paasche indices. Instead, the consequences of chaining are in general reduced quite significantly when applied to these other formulas.

Edgeworth and Marshall have proposed that the final quantity vector (q_i) should be set equal to the arithmetic average of the

base-period and current-period quantity vectors, resulting in the following formula.

$$P_{t,0} = \frac{\sum_{i=1}^{n} p_i^t \left(\left(q_i^0 + q_i^t \right) / 2 \right)}{\sum_{i=1}^{n} p_i^0 \left(\left(q_i^0 + q_i^t \right) / 2 \right)} \cdot 100$$

Walsh, instead, has proposed that the final quantity vector (q_i) should be set equal to the geometric average of the base-period and current period quantity vectors, resulting in the following formula.

$$P_{t,0} = \frac{\sum_{i=1}^{n} p_i^t \sqrt{q_i^0 \cdot q_i^t}}{\sum_{i=1}^{n} p_i^0 \sqrt{q_i^0 \cdot q_i^t}} \cdot 100$$

Sidgwick (1883) and Bowley (1901) have proposed the use of the arithmetic average of the Laspyeres and Paasche indices.

$$P = 1/2P_L + 1/2P_P$$

Instead, the well-known economist Irving Fisher has proposed the use of the geometric average of the Laspyeres and Paasche indices.

$$P_F = (P_L * P_P)^{1/2}$$

Another index is the Tornqvist index, whose formula is:

$$P_{t,0} = \prod_{i=1}^{n} \left(p_i^t / p_i^0 \right)^s \cdot 100; \text{ ku } s = 0.5 \left(p_i^t q_i^t / \sum_{i=1}^{n} p_i^t q_i^t \right) + 0.5 \left(p_i^0 q_i^0 / \sum_{i=1}^{n} p_i^0 q_i^0 \right)$$

The theory of index numbers recognizes many more index formulas, however, only the most relevant ones are mentioned here.

The Axiomatic Approach to Index Number Theory

Obviously, choosing one best index formula is not straightforward at all. From the theoretical point of view, choosing the best index depends on the desired economic and statistical properties.

However, from the practical point of view it is certainly limited by the availability of the data and from a cost-benefit perspective, which is why two main approaches are proposed in this discussion paper. In any case, economists and statisticians have tried to develop criteria for selecting superior index formulas. One of the most reputable approaches for identifying superior index formulas and comparing different index formulas is the axiomatic approach.

The axiomatic approach consists of a number of axioms that have been suggested by statisticians and economists as required properties for superior index formulas. In other words, according to the axiomatic approach, index formulas should satisfy a number of properties by fulfilling a number of axioms in order to be classified as superior. These axioms have been developed, through time, based on the properties possessed by the price index P_t/P_0 for a single commodity. Please, find a brief explanation for the individual axioms in Appendix 1.

The literature on index number theory does not strictly agree on the appropriateness and necessity of different axioms[2]. However, the axiomatic approach seems to be overall successful in identifying the main properties that an index formula should possess, in identifying the main pitfalls of different index formulas, and in identifying superior indices. The Fisher index seems to be the most outstanding one.

Appendix 1 on the Axiomatic approach and the following discussions are mainly based on Chapters 15 and 16 of the IWGPS' draft of Export and Import Price Index Manual.[3] In addition, the (non)fulfillment of the axioms by the different price index formulas has been checked by the author of this discussion paper, based on a simple hypothetical "2 commodities and 2 periods" simulation. The Fisher price index is the only index that satisfies all the axioms presented in Appendix 1. The Walsh price index, together with the respective Walsh quantity index, fails axiom 14- the "Value" Product. Despite this, the Walsh index is still considered as a superlative index in the literature on index number theory.

The Laspeyres and Paasche price indices fail axioms 9- the Symmetry of Quantity Weights and 10- the Time Reversal. Axioms

9 and 10 are considered as very important because they imply that the index is not affected by the choice of the base period. Intuitively, if two periods are compared, the index should not depend on which one is chosen as the base period. Therefore, failing to satisfy axioms 9 and 10 is seen as a potential limitation of the Laspeyres and Paasche indices. In addition, the Laspeyres and Paasche price indices, together with their respective Laspeyres and Paasche quantity indices, fail axiom 14- the "Value" Product. It is important and interesting to know that axiom 14 is satisfied by a Laspeyres price index multiplied by a Paasche quantity index, or the other way around - by a Paasche price index multiplied by a Laspeyres quantity index.

The Sidgwick-Bowley price index also fails axioms 10- the Time Reversal and 14- the "Value" Product. Instead, the Edgeworth-Marshall price index fails axioms 7- Invariance to Proportional Changes in Current Quantities and 8- Invariance to Proportional Changes in Base Quantities, as well as axiom 14- the "Value" Product. Then, the Tornqvist price index fails axioms: 6– the Fixed Basket or Constant Quantity, 9- the Symmetry of Quantity Weights, 12- Monotonicity in Current Prices, 13- Monotonicity in Base Prices, 14- the "Value" Product. Overall, the Fisher index seems to be rated as the best one, followed by the Walsh index.

Rebasing and Chaining

An important issue mentioned in the literature on index number theory is whether weights should remain fixed or should be updated, and if yes, then how frequently. This is a concern because the relevant goods and their respective share in the representative basket can change over time. Thus, it becomes necessary to update the representative basket. In this respect, the two most relevant and important biases are: 1) the substitution bias and, 2) the new goods bias.

The substitution bias is explained in Box 1. Instead, the new goods bias, as its name implies, results from the fact that as time passes new products are developed and some of the old products become obsolete. Apparently, the base-period quantity vector might lose its

relevance in the coming periods, especially after a relatively long time has elapsed. At the same time, the current-period quantity vector also might not be representative of the early periods.

Updating the weights has been naturally proposed as a solution to the two biases mentioned above. If weights are updated only once a certain number of periods have elapsed, then it is generally known as rebasing. Instead, if weights are updated for every consecutive time period, then it is known as chaining. Basically, rebasing or chaining is done by using the index value for the last period with the old weights as the base value for the coming periods with the new weights. From a practical point of view, these techniques make it easier to introduce new products and dismiss obsolete ones in due time. In addition, these techniques allow accounting for the substitution of some products to others.

The literature on index number theory suggests that chaining is especially useful when the structure of the representative basket is more similar between two adjacent periods than between distant periods. Under this condition, the index of distant time periods can be calculated by cumulating through consecutive bilateral indices for adjacent periods, during which time the representative basket has not changed significantly.

For instance, chaining might not bring any gains when the individual prices in the representative basket bounce continuously in an irregular manner, without exhibiting a general trend. Under these circumstances, the quantities and the structure of the representative basket are not necessarily more similar between two adjacent periods than between distant periods. As a consequence, chaining might make the index drift away from the true index. Instead, rebasing from time to time is seen as a better approach.

On the other hand, chaining is highly recommended when individual prices display *smooth monotonic trends* and substitution reactions take place. Under these circumstances, the quantities and the structure of the representative basket is expected to change smoothly over time. Therefore, accuracy can be gained by calculating the index for distant periods, characterized by huge

differences in the representative basket, by cumulating consecutive bilateral indices of adjacent periods, with much smaller differences in the representative basket. In this case, chaining can reduce the spread between the Laspeyres and Paasche indices caused by the substitution bias.

A chain index takes the following form. Let us assume that $P(p_1, p_2, q_1, q_2)$ is the value of the bilateral price index from period 1 to period 2, using any formula. In the same way, $P(p_2, p_3, q_2, q_3)$ is the value of the bilateral price index from period 2 to period 3. Below are presented the values of the price index for the first three periods under both the fixed-weight approach and the chain approach.

fixed weight $\Rightarrow$ 100; $P(p_1, p_2, q_1, q_2)$*100; $P(p_1, p_3, q_1, q_3)$*100;
chain $\Rightarrow$ 100; $P(p_1, p_2, q_1, q_2)$*100 ; $P(p_1, p_2, q_1, q_2)$* $P(p_2, p_3, q_2, q_3)$*100;

For example, a chained Laspeyres price index has the following functional form:

$$P_{t,0} = \frac{\sum p^1 q^0}{\sum p^0 q^0} \times \frac{\sum p^2 q^1}{\sum p^1 q^1} \times \cdots \times \frac{\sum p^t q^{t-1}}{\sum p^{t-1} q^{t-1}} \times 100$$

Instead, a chained Fisher price index has the following form:

$$P_{t,0} = \sqrt{\frac{\sum p_1 \cdot q_0}{\sum p_0 \cdot q_0} \cdot \frac{\sum p_1 \cdot q_1}{\sum p_0 \cdot q_1}} \times \cdots \sqrt{\frac{\sum p_n \cdot q_{n-1}}{\sum p_{n-1} \cdot q_{n-1}} \cdot \frac{\sum p_n \cdot q_n}{\sum p_{n-1} \cdot q_n}} \times \cdots \sqrt{\frac{\sum p_t \cdot q_{t-1}}{\sum p_{t-1} \cdot q_{t-1}} \cdot \frac{\sum p_t \cdot q_t}{\sum p_{t-1} \cdot q_t}} \cdot 100$$

Obviously, the positive contribution of chaining is realized when it effectively yields weights that are much more in line and representative of the share of their respective commodities during both periods under comparison, in an evenhanded manner. From this point of view, the positive contribution of chaining is higher when applied to Laspeyres and Paasche indices, since these indices do not treat themselves the share of the commodities during both periods in an evenhanded manner. Instead, the positive contribution of chaining is severely diminished when applied to other index formulas, which to a certain extent achieve themselves an evenhanded treatment of the share of the commodities during both periods.

Likewise, even the risk of having a chained index drift away from the true index is higher when applied to Laspeyres and Paasche indices than when applied to a Fisher or Walsh Index. The justification mostly mentioned in the literature on index number theory relates to the fact that Laspeyres and Paasche indices do not satisfy the time reversal test and do not return to unity, whereas the Fisher and Walsh indices do satisfy this important test.

In order to discuss the impact of chaining on different price formulas a separate test is employed – the circulatory test. The circulatory test can be expressed in the following way: $P(p_1, p_3, q_1, q_3) = P(p_1, p_2, q_1, q_2) \times P(p_2, p_3, q_2, q_3)$. If an index formula satisfies the circulatory test, then it will yield identical results no matter if it is chained or not. According to the literature on index number theory, none of the index formulas discussed in this discussion paper satisfies the circulatory test. However, it is important to know that indices such as Fisher or Walsh do approximate the circulatory test substantially, which is not the case with the Laspeyres and Paasche indices.

"However, it is of some interest to find index number formulas that satisfy the circularity test to some degree of *approximation*, since the use of such an index number formula will lead to measures of aggregate price change that are more or less the same whether we use the chain or fixed-base systems. Irving Fisher (1922, p. 284) found that deviations from circularity using his data set and the Fisher ideal price index *PF* were quite small. This relatively high degree of correspondence between fixed-base and chain indices has been found to hold for other symmetrically weighted formulas like the Walsh index *PW* ."[4]

The excerpt above from Chapter 15 – Index Number Theory of the IWGPS' draft of Export and Import Price Index Manual conveys the idea that chaining does not make a significant difference when applied to indices such as Fisher or Walsh. The literature on index number theory reports chained Laspeyres/Paasche indices to be considerably lower/higher than their respective direct Laspeyres/Paasche indices. Instead, it is reported that the chained Fisher index and the direct Fisher index correspond and converge to a high degree.

In practice, chaining or frequent rebasing are difficult to achieve because statistical agencies base their indices on broad surveys, which either are very expensive to conduct or take a lot of time. This is why the most widely used formula is that of a Laspyeres price index with weights up-dated every five years.

Treatment of Seasonality

Seasonality is another issue that causes huge difficulties in constructing price indices. It is important to distinguish between two types of seasonality; 1) strong seasonality refers to the case when a product appears and disappears completely during certain periods of the year; and 2) weak seasonality refers to the case when the price and quantity of a product exhibit regular fluctuations during certain periods of the year, but the product does not disappear completely. The strong seasonality is the most problematic one because it is impossible to calculate the index value for a product during a period -t, if the product is missing during that period and no price quotation is available.

Obviously, the frequency of the index is an important determinant of the degree of seasonality in the index. For instance, it is quite impossible to satisfactorily reduce the seasonality in a monthly index, whereas seasonality does not constitute a concern for yearly indices. The following three approaches/measures of dealing with seasonality in *monthly* indices will be discussed in the coming paragraphs.

1. Excluding Seasonal Products from the Representative Basket;
2. Annual Basis Weights and Carry-forward of Unavailable Prices;
3. Maximum Month-to-Month Overlap Representative Baskets.

Excluding seasonal products from the representative basket is a measurement that is widely advocated by economists and statisticians, especially due to the justification that the purpose of price indices is to capture the overall trend in the movement of prices. This approach of excluding seasonal products can be extended to

strong seasonal products and weak seasonal products. However, in practice it might turn out to be difficult and arbitrary to identify commodities that exhibit seasonality, although those commodities that are subject to strong seasonality or a large degree of weak seasonality can be identified more easily.

The next approach determines the weights based on an annual basis, which aims at smoothing out the effect of seasonality on the weights. The more frequently the annual weights are updated, -let's say every year-, the better it is. Obviously, the weights will be fixed for all the months during the coming year, which basically means that a rebased Lowe index formula is applied. However, troubles can arise whenever any commodity, to which an annual weight has been assigned, disappears during a certain period. As a consequence, the price for that period is not available, which is why it should either be carried-forward from previous periods or should be imputed. In turn, carrying-forward or imputing prices can hamper a lot the accuracy of the index.

The approach of "Maximum Month-to-Month Overlap Representative Baskets" aims at calculating the price index between any two months by including in the representative basket the maximum number of commodities/transactions that exist in both months. The question that arises is: should the base month be fixed (fixed base index) or should the base month and the current month be adjacent to each other (chained index)? The answer depends mainly on the fact whether the number of seasonal products that overlap is higher between any two adjacent months or between a fixed base month and any other current month. Obviously, it is not possible to give a precise answer to this question, although the general assumption is that it is more likely that the number of products that overlap will be higher between any two adjacent months. In any case, it is crucial to be aware that this approach simply makes possible the calculation of monthly indices, despite the strong seasonality of some of the commodities. However, it does not necessarily reduce the degree of seasonality and does not tackle weak seasonality.

It is important to be aware that constructing an index involves many other issues.

For instance, the frequency of the index constitutes another important aspect, as it has already been mentioned above. However, this discussion paper is limited to considering only a monthly index because of the present need at the Bank of Albania to have a larger number of observations for the purpose of different econometric models.

The data used in constructing price indices and their properties constitute a very essential aspect for the final index as well. In most of the cases, the data are obtained either from large surveys and observations or from administrative sources. When data are direct observations or gathered from surveys, the resulting indices are generally known as price indices. Instead, when data are obtained from customs authorities, the resulting indices are generally known as unit value indices. The explanation for this has to do with the fact that customs report value and volume figures, which are divided to obtain unit value figures. Each one of the above-mentioned two practices has its advantages and disadvantages. Sampling procedures, especially when data are obtained from surveys, constitute the major focus of the discussions.

THE APPROACH BASED ON THE INDICES OF EXPORT UNIT VALUES/ PRICES OF THE MAIN COUNTRIES FROM WHERE ALBANIA IMPORTS

This section aims at explaining the approach based on the indices of export unit values/prices of the main countries from where Albania imports. This approach is based on the assumption that the exports of the main countries from where Albania imports can be considered as the imports of Albania. As a consequence, the indices of export unit values/prices of these countries can be aggregated into an index of foreign unit values/prices of Albanian imports.

However, there is still a huge risk that the representative baskets that are used for constructing the indices of export unit values/ prices of the main countries from where Albania imports can be

quite different from a truly representative basket of Albanian imports from those countries. Still, they are assumed to be less different than, for instance, the representative baskets used to construct the WPIs or CPIs of the main countries from where Albania imports. This is the initial motive why the export unit value/price indices are considered in this discussion paper, rather than the WPIs or CPIs of the countries from where Albania imports. However, certain disadvantages of the export unit value/price indices that are identified in the coming paragraphs might be considered as adequate for abandoning them and turning to the WPIs or CPIs.

The indices of export unit value/prices for the foreign countries are all expressed both in Euro and in USD. Respectively, the index of foreign unit values/prices of Albanian imports is also calculated both in Euro and USD. The expression of the index in foreign currencies guarantees that the pure effect of the exchange rate between the Albanian Lek and foreign currencies is avoided. Expressing in Euro is suggested as a much better choice based on the fact that the majority of Albanian imports are purchased in Euro.

The data, the methodology and the advantages and disadvantages of this approach are examined in the coming paragraphs.

The Data

The data include: 1) the monthly indices of export unit values/prices for the main countries from where Albania imports, and 2) the monthly values of Albanian import flows according to the foreign countries from where they are imported.

The indices of export unit values/prices for the foreign countries are obtained from the International Financial Statistics (IFS), compiled and published by the IMF. However, the indices are characterized by the following main disadvantages:

1) They are Laspeyres indices, which as argued before can be considerably upward biased due to the substitution bias and do not satisfy important axioms, such as axiom 10 - the Time Reversal, etc.

2) They are published at irregular lags of approximately 4-6 months and in some cases, previously published figures are revised.
3) The indices for some countries are unit value indices, whereas for other countries they are price indices. The aggregation of such indices of different types into a single index for Albania might have various implications and not be very advisable.

However, the above-mentioned pitfalls and constraints should be accepted due to the lack of other data.

The values of Albanian import flows according to the foreign countries from where they are imported are obtained from the statistical series at the website of the Bank of Albania and are expressed in USD. They are used to determine the weight that should be assigned to each one of these countries, as explained in the next sub-section.

The Methodology

The indices of export unit values/prices of the *main* countries from where Albania imports are considered as "elementary indices" that should be aggregated into a final index of foreign unit values/ prices of Albanian imports. Obviously, the weighting technique and the applied price index formula are of essential importance. Fundamentally, the weight assigned to a main country from where Albania imports - in other words, the weight assigned to the "elementary index" coming from this main country of importation - should reflect the share of import quantity from this foreign country to the total import quantity from all the foreign countries that fulfill the classification of main countries from where Albania imports, - which enter the index.

Obviously, it is first of all necessary to develop a framework for identifying foreign countries that can be classified as *main* countries from where Albania imports. The proposed framework suggests that an update of the classification should be done every 3 years and it should be based on the following criteria:

1) The share of total value of imports from one country to the total value of all imports, for the last 3 years prior to the data of re-classification, should be at least 5%.
2) If the sum of the shares of all the countries that fulfill the criterion 1 is less than 60%, then next-coming countries should also enter the classification of main countries from where Albania imports, until the sum of the shares of them all reaches 60%.

The proposed criteria are largely arbitrary. In any case, the 3-year period for re-classification is proposed as an in-between solution to: 1) on one hand, not ending up in a classification that is outdated for a long time, and 2) on the other hand, smoothing out seasonalities and major events during one specific year. The 5% and 60% thresholds explained above are proposed as an in-between solution to on one hand, 1) identifying the main countries from where Albania imports and whose individual shocks in the respective export unit value/prices might reasonably shock foreign unit values/prices of Albanian imports, 2) keeping a minimum level of representation of the countries from where Albania imports the most, and 3) on the other hand, facing the lack of export unit value/price indices for other foreign countries from where Albania has imported less during the entire period taken into consideration so far, 1993-2006.

Please, be aware that the framework presented above serves only for identifying the main countries from where Albania imports and the respective "elementary indices", which are updated every 3 years. It does not determine or affect the way these "elementary indices" are weighted or aggregated, which is explained below. Please, refer to Appendix 2 for the detailed results obtained by using the above-mentioned framework.

Instead, the weights are based on proxies of series of volumes of Albanian imports according to foreign countries, which are expressed in base-year prices. To be more precise, the series of values of Albanian imports have a quantity effect as well as a price effect incorporated within them. For the purpose of our index, it is necessary to eliminate the price effect, because the weights in a

price index should be determined only by the quantities. Otherwise, the index will be biased because the price effect will be double counted – once directly from the "elementary indices" and once from the weights. In order to eliminate the price effect, the series of the values of Albanian import flows are divided (deflated) by the respective export unit value/price indices, according to the main country of importation that they represent. The resulting series can be considered as proxies of series of volumes of Albanian imports expressed in base year prices and the weights are based on these resulting series.

The formula used is that of a chained-Fisher. Please, refer to section 2 on a general discussion of price indices and index number theory for a better explanation of the chained-Fisher index. According to the discussion in section 2, the Fisher formula turns out to be the best one, which is why its usage is advocated here. Instead, the choice between chaining or not is more vague and of little importance, knowing that the Fisher formula is chosen. For convenience, the chained-Fisher formula is presented again:

$$P_{t,0}=\sqrt{\frac{\sum p_1\cdot q_0}{\sum p_0\cdot q_0}\cdot\frac{\sum p_1\cdot q_1}{\sum p_0\cdot q_1}}\times\cdots\sqrt{\frac{\sum p_n\cdot q_{n-1}}{\sum p_{n-1}\cdot q_{n-1}}\cdot\frac{\sum p_n\cdot q_n}{\sum p_{n-1}\cdot q_n}}\times\cdots\sqrt{\frac{\sum p_t\cdot q_{t-1}}{\sum p_{t-1}\cdot q_{t-1}}\cdot\frac{\sum p_t\cdot q_t}{\sum p_{t-1}\cdot q_t}}\cdot 100$$

The base month for the index in USD is January 1993, whereas the base month for the index in Euro is January 1999. Please, find the chart of the two indices in Appendix 3.

The Advantages and Disadvantages

The aim of this subsection is to summarize the main advantages and disadvantages of this approach. The main advantage of this approach is that it results in an index that is straightforward to maintain, unless the IMF ceases publishing the export unit value/ prices index of any one of the major countries from where Albania imports.

On the other hand, this approach features the following main disadvantages:

The index for the future months can be calculated only after a lag of 4-6 months, because IFS's export unit value/price indices are published approximately after 4-6 months.

The representative basket used for calculating the export unit value/price index of a foreign country might differ a lot from the true representative basket of Albanian imports from this country.

The differences in transportation and insurance costs with respect to different foreign countries are ignored by this approach.

CONCLUSIONS

The scope of this discussion paper is to propose an approach for an index of Foreign Unit Values/Prices of Albanian Imports. The original index focuses on the prices of Albanian imports in the markets from where they are imported. This excludes the effect of the exchange rate and allows the impact of these two effects on different macroeconomic indicators of interest to be analyzed and quantified separately. The discussion paper offers also a brief review of index number theory, which unveils important aspects that need to be kept in mind by economists and policymakers while performing economic analysis and recommending or implementing economic policies. The proposed approach is based on this review of index number theory.

The most important conclusions from the general discussion on price index theory are:

1) The Laspeyres indices, which are widely used by statistical agencies – for instance, even for the Albanian CPI, exhibit an upward bias that results from their inability to account for the substitution bias;
2) According to the axiomatic approach, the Fisher index formula emerges as the best formula;
3) Chaining is advocated as useful if prices reveal smooth monotonic trends, but chaining can cause a drift in the index if prices bounce up and down in a continuous and irregular manner;

4) The positive as well as negative effects of chaining are "felt" more when it is applied to Laspeyres and Paasche formulas, instead the effects of chaining do not seem to be that relevant when it is applied to the Fisher formula; etc.

The approach for constructing the Index of Foreign Unit Values/ Prices of Albanian Imports is based on the IFS's publications of the export unit value/price indices for the main countries from where Albania imports. The approach results in an index that is straightforward to maintain and requires less effort. However, the approach is based on an "effective" representative basket that might be quite different from a true representative basket of Albanian imports and future values can be calculated only after approximately 4-6 months.

APPENDIX 1 – AXIOMATIC APPROACH

Axiom 1 – Positivity

The positivity test, $P(p^0, p^t, q^0, q^t) > 0$, says that any index value should be positive, which is straight forward.

Axiom 2 – Identity or Constant Prices

The identity test, $P(p, p, q^0, q^t) = 100$, says that if all the individual prices are equal between the two periods, then the price index value should be equal to 100, no matter how quantities change.

Axiom 3 – Proportionality

The Proportionality test, $P(p, C \times p, q^0, q^t) = 100 \times C$, says that if all the individual prices increase by the same rate –C between the two periods, then the price index value should be equal to 100xC, no matter how the quantities change.

Axiom 4 – Proportionality in Current Prices

The proportionality in current prices test, $P(p^0, C \times p^t, q^0, q^t) = C \times P(p^0, p^t, q^0, q^t)$, says that if all the individual prices in period t are multiplied by the same positive constant -C, then the new price index value should be C times the old price index value.

Axiom 5 – Inverse Proportionality in Base Period Prices

The test for inverse proportionality in base period prices, $P(C \times p^0, p^t, q^0, q^t) = 1/C \times P(p^0, p^t, q^0, q^t)$, says that if all the individual prices in period 0 are multiplied by the same positive constant C, then the new price index value should be 1/C time the old price index value.

Axiom 6 – Fixed Basket or Constant Quantity

The fixed basket test, $P(p^0, p^t, q, q) = \sum_{i=1}^{n} p_i^t q_i \Big/ \sum_{i=1}^{n} p_i^o q_i$, says that if the quantities are constant between the two periods, then the price index should be equal to the ratio of the revenue in the current period to the revenue in the base period.

Axiom 7 – Invariance to Proportional Changes in Current Quantities.

The test for invariance to proportional changes in current quantities,

$P(p^0, p^t, q^0, C \times q^t) = P(p^0, p^t, q^0, q^t)$, says that if all the quantities in period t are multiplied by the same constant C, then the old price index value and the new price index value should be the same.

Axiom 8 – Invariance to Proportional Changes in Base Quantities

The test for invariance to proportional changes in current quantities,

$P(p^0, p^t, C \times q^0, q^t) = P(p^0, p^t, q^0, q^t)$, says that if all the quantities in the base period 0 are multiplied by the same constant C, then the old price index value and the new price index value should be the same.

Axiom 9 – Symmetry of Quantity Weights

The test for the symmetry of quantity weights, $P(p^0, p^t, q^0, q^t) = P(p^0, p^t, q^t, q^0)$, says that the quantity vectors of the two periods should be treated in an evenhanded manner.

Together, axioms 7 and 8 imply that all the individual prices should be weighted according to the relative share of their respective commodities in the representative basket. As a consequence, equally proportional changes in the quantities of all the commodities, either in the base year or in the current year, should not affect the price index value since such changes do not affect the relative share of the commodities. Instead, axiom 9 implies that both quantity vectors, - that of the base period and that of the current period -, should be equally important and have the same say in determining the relative share of the commodities.

Axiom 10 – Time Reversal

The test for time reversal, $P(p^0, p^t, q^0, q^t) = 1/ P(p^t, p^0, q^t, q^0)$, says that if the price and quantity data for the two periods are interchanged, then the new price index should equal the reciprocal of the old price index.

Axiom 11 – Mean Value for Price

The test for mean value for prices, $Min_i (p_i^t/p_i^0) < P(p^0, p^t, q^0, q^t) < Max_i (p_i^t/p_i^0)$, says that the price index value should lie between the minimum and maximum individual price ratio, as it is supposed to be a sort of weighted-average of the individual price ratios.

Axiom 12 – Monotonicity in Current Prices

The test for the monotonicity in current prices says that the price index value should increase, if it is recalculated assuming an increase in anyone of the current prices.

If we assume $p_i^1 < p_i^2$ for only one current price observation -i and all the other price and quantity observations remain the same, then $P(p^0, p^1, q^0, q^1) < P(p^0, p^2, q^0, q^1)$.

Axiom 13 – Monotonicity in Base Prices

The test for the monotonicity in the base prices says that the price index value should decrease, if it is recalculated assuming an increase in anyone of the base prices.

If we assume $p_i^0 < p_i^1$ for only one base price observation –i and all the other price and quantity observations remain the same, then $P(p^0, p^t, q^0, q^t) > P(p^1, p^t, q^0, q^1)$.

Axiom 14 – "Value" Product

Changes in the value of a set of commodities/transactions can be caused by a change in the prices, a change in the quantities, or both. The aim of economists and statisticians is to construct indices that separate the price effect and the quantity effect from each other. Due to this reasoning, another very important property for index formulas has been developed. Actually, every price index $P(p^0, p^t, q^0, q^t)$ should have a corresponding quantity index $Q(p^0, p^t, q^0, q^t)$, such that the product of these two indices should be equal to the value ratio, between any two periods. This is known as the "value" product test:

$$V^t/V^0 = P(p^0, p^t, q^0, q^t) \times Q(p^0, p^t, q^0, q^t).$$

As a consequence, once a price index and the value ratio V^t/V^0 are available, then the corresponding quantity index should be determined as a function of the two, or the other way around. According to the axiomatic approach, the resulting quantity vector also should desirably possess the characteristics described through the axioms. For instance, likewise the last two monotonicity tests, two other monotonicity tests can be developed, for current quantities and base quantities.

APPENDIX 2 – THE MAIN COUNTRIES FROM WHERE ALBANIA IMPORTS

The identification of the main countries from where Albania imports is done based on the framework proposed in section 3. The classification is updated every 3 years. More precisely, the entire period starting from January 1993 is divided into 3-year periods as follows: 1) 1993-1995; 2) 1996-1998; 3) 1999-2001; 4) 2002-2004; 5) 2005-.

The table below presents the shares of the value of imports from one country to the total value of all imports from all the countries, for all the 3-year periods. The shares for the period 2005-, are based on the two years available so far – 2005 and 2006-, and should be re-estimated at the end of 2007.

1993-1995		1996-1998		1999-2001		2002-2004		2005-	
Italy	35.27%	Italy	43.05%	Italy	35.56%	Italy	33.59%	Italy	28.68%
Greece	22.51%	Greece	24.78%	Greece	28.25%	Greece	21.46%	Greece	16.17%
Germany	7.61%	Germany	4.72%	Turkey	5.73%	Turkey	6.72%	Turkey	7.52%
Bulgaria	7.30%			Germany	5.06%	Germany	5.60%	China	6.32%
								Germany	5.53%
Total		Total		Total		Total		Total	
All	72.69%	All	72.55%	All	74.60%	All	70.37%	All	64.22%
Available	65.39%	Available	72.55%	Available	74.60%	Available	70.37%	Available	64.22%

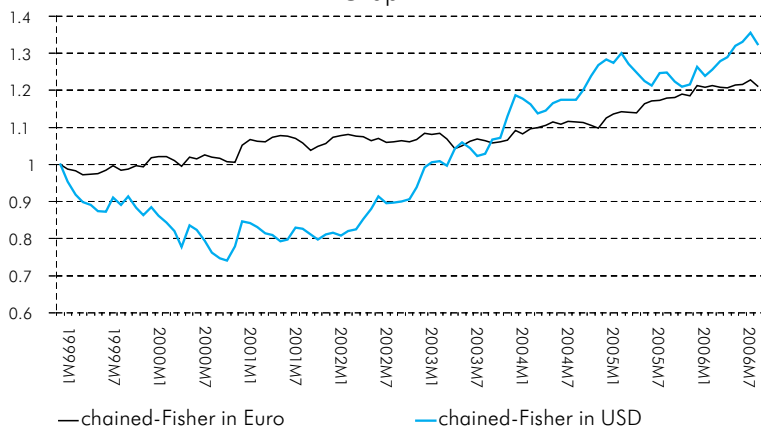
* Bulgaria (1993-1995) emerges as a main country from where Albania imports, but the lack of export unit value/price indices for it makes it impossible to be represented in the final index of unit values/prices of Albanian imports. Instead, Germany (1996-1998) does not strictly emerge as main country of importantion, but since it emerges in all other periods, it was decided to keep it. Moreover, please, remember that results during one 3-year period are used to determine whose foreign countries' export unit value/price indices will enter the final index during the coming 3-year period. For instance, the results presented in the table above for the period 2002-2004 are used to determine whose foreign countries' export

unit value/price indices will enter in the calculation of the final index for the period 2005-2007. An exception relates to the final index in USD during the period 1993-1995, which uses the same period's results because of the lack of data for the prior periods.

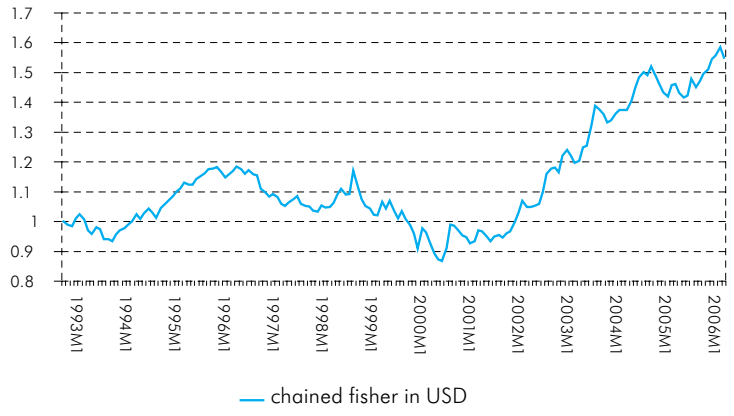
APPENDIX 3 – CHARTS

The graphs portrayed below are the charts of the Indices of Foreign Unit Value/Prices of Albanian Imports, constructed according to the second approach presented in this discussion paper – the approach based on the export unit value/prices of the main countries from where Albania imports.

Graph 1



Graph 2



The first chart presents chained-Fisher indices in Euro and USD, starting in January 1999, when Euro was introduced for the first time. The second chart presents the chained-Fisher index expressed in USD, starting from January 1993. The first chart allows the two indices, expressed in different currencies, to be compared. According to the first chart, three main periods can be identified: from 1999 to late 2001, when the index in USD tends down and further below from the index in Euro; from late 2001 to mid 2003, when the index in USD starts moving up and towards the index in Euro; from mid 2003 and on, when the index in USD takes over the index in Euro. The three phases reflect the developments of the Euro/USD exchange rate.

Revised Manual for the Export and Import Price Indices – different Chapters of the Manual; by the Technical Expert Group on the Export and Import Price Indices, under the auspices of the Inter-secretariat Working Group on Price Statistics; latest up-date in July 26, 2006; < http://www.imf.org/external/np/sta/tegeipi >
Note: The members of the technical expert group are: Kim Zieschang (IMF), Thomas Alexander (IMF), William Alterman (U.S. Bureau of Labor Statistics), Paul Armknecht (IMF), Pam Davies (United Kingdom Office for National Statistics), Erwin Diewert (University of British Columbia), Jemma Dridi (IMF), Robert Feenstra (University of California Davis), Maria Mantcheva (IMF), Keith Woolford (Australian Bureau of Statistics).

The Early History of Price Index Research; by W. Erwin Diewert, NBER Working Paper No 2713; September 1998

On the Construction of Price Indexes; by Diane F. Primont (Southest Missouri State University)

The Super Price Index: Irving Fisher and After; by Sydney Afriat (Department of Economics, University of Siena) and Carlo Milana (Institute of Economic Studies and Analysis, Rome); No 492.

ENDNOTES

** Risan Shllaku, specialist, Research Department, Bank of Albania.*

[1] Please, be aware that a value of 100 in the base year, instead of a value of 1, is assumed in the entire discussion paper and is represented in all the formulas.

[2] The aim of Appendix 1 on the Axiomatic Approach is to explain only the most important and widely accepted axioms.

[3] The draft of Export and Import Price Index Manual has been supervised by the Technical Expert Group on Export and Import Price Index (TEG-XMPI), under the auspices of the Inter-secretariat Working Group on Price Statistics, which is a joint initiative of IMF, World Bank, OECD, ILO, etc.

[4] Source: The draft of Export and Import Price Manual, Chapter 15- Basic Index Number Theory, pg 41-42; by the Technical Expert Group on Export and Import Price Index (TEG-XMPI), under the auspices of the Inter-secretariat Working Group on Price Statistics; July 2003.

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Tel.: +355-(0)4-2222152;
Faks: +355-(0)4-2223558

or send an e-mail to:

public@bankofalbania.org

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