MEASURING INFLATION IN EGYPT: ASSESSMENT OF THE CPI ACCURACY

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Abstract

This paper examines the accuracy of measuring headline inflation in Egypt. Thus, the methodological framework of this paper includes a presentation of the most commonly used price indices in order to see why the CPI has become the main reference of headline inflation in most—if not all—countries. The study then discusses the construction of the CPI in Egypt, reviews and updates the assessment of the quality of Egypt's CPI against the internationally accepted guidelines and practices. The study shows that, overall, Egypt's CPI construction follows procedures and techniques that are increasingly consistent with international standards, guidelines and agreed practices. Yet, the gap is still wide between the public perception of inflation developments and the announced official figures. To improve credibility in official measures of inflation, the study proposes to make the calculations and methodology adopted in the construction of the CPI available to the public for independent verification. The paper also points out several shortcomings that, unless addressed, could become more serious over time for the CPI's accuracy and reliability. These are mainly the way the outlet sample is selected, housing pricing, and the biases resulting from the substitution, quality adjustment and introduction of new goods.

ملخص

تتناول هذه الدراسة بالبحث مدى دقة قياس التضخم الإجمالي في مصر. ولذلك، يضم إطار العمل المنهجي لهذه الورقة عرضا للأرقام القياسية للأسعار شائعة الاستخدام بغية معرفة السبب الذي جعل الأرقام القياسية لأسعار المستهلكين المرجع الرئيسي للتضخم الإجمالي في غالبية، إن لم يكن كافة، الدول. وتنتقل الدراسة بعد ذلك إلى مناقشة تكوين الأرقام القياسية لأسعار المستهلكين في مصر، ثم تقوم بمراجعة وتحديث تقييم لجودة هذه الأخيرة مقارنة بالإرشادات والممارسات المتعارف عليها دوليا. ويتضح من الدراسة أن تكوين الأرقام القياسية لأسعار المستهلكين في مصر بصفة عامة يتبع إجراءات وتقنيات في اتساق متزايد مع المعايير والإرشادات والممارسات الدولية. إلا أن الفجوة بين نظرة الجمهور لتطورات التضخم، والأرقام الرسمية المعلنة مازالت متسعة. ولزيادة مصداقية القياسات الرسمية للتضخم، تقترح الدراسة الإفصاح عن الحسابات والمنهجية المتبعة في تكوين الأرقام القياسية لأسعار المستهلكين للجمهور للتحقق منها بصفة مستقلة. كما تشير الورقة إلى أوجه قصور عديدة قد تصبح بمضي الوقت، إن لم تتم مواجهتها، أكثر خطورة على دقة ومصداقية الأرقام القياسية لأسعار المستهلكين. وتتركز أوجه القصور بصفة رئيسية في طريقة اختيار عينة المنفذ، وفي تسعير الإسكان، والتحيزات الناتجة عن إحلال، وتعديل جودة، وطرح سلع جديدة.

1. INTRODUCTION

Inflation is one of the most important indicators of macroeconomic stability. It also affects welfare and serves as a goal to public policy. Since the floatation of the Egyptian pound in 2003, the Egyptian economy has been subject to cycles of relatively high increases in prices. At each time, a heated debate would renew about the accuracy of the official inflation rates in reflecting actual changes in prices. Most Egyptians, whether economists or not, would argue that the Consumer Price Index (CPI) is underestimating the actual increases in prices, and is therefore, undermining the deterioration in the living standards in Egypt. At the same time, the Central Bank of Egypt (CBE) has announced its intention to move to an inflation targeting framework that aims to achieve price stability.[1] Since a target for inflation should be then set and sought by the monetary authorities, the use of an accurate and adequate measure of inflation becomes imperative.

The motivation for this study also comes from the due concern that the absence of reliable and accurate measurement of inflation may lead to the distortion of policy decisions and complication of macroeconomic management. Since inflation is a central guide to consumption and investment decisions, an inaccurate measure of inflation could, therefore, hinder the efficient allocation of resources in a market economy (Greenspan 1997). Furthermore, inadequate measurement of inflation may also distort both short and long-term policy decisions (Gordon 1992). For instance, an overstatement of the true rate of inflation can lead policymakers to adopt short-run restrictive policies when none may be required. In the long run, errors in measuring the change in the price level lead to incorrect measures of the growth of output and productivity over time and may mislead the comparison of a country's economic performance over time or with other countries. Finally, inadequate measurement of inflation may also add difficulty in explaining the causes of inflation as well as predicting it (Triplett 1977). The primary objective of this study is therefore to examine the accuracy of measuring inflation in Egypt. There has been little work that dealt with this issue. In fact, only one research study (Fares 1997) reviewed the construction of the CPI in Egypt in

[1] Monetary Policy Statement, June 2005. Available on:
http://www.cbe.org.eg/public/MONETARY percent20POLICY percent20STATEMENT.pdf.

a cross-country comparison and a report (IMF 2005) provided an assessment of the quality of Egypt's macroeconomic statistics, including the CPI.[2]

In order to achieve this objective, the methodological framework of this paper includes presenting the array of the most commonly used price indices in order to identify the most appropriate measure for analysis of inflation. The study then discusses the construction of the CPI in Egypt, reviews and updates the assessment of the quality of Egypt's CPI against the internationally accepted guidelines and practices. The remainder of the paper is thus organized as follows:

- Section 2 reviews different approaches used for inflation measures, highlighting their strengths and weaknesses.
- Section 3 describes the construction of the CPI in Egypt (its scope, data collection and processing, calculation methods, etc.), and presents recent developments undertaken to improve its accuracy.
- Section 4 reviews previous work assessing the quality of Egypt's CPI, and updates the assessment in light of recent developments against the international standards and practices.
- Section 5 summarizes the overall findings of the study and suggests a number of proposals to improve Egypt's CPI accuracy.

2. INFLATION MEASUREMENT

Inflation is often said to be "*persistent* increases in the *general* level of prices, or a *persistent* decline in the purchasing power of money, caused by an increase in available currency and credit beyond available quantities of goods and services."[3] The first part of the definition refers to general conditions while the other part refers mostly to monetary aspects of rising prices (Guðnason 2003). However, both parts imply that only *sustained* increases in prices or *sustained* declines in the purchasing power of money are considered inflation. Thus, any temporary increase in prices or temporary decline in the purchasing power of money should

[2] The IMF assessment of Egypt's data quality was done against the Special Data Dissemination Standard (SDDS) complemented by an assessment of data quality based on the IMF's Data Quality Assessment Framework. It is important to note that the report assesses the situation before 2003.

[3] Webster (2000).

be excluded from the inflation measure. Furthermore, inflation is an increase in the general level of prices, which means that an increase in one price, others remaining the same, is a change in relative prices and is not considered as inflation per se (Wahl 1983).

The question then arises about how to measure this permanent increase (or more precisely, change) in prices. The answer is certainly: by using price indices that measure price changes in distinct periods. There is some convergence of views as to the ideal conceptual properties that would be possessed by a system of price indices designed for the analysis of inflation. These can be summarized as follows (see ABS "Australian Bureau of Statistics" 1997):

1. It would encompass only market transactions, meaning that government services which are not marketed would not be included,
2. It would capture the current inflationary trend in prices associated with transactions in goods and services,[4]
3. It would embrace the entire economy and not be restricted to particular segments,
4. It would provide a measure of *pure price change* (i.e., an increase in the price of all commodities without a change in relative prices).
5. It would be able to identify the effects of erratic price fluctuations, and
6. It would be non-revisable and provide certainty to users.

In practice, the fulfillment of all these criteria is almost impossible. Therefore, each of the various price indices, which have been developed to allow the measurement of inflation, captures some but not all of the above-mentioned properties. What really makes the difference among various price indices are the decisions concerning some aspects related to the construction of the index. These aspects need to be clearly defined and they include: what commodities or items should be included in the index, how to determine the prices of these items, what transactions that involve these commodities to include and finally how to determine the weights and from which sources these weights should be drawn.

[4] Accordingly, it would not include interest rates. The latter represent the price of money, or more correctly, the relative price of consuming goods and services today rather than in the future (ABS 1997).

2.1. Current versus Fixed Weight Price Indices

In general, price indices could reflect current or fixed weights of the components of the index over time. The current weight price indices (CWPIs) combine various components of price changes using expenditure information for each period. In other words, this category of indices shows changes in expenditures between two periods of time when both the quantity of goods and services and prices are allowed to change. Differences in the value of the indices over time may reflect price and/or price and quantity changes. This feature can be an advantage for certain types of analysis, such as those for export and import prices where significant compositional change can occur over time and it is desirable to take into account prices that are actually paid or received in the current period rather than prices based on previous periods (ABS 1997). However, CWPIs are not considered a measure of "pure" price change.

On the other hand, Fixed Weight Price Indices (FWPIs) were developed to measure "pure inflation," addressing thereby the shortcoming of CWPIs. FWPIs are constructed by using over time fixed weights to the various components of the index. They measure the change in the cost of purchasing an identical basket of goods and services from one period to another. When these indices are calculated, it is supposed that consumers will not change their selection of goods when the relative prices change, i.e., there is no substitution. FWPIs are not thus subject to the impact of changes in the composition of the underlying components and do not reflect changes in quality, and so provide a measure of pure price change. But, if the weights remain fixed for a long period of time, the index may become less representative over time as its composition will not tend to reflect the changes in the quantities and characteristics of goods. This implies that any FWPI will be an imperfect long-run representation of price change. The majority of price indices are FWPIs. In general, weights are usually updated to overcome the problems related to these indices (ABS 1997).

2.2. Main Price Indices

Price indices can be constructed using one of two possible broad approaches: (i) The *national accounts approach* that gave birth to the so-called *broad indices*, like the GDP implicit deflator, and (ii) the *market transactions approach* that was a fertile ground for the development of a wide range of *partial indicators* relating to a particular segment of economic activity. The main difference between the national accounts and market transactions

approach is that the former has a broader scope of goods and services, as well as more comprehensive reference population. In the following, a description of the main price indices under these two approaches is presented.

The national accounts approach (broad price indices)

While national accounts were not designed with the specific intention to measure inflation, national accounts aggregates could provide a good framework for designing and organizing a system of consistent price statistics that relate to a set of economically interdependent flows of goods and services. This is because national accounts provide linkages between the major flows of goods and services associated with activities such as production, consumption, importing and exporting (ILO 2004).

The strength of this approach lies in several areas. First, national accounts represent the major flows of goods and services and levels of tangible and intangible stocks in the economy (ILO 2004). They are therefore the only comprehensive and detailed framework for the systematic and integrated recording of the stocks and flows of an entire economy. Second, they cover all resident households. Third, most users of economic statistics are familiar with their underlying principles and major aggregates (ABS 1997). However, price measures derived from this approach include notional transactions, and entail some sacrifice in terms of the timeliness with which the inflation estimates could be obtained. Moreover, they are subject to revisions as firmer data are included in the accounts. This approach is used to construct implicit price deflators as well as FWPIs.

Implicit GDP Deflator: It is defined to include the prices of all domestically produced final output, whether purchased by consumers, businesses, governments, or the rest of the world, and is obtained by dividing the current value of GDP by its corresponding constant value. It is considered a CWPI because it reflects the current quantity weights in each period. Yet, because the weights change from one period to the other, the implicit GDP deflator does not compare the price of a constant basket of goods and services. Therefore, changes in its value could be due to a change in price and/or a change in the composition of relative quantities. As a result, this deflator is not a measure of pure inflation. It is also very costly to produce since it needs to be constantly revised to reflect current weighting, and only tracks domestic inflation since GDP does not include imports.

Fixed weight GDP Index: This is formed by applying fixed weights to the detailed price indices used to derive constant price estimates. The fixed weights are applied to each component to reflect the relative contribution of each individual expenditure item to total GDP in the base period. This index has the advantage of providing a measure of pure price change, but is still subject to the above-mentioned main limitations of the national accounts approach (i.e., timeliness and revisions).

The market transactions approach (partial price indices)

This approach has been developed to overcome the deficiencies of the previous approach in measuring inflation. It considers that inflation is specific to market transactions, and thus non-market transactions are not included. It also considers the issue of price measurement from a micro-economic perspective that assumes that it is possible to define a price measure for each institutional unit (e.g., each household, business entity or government) in terms of goods and services actually purchased by each unit in the market. Yet, it is not feasible to collect prices and quantities of goods and services purchased by each unit; and aggregation across the units could include prices for both intermediate and final transactions, possibly leading to multiple counting (ABS 1997).

Inflation measures developed based on this approach represent *"partial*" measures only because they pertain to a number of individual transactions in specific markets. Therefore, they only include a subset of commodities consumed or produced in the economy, providing a representative characterization of aggregate price change. The composition of this subset or representative basket of goods relies on the fixed-weight index concept, described above. The cost of this subset of goods and services is then compared in two distinct periods to yield a measure of inflation. But this measure of price change will not be able to discriminate between relative and pure price changes, so that an increase in the price of a single good may cause the index to rise.

The most widely used total or headline inflation measure is the CPI. Yet, in association with the spread of inflation targeting regimes in many countries, a more recent measure of "core inflation" was developed from the headline inflation measure to provide a more accurate measurement of inflation. Also, because the CPI only measures changes in private consumption and does not cover investment (capital goods and services consumed by enterprises) or public consumption, it is often complemented by other indices to provide a

more complete analysis of inflationary pressures in an economy. These indices include for instance the Producer Price Index (PPI) or Wholesale Price Index (WPI) or more specialized indices that take into account other price movements such as the changes in prices of imports and exports. All these are direct indicators for inflation for various types of transactions. Together, they provide an integrated and consistent view of price developments pertaining to consumption, production and international trade (ILO 2004). The following section presents a description of the conceptual framework behind the construction of price indices followed by a presentation of the main direct price indices.

The Cost of Living Index (COLI): Inflation measurement (mainly for consumption prices) could find a guiding principle in the concept of the COLI, which is considered as the perfect measure of inflation. COLI measures changes in welfare in a broad meaning. It has been defined as "the ratio of the minimum expenditures required to attain a particular indifference curve under two price regimes" or "the change in consumption costs required to maintain a constant standard of living". Economically, it is connected to theories about true cost of living, meaning that consumers maximize their utility for a given level of cost. Accordingly, individuals maximize their utility by changing their consumption if prices go up to buy cheaper goods or goods with smaller rise in prices.

However, since all aspects of welfare cannot be measured with price indices (such as influence of climate, natural catastrophes, terrorism and plagues), conditional cost of living indices were developed to cover domain where price indices can be used while holding constant other aspects/variables (level of utility or welfare; set of consumer preferences; state of the physical and social environment). Even then, the conditional COLI compares the cost of two baskets that may not be exactly the same but which bring the same satisfaction or utility to the consumer. Therefore, the COLI is not a measure of pure inflation as it takes into account changes in both prices and relative prices that result into adjustment of consumers' expenditure through substituting more expensive goods by cheaper ones. Yet, it remains an appropriate theoretical framework for the construction of a measure that captures changes in consumption because it derives from the consumer theory and deals well with problems such as changes in expenditure patterns or the introduction of new goods. Therefore, all other partial measures of inflation have been developed in an attempt to be as close to the concept of the COLI as possible.

However, still the computation of this index is not easy, because the COLI cannot be directly calculated. Many approximations have been proposed (Diewert 2001), but very few national statistics institutions actually produce this kind of index. The US Bureau of Labor Statistics has recently started to calculate it on an experimental basis, and remains committed to using a COLI as its theoretical goal for the CPI (Johnson, Reed, and Stewart 2006).

The Consumer Price Index (CPI): The CPI is one of the most widely available and the most closely watched price statistic to measure inflation. It is defined as "a current social and economic indicator that is constructed to measure changes over time in the general level of prices of consumer goods and services that households acquire, use or pay for consumption" (ILO 2004). The index aims to measure the change in consumer prices over time. This may be done by measuring the cost of purchasing a fixed basket of consumer goods and services of constant quality and similar characteristics, with the products in the basket being selected to be representative of household's expenditure during a specified period (year). The construction of the CPI relies on the fixed weight basket concept and therefore is considered as a measure of pure price change. The weights are usually derived from household surveys (HHS) and are updated every time a new HHS is available, preferably not longer than 5 years. The CPI coverage is, therefore, rather limited to consumer goods and services.

There is a wide variety of purposes for constructing consumer price indices (Turvey 1989; Hill 1997; Cook and Lewington 1997; Stott 1998; EUROSTAT 1996 and 2002; OECD 2002; ILO 2004) that can be summarized as follows:

- A measure of inflation (including the analysis of the inflation process) and of change in the cost of living;
- A measure for the deflation of consumption aggregates in the national accounts;
- Accounting purposes, as the CPI is often used to scale up monetary values between two periods[5] and to adjust original prices for assets;[6]
- A means for international comparisons of inflation;

[5] This is known as current purchasing power accounts.

[6] This is known as current cost accounting, which is a method of accounting for the use of assets in which the cost of using the assets in production is calculated at the current prices of the assets and not the price at which the assets were purchased.

- General indexation of public and private sector contracts (in particular for indexation by government, prices, wage and salary adjustment in contracts).

The publication of the Boskin Commission Report in 1996, which criticized the United States' CPI, ignited international debate concerning the differences between the concepts of inflation and the cost of living. In this regard, even though the CPI is an index of a price change only, it could be viewed as a sub-component of the COLI. Moreover, the CPI is constantly being improved to capture changes in the consumption patterns in response to relative price changes. This explains why the CPI has become the most widely used measure of inflation in the world.

The Producer Price Index (PPI): In the same way that there is no single, precise definition of what a CPI should measure, the term PPI is used to cover a number of different concepts. The IMF Producer Price Index Manual defines the PPI as "the average change in the price of goods and services as they leave the place of production or as they enter the production process" (IMF 2004). Whereas CPIs measure changes over time in retail prices of goods and services, PPIs provide a measure of change in prices received by the producers of commodities. PPIs are not a measure of average price levels or a measure of the costs of production. Moreover, PPIs do not include commercial mark-ups, transport costs and consumption taxes (OECD 2002).

The scope of the PPI is wider than the CPI in terms of goods, as the PPI covers in principle total output, which by definition includes intermediate consumption as well as value added (OECD 2002). In practice, the industrial coverage of the PPI is limited to a few industries such as agriculture, mining, manufacturing and energy supply. Yet, the use of the PPI as an indicator of general inflation creates pressure to extend its coverage to include more industries and products. However, the progress in extending the coverage to all output–producing activities, particularly services, has proceeded very slowly owing to the technical difficulty of specifying service products and measuring the associated prices. Yet, this is becoming an important issue especially that the share of services in national economies has increasingly become important (IMF 2004).

PPIs are used extensively at a detailed level for monitoring price movements (or deflating output) of specific products or industries. In addition, PPIs are usually aggregated in some way to provide more general indicators of inflationary pressure. Many countries

aggregate by stage-of-processing, i.e., PPIs are calculated for raw materials, intermediate goods and finished goods (sometimes split into consumer and investment goods) for specific industries, where possible, or for the whole economy. They thus provide some information on the transmission of inflation through the economy by stage of processing, for instance from primary products to finished products (IMF 2004). Finally, it is worth noting that export and import prices are an important extension of domestic PPIs which together provide a price index for total market supply.

Wholesale Price Index (WPI): WPIs reflect changes in the prices of products as they flow from the wholesaler to the retailer. They include products from domestic wholesalers and factories as they are delivered to retailers. They can include prices of raw materials for intermediate and final consumption, prices of intermediate or unfinished goods, and prices of finished goods through the distribution chain up to the point of retail. Investment and consumer goods may also be covered. Prices of imports are usually included. Prices for WPIs will generally be valued at purchasers' prices, i.e., discounts and rebates are reflected, taxes and subsidies on products are included and some trade and transport margins are included (OECD 2002).

As such, the WPI differs from the PPI because it includes both domestically produced products sold in the home market (included in the PPI) and imported products (excluded from the PPI), while excluding prices of exported products (IMF 2004). Other differences exist in the basket of products in the sample (weights), the inclusion/exclusion of prices of imported/exported goods, the types of establishment in the sample (wholesalers and/or producers), and the price components included (OECD 2002).

One of the most important advantages of the WPI is that it can provide policymakers with a good indication of the level of inflation at one stage prior to final demand. They can therefore take preemptive actions to control inflation before it flows to consumer goods and services. In many countries, the WPI has been replaced by PPIs that are broader in coverage as they include services. However, one of the very few countries that are still using the WPI as the main reference of inflation is India.

The Core Measure of Inflation: It could be defined as "the trend rate of increase" of either "the price of aggregate supply" or "the cost of the factors of production" (Eckstein 1981). Its development is related to the recent sharper focus on price stability and the

adoption of inflation targeting in many countries. These countries require a credible, more accurate and reliable measure of inflation to target than the CPI. One way to improve the reliability of the CPI is to exclude any short-term movements because they contain substantially less information about the long-term trend in inflation (Agénor 2000). Some countries use a core measure of inflation even though they do not adopt inflation targeting, because this measure allows central banks to resist only persistent sources of inflationary pressures and not be concerned with short-term movements in prices that could result from rapid adjustment to frequent real shocks that are often reversed (Agénor 2000). It may thus avoid unnecessary fluctuations in interest rates, employment and output.

Core inflation could typically exclude three categories of volatile components from the calculation of the CPI. The first and more popular is the exclusion of items such as food and energy that are subject to supply shocks that are generally offset after some time. The second category involves components that are beyond the control of central banks (such as administrative prices, terms of trade and indirect taxes) that may lead to a one-off jump in the price level, without sustained long-term effects on the inflation rate.[7] The third category consists of disturbances in prices that can be associated with the direct effects of policy changes on inflation, in case the price index contains components (such as mortgage payments) that vary directly with the level of short-term interest rates. The exclusion of such components from the calculation of the CPI may avoid a spurious rise in inflation when a policy tightening (through a rise in short-term interest rates) is needed to dampen expected inflation (Agénor 2000). This is because the interest rate increase could flow through higher mortgage lending rates and cause the CPI to rise further.

While the calculation of the core measure of inflation has the advantage of providing the central bank with the flexibility to abstract from volatile movements, it has several drawbacks:

- It is less representative of the cost of living than the CPI, especially, since this measure excludes food and energy prices, a component with a large weight in the CPI basket. Moreover, the central bank may be criticized that it does not care sufficiently about the poor who spend a large share of their income on these items (Fraga, Arminio Ilan Goldfajn, and André Minella 2003).

[7] For instance, core inflation would allow removing a one-off rise in indirect taxes that have a first-round effect of raising prices in proportion to the tax change.

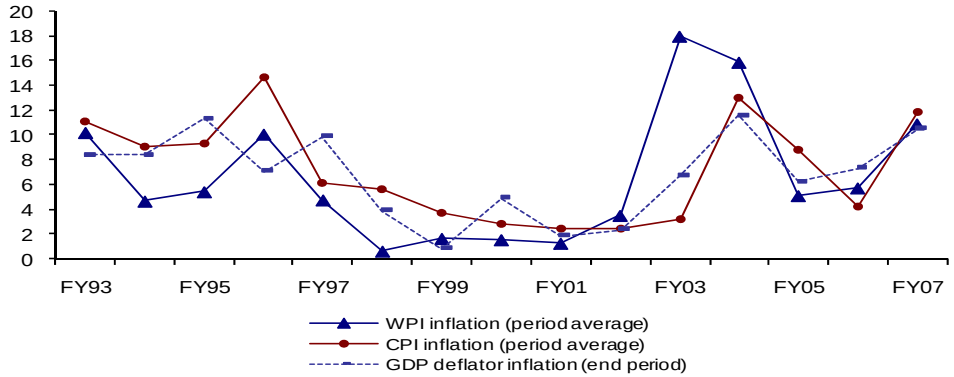
- It is not as transparent as the CPI (especially that judgment is required to identify the shocks to exclude from the calculations), and is less familiar to the public, leading to confusion especially if all the price and wage decisions in the economy are made on the basis of the "headline" rate of inflation.
- It does not deal with aggregate demand and supply shocks.

In order to increase the public acceptability and understanding of the core measure of inflation, it is beneficial to calculate it using a known and accepted technique. Furthermore, to improve credibility and reduce the perception that central banks manipulate the data, Carare et al. (2002) propose that an independent statistical agency other than the central bank do the calculations (as in the case of Finland); otherwise the central bank should make public the method of calculating the underlying measure, so that it can be independently verified.

3. Inflation Measurement in Egypt: Construction of the CPI

Egypt started to develop price indices around 1914, a time when price indices were attracting attention worldwide. At present, data are available for the CPI, WPI, PPI, and implicit deflators of GDP and its components (consumption, investment, exports and imports). A PPI that has just been developed was first published in September 2007, and is planned to replace the WPI starting January 2008.[8] As Figure 1 indicates, the implied annual inflation rates of these price indices are not of the same magnitude or follow necessarily the same direction, but their long-term trends show similar patterns.

Figure 1. Inflation Rates of Various Price Indices in Egypt, 1993-2007



Source: CAPMAS for WPI and CPI data. GDP deflator is calculated from the GDP data of the Ministry of Economic Development.

[8] See Annex Table 1 that shows the main price indices in Egypt.

In practice, however, only two price indices are commonly quoted in any discussion about the direction and magnitude of price increases, namely the CPI and the WPI. They are both produced by the main statistical office in Egypt, namely, the Central Agency for Public Mobilization and Statistics (CAPMAS). Because of the limited commodity scope of the WPI, the CPI has been the most popular and the most closely watched by the CBE and the public. Its importance has increased recently even more, since the CBE announced its determined plans to move Egypt's monetary policy toward targeting inflation. Therefore, the assessment of how well inflation is measured in Egypt will focus on how accurately Egypt's CPI reflects the actual changes in the general level of prices in the Egyptian economy.

In general terms, to identify the problem of the construction of an adequate CPI, one needs to look at both (i) how accurate the necessary information available is, namely prices and weights at the various time periods under consideration, and (ii) how accurate the calculation of the index is, namely the computation of lowest level indices (elementary aggregation) and index aggregation. This section describes how CAPMAS deals with these two questions leaving to the following section the appraisal of how accurate the resulting CPI could be from the processes in practice.

3.1. The Information Collection Process

The quality of the price information is the crucial determinant of the reliability of any price index. It also depends on how adequately all the phases of data collection are accomplished. The following presents a summary of the most important information collection procedures.

Population coverage and sources of weights: the target population includes the total population living in urban and rural areas regardless of the income expenditure level. In addition to an urban CPI and a rural CPI, with separate indices for main metropolitan cities and regions,[9] there is a national aggregate index that was first produced in July 2003. Individual commodities in the CPI are weighted by the share of expenditure on the item, as estimated in the Household, Income, Expenditure and Consumption Survey (HIECS). Until very recently, expenditure weights for the CPI were based on the HIECS of 1999/2000, but starting January 2007 CPI monthly data show the introduction of new weights derived from

[9] The CPI for urban areas covers six regions (Cairo, Alexandria, Canal cities, urban Lower Egypt, urban Upper Egypt and urban Frontier governorates), while for rural areas it covers two regions (rural Lower Egypt and rural Upper Egypt).

the HIECS of 2004/05 that were updated to reflect weights in January 2007,[10] and a change in the base year prices to January 2007. The coverage of both 1999/2000 and 2004/05 HIECSs is representative of income groups at the governorate level (with 48,000 households in the last two surveys).

Commodity coverage: The HIECS covers all consumption expenditures of households (including second-hand products, donations, and in-kind transfers for education, health, and housing) and capital formation in dwellings. Only expenditures on illegal goods or services are excluded. The expenditure aggregate of the CPI includes: (i) all consumption expenditures of households—including subsidized products and controlled prices for certain goods[11] and services (food, housing, education and health) that are representative for what most consumers are paying—valued at purchasers' prices on the survey day, (ii) own-account production of market goods (agricultural and foodstuffs products) valued at equivalent market price, and (iii) owner-occupied housing based on rental equivalents.

Egypt's CPI has 12 major sections. These sections are built up from 43 groups that in turn are comprised of 87 classes made up of 171 sub-groups covering about 274 items[12] (with HIECS-based weight by governorate) that constitute the elementary indices, and around 826 commodities[13] (see Figure 2). The latter are derived from the HIECS, and are classified according to the Classification of Individual Consumption by Purpose (COICOP) followed in the UN System of National Accounts (SNA 1993). This classification was introduced to Egypt's CPI construction in July 2003, but with a few deviations that reflect country specifics and refer mainly to excluding certain items, considered non-representative of household consumption, and the aggregation of others at the 2-digit level. The price information covers more than 90 percent of commodities consumed in the Egyptian economy.

Outlet sample: Price collection, undertaken by the CAPMAS regional branch offices located in the capital center of each governorate, is based on a stratified sample of outlets for

[10] See the formula that CAPMAS uses in updating the weights in Annex Methodology 1.

[11] Prices are currently subsidized and controlled for a small number of food items (sugar, bread and cooking oil) and a large share of services (health, education, etc.). While baladi bread subsidy is universal, only households who hold ration cards (almost half of the Egyptian population) are entitled to a fixed quantity of food items at subsidized prices; purchases beyond that allowance can only be made at free-market prices.

[12] Up from 204 in the CPI based on the 1994/95-HIECS.

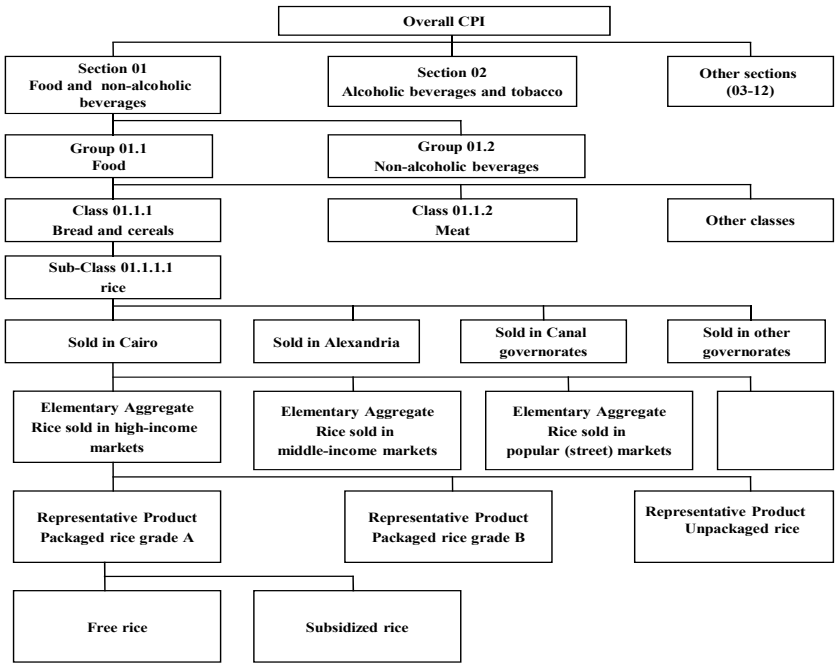
[13] Up from 655 in the CPI based on 1994/95 HIECS, and 800 in the CPI based on the 1999/2000 HIECS.

urban and rural areas throughout the 26 governorates, mostly covering the HIECS locations. The outlet sample in urban areas includes one district for each urban center within governorates and two districts for Cairo and Alexandria. In each district, prices are collected from three types of outlets for each variety of food items (street merchants, supermarkets or grocery stores, and government-owned stores). For clothing and other consumer goods, prices are collected from three outlets (two private stores and one government-owned store) in each district. As to rural areas,[14] each governorate is divided into three sub-regions. Three villages are then selected, four outlets for each sub-region. The selection of the retail outlets was designed to represent those most frequented by consumers for purchases of goods and services. Rent information is collected including energy and water usage throughout urban and rural centers. Data on rents are collected according to the same geographic outlet sample frame, and cover rented housing units and owner-occupied ones.

Price data collection method and frequency: Most prices are collected through personal visits of CAPMAS' field agents using price collection forms, but prices for some items are collected centrally or by telephone. Most prices are collected monthly in urban areas (from around 3324 retail outlets) and every other month in rural areas (from around 3825 retail outlets). Collection is spread over three days of each month (15–17), and reflects the actual prices that consumers are paying on the day of the survey. Prices for certain products or services that change less frequently or are controlled are collected yearly or when new price regulations are enforced by the government. For a number of commodities (electricity, gas and communications) prices are collected quarterly. All data collected are then subject to field editing in the regional offices and office editing in the head office. Major updates of the CPI basket are only done at the time of weights change when a new HIECS is available (every five years since 1990/91).

[14] Spread across 17 of the 26 governorates.

Figure 2. Aggregation Structure of Egypt's Consumer Price Index (CPI)



Source: This Chart is based on information provided by CAPMAS staff on the methodology of aggregation structure, and from COICOP-HBS 2003 on commodity classification.

CPI is published monthly for urban areas and every two months for rural areas. Thus, the national CPI for the whole country is estimated every two months. All CPIs are typically published about one week after the end of the month to which they refer.[15]

3.2. Statistical Techniques

In practice, a CPI is constructed in two stages. The first stage is represented by the calculation of the price ratios by 'specific object' (i.e., a pre-established quality of the commodity) and, subsequently, the calculation of elementary indices for each commodity or commodity group (using an adequate arithmetic average, weighted or not, formula or a geometric average formula). The second stage consists of aggregating the relatives (or ratios) and elementary indices into the higher-level indices.

[15] Monthly CPI series are posted on the CAPMAS website a few days after their production, and in the following month in the CBE *Monthly Statistical Bulletin* and *The Financial Monthly* of the Ministry of Finance.

Computation of lowest-level indices (elementary aggregates)

The elementary aggregates are the item strata indices constructed by area level from the prices collected for specific items in specific outlets (see Figure 2). They should be deliberately constructed in such a way to group together similar items that are similar in their end-uses (i.e., close substitutes for each other) and are expected to have similar price movements. Yet, in practice the degree of homogeneity achieved within an elementary aggregate depends on the availability of corresponding expenditure data. Being the building block of the CPI construction, the quality of elementary indices is crucial for the overall quality of the CPI.[16]

In Egypt, the elementary indices compilation is done by region, up to the commodity (variety) level, based on price lists transmitted by regional offices of governorates. For each variety, a regional average price is produced from data collected from governorates. The average price by region is next compared to the base-year price to obtain a price relative per variety. The elementary indices are then computed as the ratio of unweighted geometric means of prices in two periods, using "Jevons Price index"[17] as follows:

$$I_{JRA}^{0:t} = \frac{\prod \left(p_i^t\right)^{1/n}}{\prod \left(p_i^0\right)^{1/n}} \qquad (1)$$

Where $I_{JRA_i}^{0:t}$ is the ratio of the geometric average prices, named after Jevons, of commodity *i* for the two periods, *0* and *t*, p_i^t is the price of commodity *i* in period *t*, p_i^0 the price of commodity *i* in the base period *0*, and *n* the number of price observations.

The main improvement seen in this stage of calculating CPI is the shift since July 2003 from the manual compilation of price data to the usage of computers throughout all steps. Because of the enormous amount of work that was needed to handle all price data manually, only a part of the prices was used in the average price compilation after eliminating most

[16] For more details on the appropriate formulae used to calculate elementary aggregates, see Annex Methodology 2.

[17] The use of geometric means in the price indices is equivalent to assuming that the expenditure shares remain constant, so that if one price doubles while all other prices are constant, the quantity purchased of the former will halve. This would capture the effects of price rises best if, loosely, we believed that demand had unit elasticity (i.e., the amount spent did not change much with prices). On the other hand, the use of arithmetic means is, loosely, rather like assuming that the volume of goods and services purchased is invariant to their prices. This would capture the effects of price rises most accurately if we believed that demand was very inelastic (that is to say, the volumes purchased did not change much with prices).

outliers. This practice was seriously affecting the accuracy of the index. Since July 2003, price database has been transmitted electronically to head office, where information is automatically fed into one of the most advanced software (Oracle) to produce the average elementary aggregates.

Computation of upper-level indices

A higher-level index is an index for some expenditure aggregate above the level of an elementary aggregate, including the overall CPI itself. More specifically, once the indices for the elementary aggregates have been estimated, class indices are obtained as their weighted averages. Class indices are then combined, following the hierarchy of the classification, with appropriate expenditure weights applied along the way. For example, the price indices for rice in different regions are combined in the price index for rice using appropriate regional weights. The price indices for rice, bread, pasta products, and sandwiches are then combined to form an index for bread and cereals with appropriate weights for each of these items. Similarly, the various price indices for clothing materials are combined to obtain a clothing materials' index. These indices are then further combined to produce major section indices, in these cases, "food and non-alcoholic beverage", "alcoholic beverages, tobacco and narcotics", "clothing and footwear", etc. Finally, the major division indices are combined to arrive at the "all-items" index, the CPI (see Figure 2).

In Egypt, higher-level indices are compiled by using the Laspeyres formula and the weights provided by the HIECS. For the CPI series with July 2003 reference period, the formula used was the so-called "true Laspeyres" with weights derived from 1999/2000 HIECS, as follows:

$$I^{0:t} = \sum_{i=1}^{n} w_i^0 \times \left(\frac{p_i^t}{p_i^0} \right) \qquad (2)$$

Where $I^{0:t}$ [18] denotes the overall CPI, or any higher-level index, from period *0* to *t*; $\frac{p_i^t}{p_i^0}$ the long-term price relative of item *i*, and w_i^0 its corresponding base period expenditure share.

[18] Whereas elementary indices are identified by the subscript i, the higher-level index carries no subscript.

Starting January 2007, CAPMAS started to use the Modified Laspeyres formula in the computation of higher-level indices:

$$I^{t\to 0} = \sum_{i=1}^{n} w_i^{t-1} \times \left(\frac{p_i^t}{p_i^{t-1}} \right) \qquad (3)$$

Where $\left(\frac{p_i^t}{p_i^{t-1}} \right)$ is the short-term price relative of item *i*, w_i^{t-1} is the base period value share, (w_i^0), updated for price change to the previous period (*t-1*), as

$$w_i^{t-1} = w_i^0 \times \left(\frac{p_i^{t-1}}{p_i^0} \right) = w_i^0 \times \left(\frac{p_i^1}{p_i^0} \right) \times \left(\frac{p_i^2}{p_i^1} \right) \times \prod_{k=3}^{t-1} \left(\frac{p_i^k}{p_i^{k-1}} \right),$$

which means that the Modified Laspeyres weights each item's short-term price relative $\left(\frac{p_i^t}{p_i^{t-1}} \right)$ by its previous period expenditure share w_i^{t-1}.

CAPMAS produces 11 higher-level CPI indices: eight regional indices, an urban CPI, a rural CPI, and an overall CPI. Within the urban CPI each of the six regional indices has a discrete set of item weights. The urban CPI is constructed as a weighted average of the six regional indices using expenditure as weights. Similarly, the rural CPI distinguishes between Upper Egypt and Lower Egypt.

Treatment of missing prices, new goods and changes in quality

Missing prices: Temporarily missing prices in one outlet are first checked against other outlets and imputed with the price of the same product in other outlets. In case they are missing temporarily in all outlets (like for seasonal items), the price for the respective product is imputed using the short-term relative price change for similar items. When the product becomes permanently unavailable (after three months); a similar product will be selected to replace it using one of the replacement procedures. The alternatives are to select (i) the most popular variety among those that belong to the same elementary aggregate, (ii) the most similar to the replaced variety and (iii) the variety most likely to be available in the future (see Annex Methodology 3) .

Adjustment for quality differences: The CPI should measure price change unaffected by changes in the quality/utility of the goods and services purchased. Thus when a quality change

(either improvement or degradation) is detected, an adjustment must be made to the price, so that a true price movement can be estimated. If this is not done, the index will either record a price change that has not taken place or fail to record a price change that did happen. It is thus recommended that attention should be paid to quality changes because the accuracy of the CPI depends on the adequacy of this process. CAPMAS adopts, in principle, the "differences in production costs" approach that relies on the information provided by the manufacturers on the production costs of new features of the replacements (new models), to which retail mark-ups and associated indirect taxes are then added.

New products: In general, new products are introduced with weights update according to information obtained from HIECS, i.e., every five years. The most important new items that were introduced in the CPI of 1999/2000 are: computers, telecommunications services (cell phones), air tickets, gas, travel expenses of regular visits to holy places, etc. Those recently introduced in the last updated series of CPI (with January 2007 as base period) are mainly in communications (e.g., various types of cell phone services), education (e.g., Azhar schools), health (e.g., health insurance), recreation and culture (e.g., equipment for sport). Only occasionally new items, such as the subway tickets, can be introduced into the CPI after they have gained significant market share.

Assessment and validation of source data

As previously mentioned, the CPI construction relies on two data sources: the price data sample and the household survey. Sampling errors for the HIECS are available and are published (less than 1 percent for the 2004/05 HIECS). The results of the HIECS are adjusted for non-response and efforts are made to minimize errors. Repetitive visits to sampled households by collectors have contributed to a small non-response rate (5-6 percent in the 1995/96 HIECS and 3.2 percent in the 2004/05 HIECS). Regarding the verification and correction of prices and intermediate results, the price data collectors are supposed to verify all price changes and are required to provide explanations for unusual movements. In some cases, there is double checking of the data collected in the field and in the data entry phase, and regional centers are contacted to verify and correct the values as needed. Also, contacts are maintained with different government agencies, retail companies, and internal departments for updating and cross-checking data. As to the verification of processing,

calculations of the two steps of CPI's construction are reviewed by statisticians in the Prices and Indices Department for reasonableness and consistency with external information.

4. HOW ACCURATE IS EGYPT'S CPI?

To assess the quality of Egypt's CPI, several criteria should be revised (IMF 2005):

• *Prerequisites of quality* identify conditions within the agency in charge of producing statistics that have an impact on data quality. The elements within the category refer to the legal and institutional environment, resources and quality awareness.

• *Integrity* detects features that support firm adherence to objectivity in the collection, compilation, and dissemination of statistics so as to maintain users' confidence. Elements refer to the professionalism and ethical standards that should guide policies and practices, which should be reinforced by their transparency.

• *Methodological soundness* refers to the application of international standards, guidelines, and agreed practices. Application of such standards, which are specific to the dataset, is indicative of the soundness of the data and fosters international comparability. Elements refer to the basic building blocks of concepts and definitions, scope, classification and sectorization, and basis for recording.

• *Accuracy and reliability* pinpoint aspects that contribute to the goal that data portray reality. Elements refer to identified features of the source data, statistical techniques, and supporting assessments and validation.

• *Serviceability* focuses on practical aspects of how well a dataset meets users' needs. Elements refer to the extent to which data are relevant, produced, and disseminated in a timely fashion with appropriate periodicity, are consistent internally and with other datasets, and follow a predictable revisions policy.

• *Accessibility* deals with the availability of information to users. Element refers to the extent to which data and metadata[19] are clear and easily available and to which assistance to the users is adequate to help them find and use the data.

[19] 'Metadata' refers to post description of statistical methodological information that outlines definitions, sources, methods of compilation, and data dissemination practices etc., of the indicators in question.

In the latest available assessment of Egypt's CPI (IMF 2005), it was shown that except for some elements in the "prerequisites of quality" and "accuracy and reliability" categories, all other criteria were considered as broadly consistent with internationally accepted standards and practices (see Annex Table 1). The focus thus in this section will be on the areas where the IMF (2005) identified some shortcomings, and presents the likely improvement impacts of the measures undertaken by CAPMAS since then in these areas.

4.1. Prerequisites of Quality

Two of the three elements of this category were assessed as areas of major concern, namely resources and quality awareness.

Resources: Although staff resources (in terms of number, education, training and exposure to international and local experts' assistance) have been somewhat commensurate with the work program, computer equipment was inadequate until 2004. There was just one computer that was used in the calculation of higher-level indices, there was no electronic price database, the software used was outdated (dBase III program), supervision of staff work, particularly in the regional centers, was insufficient, and data procedures and checking for errors were inadequate. However, since July 2003, many of these shortcomings, which were affecting the quality of the CPI and limiting the efficient use of staff resources, have been gradually dealt with. The number of computers has increased, the staff of the "Prices and Indices" department has its own lab with 7 adequate computers, and it can also use when needed the Central Administration's lab (with another 7-8 computers). The outdated software was replaced with an up-to-date one (Oracle), allowing to establish an electronic price database.

Quality awareness: Although quality of price statistics in general and the CPI in particular is a matter of concern for CAPMAS management, no systematic reviews are undertaken to identify problems at the various stages of collecting, processing and disseminating data. Furthermore, given the still limited resources relative to the ambitious plans for quality improvement, updating the CPI and replacing the WPI with a PPI have been preceding accuracy and reliability in CAPMAS' priorities.

4.2. *Accuracy and Reliability*

Many important aspects related to the accuracy and reliability of Egypt's CPI were flagged in the IMF report (2005):

Source data: Although it was acknowledged that the source data for CPI weights were determined using sound techniques, the 2005 IMF report highlighted important shortcomings that could lead to a considerable downward bias in the CPI. These were:

1. *Unrepresentative outlet sample*: The outlet sample was not seen as well representing the significant changes in retail trade activity, with the massive replacement of government-owned stores by private ones. It was further argued that when the update of the outlet sample occurred, it was not conducted in a systematic way. At present, private outlets are the main source of price information for CPI construction purposes (in the outlet sample, all outlets for food items and more than 90 percent of the remaining outlets are private). However, some challenges remain. First, the outlets are selected purposively (also referred to as a judgmental sample) upon decisions made by the regional offices' heads who are supposed to have the best knowledge about developments of the retail market in their relevant regions. There must be some broad guidelines for the specification of the outlet sample, but they have never been documented or assessed to see whether the selected outlet sample has the same proportions of units as the universe of outlets with respect to the established specified criteria. Second, the choice of outlets, as described above, although geographically representative, assumes that all households equally favor the three sources chosen since different types of shops carry equal weights. Finally, selecting only three outlets per location is not necessarily representative at this level. The direction and magnitude of the combined bias effects of these problems on the CPI are difficult to assess and need future empirical work. Third, to put this in a comparative context, the outlet selection approach adopted by CAPMAS is one of three available alternatives. While international guidelines favor the use of *random sampling* techniques for outlet selection in the belief that they will enhance the accuracy of the index and allow estimation of the sampling error, such techniques are rarely used in practice. Notable exceptions are the United States and Mexico where outlets (and of course items) are selected using Probability Proportional to Size (PPS) methods. A second method is to include in the *household survey a question about where consumers shop* for certain products, in order to identify consumers' buying preferences. Chile is a good example of countries adopting this

method.[20] Finally, *outlets could be selected purposively* (as in the case of Egypt). Accordingly, turnover[21] data and local expertise should be used to select the most representative outlets, and the national statistical institute head office should stipulate quotas for major outlet types, e.g., 80 percent of fruit and vegetable prices to be collected in markets, 20 percent in shops, to ensure representative coverage of outlet types. The United States CPI takes advantage of the use of the modified Laspeyres to continuously revise the outlet sample on a rotational basis (PPS using turnover), and the United Kingdom reselects 20 percent of the outlet sample each year as part of the annual weight revision exercise (PPS using floor space).

2. *Over-weighted subsidized and controlled prices*: Subsidized and controlled goods and services were deemed overrepresented (most importantly, bread and many services) in the basket, leading to the underestimation of the CPI. This was true until the introduction of questions about household consumption expenditure on subsidized and free bread in 1999/2000 HIECS and on the two types of ration cards (high-subsidy and low-subsidy cards) in the 2004/05 HIECS. In addition, the 2004/05 HIECS contains more questions on private education and private health services purchased by households. This has provided information that better reflects the actual consumption pattern of Egyptian households, improving the accuracy of weights estimates.

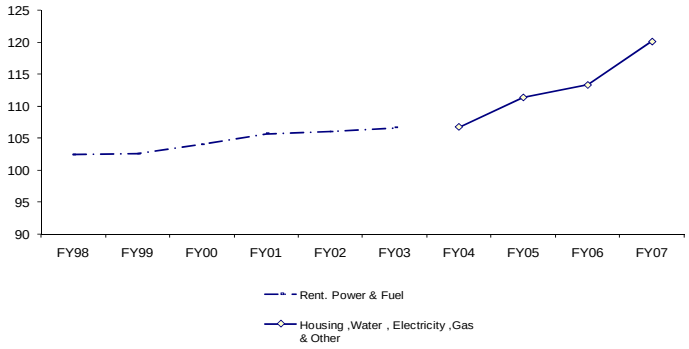
3. *Underweighted new rent*: The weights used for rent, particularly new rent, in the basket of goods and services have been a concern in all discussions about the accuracy of Egypt's CPI. The CPI series based on the weights derived from 1995/96 HIECS, attributed for rent, including imputed rent for owner-occupied housing, a weight of around 3 percent. This low weight was mainly due to the imputation of rental value for owner-occupied housing on the basis of fixed rents set by government after 1953 revolution. However, this has changed since July 2003 when new weights were derived from the 1999/2000 and the 2004/05 HIECS to reach 7.8 percent 9.6 percent, respectively. The owner-occupied housing represents 86 percent of the rent weight (equivalent to 8.3 percent of the CPI weights) according to 2004/05 weights (see Annex Table 2). Since July 2003, the rental equivalent of this category of rent started to be imputed based on actual rents of similar housing units in the neighborhood. This

[20] Chile also conducts an outlets census to identify the most representative outlets carrying and selling different items.

[21] There is no universally accepted definition of "turnover" or "sales" and the terms are often used interchangeably by many national and international agencies. For more details on this, see *Main Economic Indicators Comparative Methodological Analysis, Supplement 1,* OECD, Paris 2002, pages 57-58.

approach is used in many countries.[22] As to the remaining components of rent in the CPI, namely old and new rents, although there are no specific weights assigned to each of these rents the potential bias that could result should not be significant because of their little weight (combined they represent 1.3 percent of the CPI). However, by looking at the housing price index over the last decade, one can argue that the price movements as implied by this index divorce from reality (see Figure 3). This could be because the rental equivalents are not appropriately imputed, or that the housing sample is not representative of all housing forms, i.e., it tends to be dominated by lower levels of housing, despite the very wide variations in the cost of the variety of housing options facing Egyptian consumers.

Figure 3. The Housing Price Index in Egypt



Source: CBE time series on **www.cbe.org.eg**.

Many of the problems related to the likely rent bias could be solved by conducting a housing survey. In fact, the ILO guidelines state that rent information should be obtained from specially designed surveys of dwellings periodically updated to ensure continuing representativeness. In OECD Member countries, rent surveys are often quite small though a notable exception is the United States where a survey of 40,000 tenants is conducted monthly. In a number of other countries, for example Australia, New Zealand and the United Kingdom, rent survey information for private sector properties is supplemented by data supplied directly by public rental authorities. Annex Table 3 summarizes methodologies actually used and lists a range of different approaches to obtain price details on rent. These entail the collection of information from agents, landlords or tenants.

[22] For example, the United States, Japan, Korea, Czech Republic, Denmark, Germany, Hungary, Iceland, Netherlands, Norway, Slovak Republic, Switzerland, Turkey and Mexico.

Statistical techniques: These cover what relates to data compilation, data adjustment and transformations and statistical analysis. The *expenditure estimates* provided by the HIECS have been always sufficiently detailed to be of effective use as CPI weights. Also, the CPI composition has undergone important changes since July 2003 and is deemed to reflect consumer price movements quite well. New products have been added to the consumer basket (like computers, cell phones, gas, etc.), and weights have been updated in July 2003 (from the 1999/2000 HIECS) and in January 2007 (from the 2004/05 HIECS). But as noted earlier, the computerization of all steps of *compilation of intermediate data*, that used to be manually processed before January 2007, should significantly improve the accuracy of elementary aggregates and consequently the accuracy of the CPI.

Elementary aggregates

Also, many studies show that based on various approaches,[23] the Jevons index formula, which is used by CAPMAS to average the prices—more specifically the relative prices—to estimate *elementary aggregates*, emerges in general as the preferred index. This explains the apparent worldwide increasing tendency for statistical offices to switch to the Jevons index (ILO 2004). However, there may be cases in which little or no substitution takes place within the elementary aggregate and the Carli index might be preferred (see Annex Methodology 2). Therefore, the index compiler must make a judgment on the basis of the nature of the products actually included in the elementary aggregate.

In fact, some countries use different formulae for different elementary aggregates within the same CPI. As Annex Table 4 indicates, in most cases the price indices for elementary aggregates are calculated without the use of explicit expenditure weights. This is so because the elementary aggregate is simply the lowest level at which any reliable weighting information is available. However, the lack of weights within the elementary aggregates can be considered a source of bias, particularly for those categories of products that show different price movement of various components (e.g., bread, rent, education). In fact, until fairly recently it was thought that the biases, which might result from the use of unweighted indices, were not particularly significant. But, with the availability of scanned data (i.e., of detailed data on prices and quantities of individual items that are sold in retail outlets) it has been possible to compute ideal elementary aggregates for some item strata and compare results

[23] For more details on these approaches, see ILO 2004.

with statistical agency estimates of price change for the same class of items. The results of many studies indicate that when detailed price and quantity data are used in order to compute superlative indices[24] or hedonic indices[25] for an expenditure category, the resulting measures of price change are often below the corresponding official statistical agency estimates of price change for that category (ILO 2004). These results indicate that there may be large gains in the precision of elementary indices if a weighted sampling framework is adopted. This is not however feasible given the current relatively limited availability of scanned data in Egypt, but it may be expected to increase over the course of time and consequently to be used for CPI purposes.

Higher-level aggregates

Similar to elementary aggregates, the upper level indices could also be calculated by using several types of formulae. The 2003-ILO resolution acknowledges the fact that for compilation of a timely index, the only *practical* option is to use a formula that relies on the weights relating to some past period. One such formula is the Laspeyres-type index.[26] Actually, most if not all developed countries are using the Laspeyres type index formula (see Table 5). The Laspeyres index is characterized by a fixed base and fixed quantities. The meaning of such an index is easy to grasp and to explain to users. Since the quantities of the goods and services in the basket remain fixed, indices of this kind are sometimes described as "pure" price indices because they change purely in response to price changes. It should be noted however that the Laspeyres-type indices assume that no important quantity changes

[24] Price indices can be divided into two broad classes, the superlative indices, and the non-superlative indices. Superlative indices in theory approximate a true cost-of-living index (which is impossible to directly calculate). A characteristic feature of a superlative index is that it treats the prices and quantities in both periods being compared symmetrically. Different superlative indices tend to have similar properties, yield similar results and behave in very similar ways. Because of their properties of symmetry, some kind of superlative index is also likely to be seen as desirable, even when the CPI is not meant to be a cost of living index. Non-superlative indices are the ones actually used in practice, because of the timeliness with which their sample based estimates can be produced. Yet, they deviate in theory from the cost of living index and in practice from the superlative indices (Dorfman, Leaver, and Lent 1999).

[25] A hedonic regression method estimates the price of an item as a function of the characteristics it possesses. The relationship between the prices and all relevant and observable price-determining characteristics is first estimated and then results are used to estimate the effects of changes in these characteristics on prices.

[26] It has been the long-standing tradition of the International Labour Organization to ensure that the international standards on the topic reflect current best practices and methodological advances. The first ILO resolution was adopted in 1925 by the Second International Conference of Labour Statisticians (ICLS), and subsequent revised resolutions were adopted by the Sixth (1947), Tenth (1962), Fourteenth (1987) and Seventeenth ICLS (ILO 2003a).

take place in response to changes in relative prices, between the base period and the current period. It thus has an upward bias, usually described as *'substitution bias'*.

As mentioned previously, CAPMAS currently uses the so-called Modified Laspeyres, illustrated in formula (3). Although the latter is algebraically equivalent to formula (2), there are gains from using the Modified Laspeyres version. On one hand, formula (2) requires tight control over item specifications; needs imputation of a base-period price to edit (quality-adjust) the current period's price, and estimate missing prices for unobservable transactions; and does not provide much flexibility if there is a discontinuity of products, frequent substitution of items, and/or important informal markets. On the other hand, the chaining process in formula (3) facilitates the introduction of replacement transactions, new varieties and new products as the need arises, and makes the estimation of missing prices easier.

Thus the main advantage of the "modified" Laspeyres index is that it allows the sampled products within the elementary aggregate index from *t-1* to *t* to differ from the sampled products in the periods from *0* to *t-1*. It does not change the consumption pattern of the weight-reference period but allows the expenditure shares to vary with the developments in relative prices, something that the use of fixed-base Laspeyres indices cannot capture. This explains why more and more frequently, countries are using "modified" Laspeyres indices (ILO 2003b).

Some would argue that it is statistically more appropriate to use a Fisher or other "superlative" index number formula (e.g., the Tornqvist index or the Walsh index), since they are theoretically considered the best proxies of an ideal index. This is based on the fact that "superlative" indices make use of the expenditure patterns in the two comparison periods. Theory also shows that a Laspeyres index (a non-superlative index) usually overestimates the Fisher index. However, in practice, given unavailability of both base-period weights and current-period weights superlative indices cannot be calculated within the short deadlines required for the CPI. Therefore, the value added of superlative indices would be the comparison between any of these indices and the CPI estimated with a Laspeyres formula. This helps to give some indication of the combined impact of income change, preference change and substitution effects over the period in question, which may be important information for users.

Adjustment for quality differences

All methods for quality adjustments may be grouped in two main categories, depending on whether the price or quality component is estimated first:

- *Explicit (or direct) quality adjustment methods* that directly estimate the value of the quality difference between the old and new item and adjust one of the prices accordingly. Pure price change is then implicitly estimated as the difference in the adjusted prices.

- *Implicit (or indirect) quality adjustment methods* which estimate the pure price change component of the price difference between the old and new items based on the price changes observed for similar items. The difference between the estimate of pure price change and the observed price change is considered as change due to quality difference.

However, adjusting for quality change is difficult to do well in practice. First, some quality dimensions of products are readily observable (e.g., volume or weight) and adjustments for changes in these are relatively straightforward, while other changes are less visible and hence are difficult to measure and make adjustments for. Second, a wide variety of approaches may need to be adopted, depending on the particular goods and services involved.[27] Finally, the methods for the easily observed quality changes (the explicit methods) are more complex, difficult and costly to apply.

From all the above mentioned and given the relatively limited resources available for CAPMAS, it is difficult to expect that during the construction of Egypt's CPI adjustment for changes in quality is always accounted for in a satisfactory manner. On the other hand, the "differences in production costs" approach adopted by CAPMAS is known to be most practicable in markets with characteristics that are broadly similar to those of the Egyptian markets, namely relatively small number of producers, with infrequent and predictable model updates. Also, the Modified Laspeyres formula, which has been recently used in constructing Egypt's CPI, can reduce implicitly the quality adjustment bias.

[27] The ILO 2003 resolution recommends using explicit quality adjustment whenever possible, especially for the items with large weights and characteristics that change in ways that are easily described. For items whose characteristics change in ways that are difficult to describe and/or are not easily observable, indirect methods might be applied.

Assessment and validation

As to verifying data collection and processing, the approach adopted by CAPMAS (see section 3) is in principle consistent with international standards. Whether in practice all guidelines of data cross-checking, regular investigation of intermediate data and supervision of staff work in the regional centers are well implemented is another question that needs close examination. But this goes beyond the scope of this study.

5. SUMMARY AND CONCLUDING REMARKS

Inflation is undoubtedly one of the most important indicators of macroeconomic performance. It refers only to the *sustained* increases in the general level of prices. This implies that any temporary increases in prices or an increase in one price should not be considered as inflation per se. Any inaccurate measurement in inflation may, for various reasons, hinder the efficient allocation of resources in a market economy and complicate unnecessarily the economic management. There are various price indices that can be used to measure inflation. Theoretically, these indices can be divided into two main broad categories. One where both the quantity of goods and services and prices are allowed to change, known as *current weight price indices*; and the second where expenditures are kept fixed, measuring thus "pure inflation," known as fixed weight price indices. Price indices can also be grouped into "broad indices" that fall under the *national accounts* approach—like the GDP deflator; and "partial indices" that are based on the market transactions approach—like the CPI, WPI, PPI and other more specialized indices.

Among the various measures of inflation, the CPI has become the main reference of headline inflation in most—if not all—countries for several reasons: (i) it is based on consumption expenditures that account for a large proportion of total final expenditures, (ii) it is easily understood by the public, (iii) it is published regularly (usually monthly) and in a timely manner, allowing a close monitoring of inflation, and (iv) it is seldom subject to frequent revisions once it is published making it attractive for indexation purposes.

Egypt has a long history of constructing price indices, and more specifically the CPI. CAPMAS, the statistical agency that produces price indices in Egypt, has made important efforts to improve the CPI quality. This has been part of the Egyptian authorities' strong commitment to improving Egypt's macroeconomic statistics by adhering to internationally accepted standards and best practices needed to subscribe to the Special Data Dissemination

Standard (SDDS). Yet, the gap is still wide between the public perception of inflation developments and the announced official figures. One useful way to improve credibility in official measures of inflation is to make the calculations and methodology adopted in the construction of the CPI available to the public for independent verification.

Basically, Egypt's CPI construction follows procedures and techniques that are increasingly consistent with international standards, guidelines and agreed practices. This applies specifically to the following:

1. The selection of the CPI commodity basket that has been consistently increasing and currently covers more than 90 percent of the total consumption,
2. The weights assigned to these items are revised every five years starting from the 1990/91 HIECS. Furthermore, CAPMAS plans to have a household survey every two years, with the next round starting in early 2008,
3. The classification of the commodity basket according to the Classification of Individual Consumption by Purpose (COICOP) starting July 2003,
4. The establishment of an electronic price database that was first used in the calculation of the new CPI series that started in January 2007,
5. The computerization of intermediate data processing, allowing full use of collected price data starting January 2007,
6. The use of up-to-date statistical techniques in the two stages of compiling the index (elementary aggregates and higher level aggregation), allowing for implicit treatment of many sources of bias (quality changes adjustment, introduction of new goods, and missing prices), and consequently more accurate CPI.

Nevertheless, several shortcomings remain, and unless addressed, could have the potential to become more serious over time for the CPI's accuracy and reliability. These are mainly the following:

Selection of the outlet sample: Private outlets have become the main source of price information for CPI construction purposes, reflecting the structural changes in the Egyptian economy during the last three decades. However, the sample is selected based on judgmental (or expert choice) method by the head of CAPMAS regional offices. The selection criteria have never been known to users, documented, or assessed. One easy way to improve the

selection of outlet sample, so as to better reflect the buying preferences of consumers is to integrate the information already present since 2004/05 from the household survey about the shopping places of surveyed households. This should allow the assignment of proper weights to the most often frequented outlets. Also, CAPMAS may benefit from the recently conducted Outlet Census of 2006 to draw the sample of outlets to be used for CPI calculation purposes.

The housing pricing: Despite a reasonable weight for rent, changes in housing prices, as indicated by the housing price index, are too small compared to reality. This may be because the rental equivalents are not appropriately imputed, or more importantly that the housing sample is not representative of all housing forms. International guidelines and countries' practices point to the importance of obtaining rent information from specially designed surveys of dwellings periodically updated to ensure continuing representativeness.

The substitution, quality adjustment and new goods biases. These are biases that commonly result while calculating CPIs, but all national statistical agencies are keen to minimize, as a large bias may undermine the credibility and acceptability of the index. These biases tend to be larger the further back in time the base period of weights is. The frequency with which weights are updated is thus a crucial factor in eliminating part of these biases. Accordingly, CAPMAS' plans to have a household survey every two years, together with the use of the "Modified Laspeyres" version in computing the overall CPI, should further improve the accuracy of the CPI.

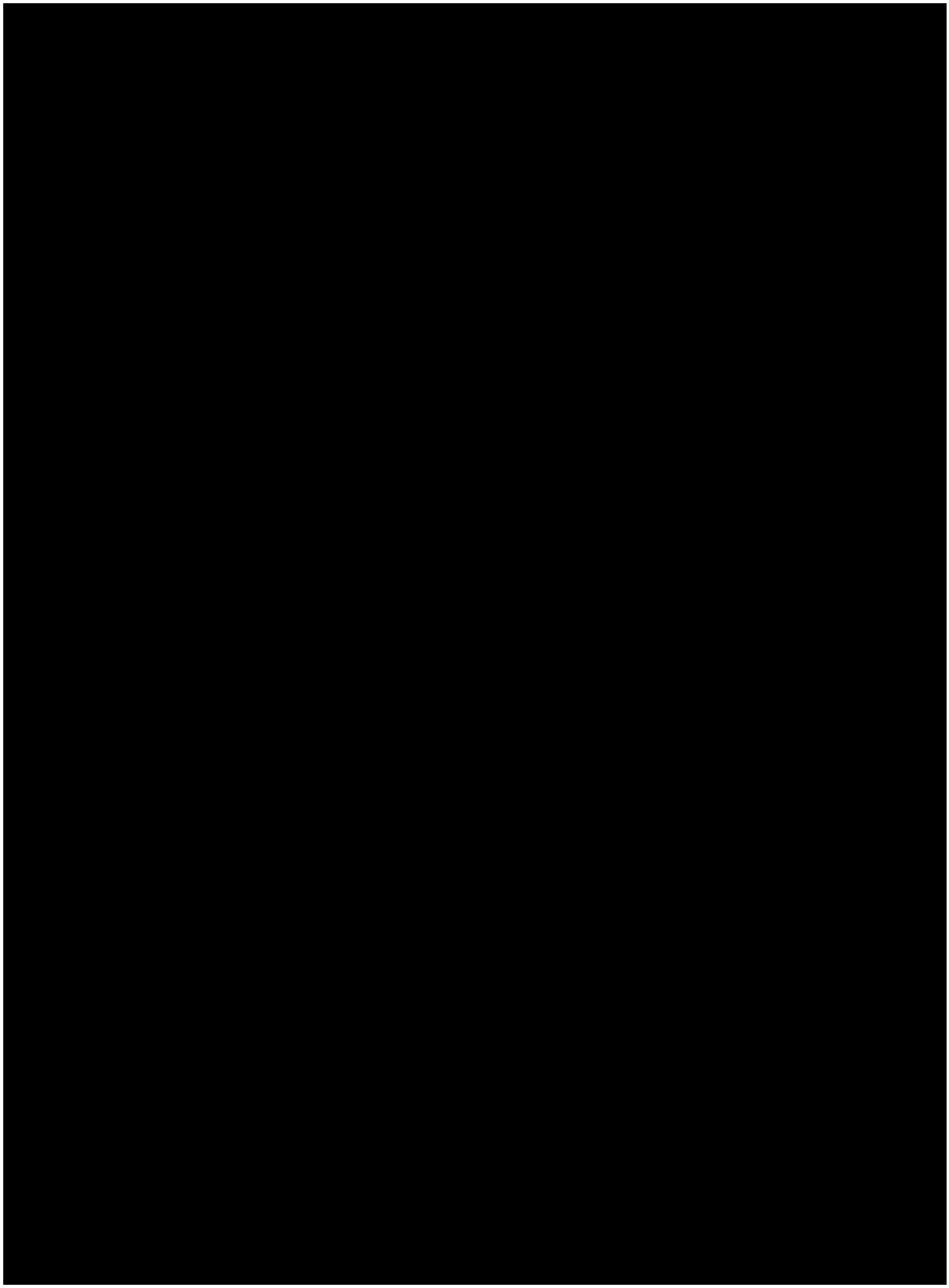
Other equally important areas that need more attention are the documentation of data compilation and data processing, the organization of supervision of regional centers to make it more efficient, regularly auditing price collection and data processing, assessing the aggregate effects of any quality adjustments made to enhance the transparency of the compilation process and publishing their estimates.

ANNEXES

Annex Table 1. Egypt's CPI Data Quality Assessment by the IMF: Summary Results as in 2005*

* This table is based on the IMF periodic consultation with Egypt, and relies on the information available at the time of the report mission in October 2003.
Source: IMF (2005).

Annex Table 2. CPI Weights by Section, for Selected Groups or/and Classes, 1999/00 and 04/05



Source: CAPMAS, *CPI Monthly Bulletin.*

Annex Table 3. Consumer Prices: Methodology for Treatment of Rented Housing, Selected OECD Countries

Source: OECD 2002, except for Egypt.

Annex Table 4. CPI Index Aggregation Formulae

	Elementary Aggregation	Higher level aggregation
Egypt	GM	Modified Laspeyres
Australia	GM+some RA	Modified Laspeyres
Austria	AR+some RA	Standard Laspeyres
Belgium	RA	Standard Laspeyres
Canada	GM+some RA	Modified Laspeyres
Czech Republic	RA	Modified Laspeyres
Denmark	GM	Standard Laspeyres
Finland	GM	Standard Laspeyres
France	GM+RA for food	Chained Laspeyres
Germany	..	Standard Laspeyres
Greece	..	Standard Laspeyres
Hungary	RA	Chained Laspeyres
Iceland	GM	Standard Laspeyres
Ireland	Weighted RA	Modified Laspeyres
Italy	GM	Chained Laspeyres
Japan	RA	Standard Laspeyres
Korea	RA	Standard Laspeyres
Luxembourg	..	Standard Laspeyres
Mexico	Weighted AR	Standard Laspeyres
Netherlands	RA	Standard Laspeyres
New-Zealand	RA	Standard Laspeyres
Norway	GM	Chained Laspeyres
Poland	GM	Chained Laspeyres
Portugal	GM+ Weighted AR	Standard Laspeyres
Slovak Republic	Weighted RA	Standard Laspeyres
Spain	AR	Standard Laspeyres
Sweden	GM	Chained linked index
Switzerland	AR	Standard Laspeyres
Turkey	RA	Standard Laspeyres
United Kingdom	AR+RA	Standard Laspeyres
United States	GM+Weighted AR	Modified Laspeyres

Note: GM stands for geometric mean; RA for ratio of averages; AR: average of relatives or ratios.
Source: OECD (2002), except for Egypt from CAPMAS.

Annex Methodology

1- Formula Used to Update the Weights

$$W_{iJan07} = W_{i2004/05}\left(\frac{I_{iJan07}}{AverageI_{i2004/05}}\right)$$

Where:

W_{iJan07} is the updated weight. $W_{i2004/05}$ is the commodity or service weight derived from the Household Income, Expenditure and Consumption Survey. I_{iJan07} is the January 2007 index with the base year 1999/00. $Average.I_{i2004/05}$ is the average of the price indices for the commodity or the service in 2004/05 with base year 1999/00.

2- Elementary Aggregates' Formulae

The question about the most appropriate formula to use to estimate an elementary price index was comparatively neglected until a number of papers in the 1990s provided much clearer insights into the properties of the various formulae and methods used to estimate the elementary aggregates, and their relative strengths and weaknesses (ILO 2004).

In most cases, the price indices for elementary aggregates are calculated without the use of explicit expenditure weights, as the elementary aggregate is simply the lowest level at which any reliable weighting information is available. Even in this case, however, it should be noted that when the items are selected with probabilities proportional to the size of some relevant variable such as sales, for example, weights are implicitly introduced by the sampling selection procedure. However, whenever information about sales of particular items, market shares and regional weights are available for certain elementary aggregates, explicit weights should be used that reflect the relative importance of the sampled items, even if the weights are only approximate. Weights within elementary aggregates may be updated independently and possibly more often than the elementary aggregates themselves.

There are two basic options for an elementary index:

i. Some kind of simple average of the price ratios or relatives;

ii. The ratio of some kind of simple average of the prices in the two periods.

In the case of a geometric average, the two methods coincide, as the geometric average of the price ratios or relatives is identical to the ratio of the geometric average prices.

Using the first of the above options, three possible elementary price indices are:

1. A simple arithmetic average of the price relatives, known as the Carli index, or $I_{C\,i}^{0:t}$

$$I_{C\,i}^{0:t} = \frac{1}{n}\sum\left(\frac{p_i^t}{p_i^0}\right)$$

2. A simple geometric average of the price relatives, known as the Jevons index, or $I_{JAR_i}^{0:t}$,

$$I_{JAR_i}^{0:t} = \prod\left(\frac{p_i^t}{p_i^0}\right)^{1/n}$$; and

3. A simple harmonic average of the price relatives, or $I_{HAR_i}^{0:t}$. $I_{HAR}^{0:t} = \dfrac{1}{\frac{1}{n}\sum\frac{p_i^0}{p_i^t}}$

For any set of positive numbers, the arithmetic average is greater than, or equal to, the geometric average, which in turn is greater than, or equal to, the harmonic average, the equalities holding only when the numbers are all equal. It follows that: $I_{C\,i}^{0:t} \geq I_{JAR_i}^{0:t} \geq I_{HAR_i}^{0:t}$.

The gaps between the three indices widen as the variance of the price relatives/ratios increases. The choice of formula becomes thus more important the greater the diversity of the price movements. $I_{JAR_i}^{0:t}$ can be expected to lie approximately halfway between $I_{C\,i}^{0:t}$ and $I_{HAR_i}^{0:t}$.

Using the second of the options, three possible indices are:

4. The ratio of the simple arithmetic average prices, known as the Dutot index, or $I_{D\,i}^{0:t}$;

$$I_D^{0:t} = \frac{\frac{1}{n}\sum p_i^t}{\frac{1}{n}\sum p_i^0}$$

5. The ratio of the simple geometric averages, again the Jevons index, or $I_{JRA_i}^{0:t}$;

$$I_{JRA}^{0:t} = \frac{\prod\left(p_i^t\right)^{1/n}}{\prod\left(p_i^0\right)^{1/n}}$$

6. The ratio of the simple harmonic averages, or $I_{HRA_i}^{0:t}$.

$$I_{HRA}^{0:t} = \frac{\sum \frac{n}{p_i^0}}{\sum \frac{n}{p_i^t}}$$

The ranking of ratios of different kinds of average are not predictable. For example, the Dutot, $I_{D_i}^{0:t}$, could be greater or less than the Jevons, $I_{JRA_i}^{0:t}$.

The three commonly used formulae are the ratio of arithmetic mean prices ($I_{D_i}^{0:t}$), the geometric mean ($I_{JAR_i}^{0:t}$ or $I_{JRA_i}^{0:t}$ which are equivalent), and the arithmetic mean of price relatives ($I_{C_i}^{0:t}$).

Based on the economic approach,[28] as well as the axiomatic approach,[29] simple arithmetic averages appear to have many undesirable properties and to produce one of the very worst of index numbers (Guðnason 2003), particularly when substitution is possible within the elements of the composed index (ILO 2003b). In general, the Jevons emerges as the preferred index, and there has been an increasing tendency for statistical offices to switch from using Carli or Dutot indices to the Jevons index. Yet, there may be cases in which little or no substitution takes place within the elementary aggregate and the Carli might be preferred. The index compiler must therefore make a judgment on the basis of the nature of the products actually included in the elementary aggregate, and it is possible to use different formulae for different elementary aggregates within the same CPI.

[28] In the economic approach to index numbers, the quantities are assumed to be functions of the prices. The sampled products for which prices are collected are treated as if they constituted a basket of goods and services purchased by rational utility-maximizing consumers. The objective is then to estimate a conditional cost of living index covering the set of products in question.

[29] Axiomatic approaches to index numbers seek to determine the most appropriate functional form for an index by specifying a number of axioms, or tests, that the index ought to satisfy. They shed light on the properties possessed by different kinds of indices, some of which are not intuitively obvious. Indices that fail to satisfy certain basic or fundamental axioms, or tests, may be rejected completely because they are liable to behave in unacceptable ways. An axiomatic approach may also be used to rank indices on the basis of their desirable, and undesirable, properties.

3- Item Replacement and Treatment of Seasonal Items

Following changes in consumer tastes, it is not uncommon that items disappear. If the absence of the product is considered permanent and upon which the product would no longer be available, a similar product would be selected (from the existing commodities in the basket of goods and services) to replace the missing item using the replacement procedures. Seasonal absences of items (resulting in a temporary absence of an item) are treated by imputing their prices using the short-term relative price change of similar items. The following formula is used to operate the substitution and treat the problem of missing seasonal items:

$$P_{x1,x2,...xn} = \left[\sum \frac{GEO_{p_{t=x_1+x_2+.....+x_n}}}{GEO_{p_{t-1=x_1+x_2+....+x_n}}} \right] xP_{t-1=x_1,x_2,...x_n}$$

Where:

P is the price of the missing item. GEO_{p_t} is the geometric mean of all prices for the commodity or the service in the current period. $GEO_{p_{t-1}}$ is the geometric mean of all available prices for the commodity or service in the previous period. P_{t-1} is the price of available items in the previous period.

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