Discussion on inflation measurement by the Irving Fisher Committee on Central Bank Statistics

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Inflation measures are of key importance to central banks, whose primary objective is to maintain price stability. The BIS has been discussing a number of aspects of inflation measurement at various meetings over the last ten years. This has included

•   CPI measurement;
•   Core inflation measures;
•   Measures of Inflation expectations;
•   The development of property price indices.

In addition, the BIS Data Bank includes detailed price statistics contributed by the participating central banks. These data provide a wealth of information on price measurement practices in different countries. Data on property prices have also been disseminated on the BIS website in order to facilitate international research and policy analysis.
The findings of the BIS data collections have been shared at meetings of senior central bankers interested in price measurement. The paper will highlight the crucial importance of micro data in assessing the trends in domestic and international inflation and explains some econometric and statistical issues that have emerged from it.

Key Words: Consumer Price Index, Core Inflation, Inflation Expectations, Property Price Indices.

1. Introduction
The CPI is a key economic indicator for central banks, since it provides the benchmark against which to assess price stability, one of their primary objectives. Thus, CPI methodology has received increasing attention over the years from policy makers. In periods of price stability, like the current low inflation period, measurement errors are de facto proportionally larger than in the past and might hide deflation episodes. Not surprisingly, the Irving Fisher Committee on Central Banks Statistics (IFC) which has established itself as an important global platform for the exchange of views amongst central bank economists, statisticians and policymakers on statistical issues of interest to central banks, has dedicated several workshops and seminars to this indicator. The first workshop, organised in Basel in April 2006, was entitled "Consumer Price Index (CPI) Measures: Central Bank views and concerns". It was followed by three regional workshops in 2009-2011.
        Beside the CPI itself, central banks scrutinise the inflation expectations to understand how inflation will evolve. In a series of 3 workshops on the use of surveys by central banks organised in 2007-2008, the IFC analysed how information on inflation expectations could be collected.
        The paper reviews the main findings from the IFC workshops, in particular the characteristics of a good CPI, the best core CPI measures and how to collect inflation expectations, and discusses the impact of the development of property price indices on the CPI calculation.

2. The Consumer Price Index
A correct measurement of inflation is of the utmost importance for central banks. CPI measures provide the yardstick to assess price stability, one of their primary objectives.

Outside the central bank community, the CPI is widely used. It is the most accessible deflator to compute real indicators from nominal ones. Furthermore, it is contractually used in the income distribution (indexation of wages and social benefits) and in the financial economy (e.g. index-linked bonds).

The important role the CPI plays implies that there are strong requirements from the users' side. Firstly, the CPI needs to be credible, i.e. it should reflect the prices paid by households. Secondly, it needs to be accurate, i.e. it should avoid measurement bias which might trigger inadequate economic policies. Thirdly, the price measure needs to be timely. There is a need to have a price measure which is more readily available than the GDP or private consumption expenditure deflators. Finally, CPI statistics should be internationally comparable. In globalised economic and financial systems, cross-country comparisons of the economic performance are increasingly important to analysts and policy makers.

The international comparability of the price indicators would be a difficult challenge without the creation of international standards. Several international organisations, the ILO, IMF, OECD, Eurostat, UN and World Bank, have published a new manual "Consumer Price Index Manual: Theory and Practice" in 2004, replacing the 1989 ILO version. The purpose of the CPI Manual is to assist the producers of CPI statistics, to reach a better international comparability of CPI statistics, and to give a better understanding of CPI methodology to users of price statistics. It deals with conceptual and theoretical issues such as the choice of formulae, the frequency of adapting weights or updating outlets and including new products, and procedures for quality adjustment and sampling.

Additional international avenues to contribute to foster the quality and the transparency of CPI statistics are the Special Data Dissemination Standard (SDDS) and the Principal Global Indicators (PGI). The IMF SDDS identifies best practices in the dissemination of economic and financial data. The PGI website launched in 2009 by the Inter-Agency Group of Economic and Financial Statistics (IAG)[1] provides internationally comparable data for the Group of 20 economies (G-20) and economies that are not members of the G-20 but have systemically important financial sectors.

In Europe, the issue of international comparability of CPI measures is of crucial importance. In the context of the monetary union, the ECB needs an indicator for the euro area as a whole resulting from measurements in seventeen different countries. To meet this need, Eurostat developed as from 1993 the Harmonised Consumer Price Index (HICP). The HICP is used by the ECB to assess price stability in the euro area. The methodology for the HICP has undergone a number of changes since 1993. Currently, the main priorities of Eurostat are to improve quality adjustment methods and to include owner-occupied housing in the HICP.

The preparation and publication of the CPI Manual, the European HICP project, and the initiatives launched by the IMF and the IAGEFS have contributed to improving CPI methodologies in a number of countries and to fostering international comparability of national CPIs. Several central banks have reported to the IFC that the introduction of explicit methods for quality changes and more frequent weight adjustments have been the most important enhancements that have been implemented recently in their national CPI. They have also indicated that the various international initiatives mentioned above have motivated their respective national CPI compilers to introduce these improvements.

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[1] The Inter-Agency Group on Economic and Financial Statistics (IAG), comprises the Bank for International Settlements (BIS), the European Central Bank (ECB), Eurostat, the International Monetary Fund (IMF, Chair), the Organisation for Economic Co-operation and Development (OECD), the United Nations (UN), and the World Bank (WB). It was established in 2008 to coordinate statistical issues and data gaps highlighted by the global crisis and to strengthen data collection.

Measurement biases

Market economies see on an on-going basis new goods and services being introduced or disappearing. Similarly, points of sales are established, others are closed. Quality of goods and services is regularly improved by technological changes. All these changes contribute to make it difficult to accurately calculate a consumer price index (CPI).

As already stated earlier, errors in CPI measurement, or even worst, biases might trigger inadequate economic policies. There are several types of biases which have been emphasised by researchers:

- The *substitution bias* occurs when consumers switch from relatively expensive goods to cheaper goods, as a result of changes in relative prices, in income and tastes. The substitution bias can be present at the elementary and higher level of aggregation. At the higher level, the substitution bias relates to changes in consumption patterns across product categories. The fixed weights Laspeyres index overstates the inflation, as the weights of the expensive/cheap products from/to which consumers move away/switch over are too high. A chained Laspeyres index, which frequently updates the base period weights, or a superlative index, which uses expenditure figures both for the base and current period as weights, could both significantly reduce the bias. At the lower level of substitution, the substitution occurs when consumers switch between items within the same product category. At this elementary level, expenditures are not weighted. The geometric mean provides better results than other formulas and has been adopted in recent years by a large number of national statistics institutes.

- The *new products bias* is observed when the choice of products becomes larger as a result of product innovation. A frequent revision of the CPI basket and weights is the only possible way to address this type of bias. Most CPI compilers now revise the consumer basket and the corresponding weights on an interval of 3 to 5 years.

- The *outlet bias* can be the result of changes in the structure of sales outlets. When consumers switch from high to lower cost outlets and CPI compilers do not account for these changes in consumer habits by adjusting the outlet structure used to observe and collect prices, the CPI can overstate the true cost of purchasing a given consumer basket.

- The *quality bias* arises when the difference in characteristics between a good that is no longer available on the market and a new one, which it replaces, is not properly valued. The "pure" price change of the product might then be over-estimated or underestimated. The treatment of the quality changes constitutes certainly one of the greatest challenges of the CPI compilers. The CPI Manual classifies the numerous methods to handle quality changes between explicit and implicit methods. The implicit methods (overlap method, class mean imputation, chaining and re-sampling method) are less and less used. The explicit methods rely on direct valuation of quality changes. It can rely on expert knowledge or simply on the price collector's judgement. The option cost adjustment method is another explicit method based on a market evaluation of each new product feature priced individually. Eventually, the most advanced explicit method of quality adjustment, which is also becoming increasingly popular one, is the hedonic approach. It consists in regressing the prices of the various product variants on the relevant characteristics. Hedonics avoids subjective judgement but the quality bias might not be entirely eliminated.

Several researches have been launched to measure the importance of the different measurement biases. In the US, the Boskin Report, published in the United States in 1996, indicated that the CPI might overestimate the inflation by 0.8 to 1.6%. More than a half of this total bias is due to the new products and quality biases. In

Europe, overestimations seem to not exceed 0.5%.

3. Core inflation

Monetary authorities show an interest in core inflation measures because they isolate the more durable component of overall inflation from temporary movements and might better predict inflation long term developments. The various indicators proposed in the literature differ in the technique used to identify and remove transient noise. Core inflation indicators can be grouped in two categories: pure statistical calculations or model-based measures.

Historically, the first type of statistical indicators has been the exclusion-based measures, which remove the more volatile prices (typically, energy and food prices) from the headline inflation. They are still popular among central banks because they are easy to compute and to explain to users, and are internationally comparable. The limited influence indicators (median or trimmed means) which exclude the largest and smallest price changes from the general index constitute a second type of statistical core inflation indices. Like the exclusion-based measures, they are not revised, which is useful from an analytic point of view. Unlike them, their calculation is not based on an arbitrary pre-selection of prices. However, they might remove from their tail useful information about future. Other statistical indicators are the variance weighted price index and the univariate statistical method. The first one heavily depends on the choice of the time horizon, which can lead to very different results. The second one generates large revisions and is not very transparent for the public.

Eventually, the model-based approach tries to derive core inflation from economic theory. It involves multivariate analysis of past relationships between aggregate inflation and its determinants in order to separate core from non-core components. This indicator has two weaknesses: it is subject to revisions and is difficult to follow by the public at large.

It is quite clear that identifying the best indicator of core inflation is a very difficult task. The traditional exclusion-based measure may represent a fair compromise in terms of transparency, communication, absence of revisions and cross-country comparability. For central bankers, it presents also the advantage of excluding elements which are beyond the control of the monetary authorities, being aware that this core inflation measure seems to have poor forecasting records in terms of headline inflation.

4. Inflation expectations

Inflation expectations play a key role in the conduct of monetary policy. They affect households and companies' economic behaviour by influencing their decisions on savings, investment and wage negotiations. Inflation expectations have an impact on future inflation and greatly influence the central bank's ability to achieve price stability. Central banks have a strong interest in monitoring long term inflation expectations and in trying to maintain them stable, to anchor them, so that unanticipated price shocks limit their effect in the short term. To try to control the inflation expectations, central banks need to measure them. Unfortunately, there is no direct way to gauge the inflation expectations of the economic agents and central banks must rely on indirect approaches.

Inflation expectations can be derived from market information. The advantage of market-based measures is their high frequency which allows examining changes in the expectation behaviour in a short horizon. The main market-based source of information on expectations is the difference in yields between nominal and real government debt. However this estimation might be biased by the difference of liquidity between the two types of debt and by an inflation risk premium the investors in nominal debt require.

Surveys are the second type of indirect measures to collect inflation expectations.

Professionals (economists, market participants), businesses or consumers can be surveyed. Survey shortcomings are their typical low frequency, their sensitivity to the question wording and their potential lower reliability compared to market-based measures because respondents do not have to act on the basis of their responses. Surveys of professionals are often based on small samples, which might biased the reported information. On the other hand, surveys are well suited to analyse long-run properties of inflation expectations. Therefore, several central banks conduct inflation expectations surveys among consumers. Armentier (2013) has shown that these surveys bring informative results: consumers do act on their stated beliefs and adjust their decisions to the changes in their inflation expectations.

5. Property prices

Housing services account for a large, and in many countries the largest, share of consumer expenditures. They include rents, owner-occupied housing (OOH) and maintenance and repair costs. Measuring the housing services costs is a very complex process owing to the heterogeneous nature of dwellings. Housing services depend significantly on the characteristics of the dwellings such as their size, age, available equipment and location. The recent development of a standardised methodology to measure residential property prices will contribute to better measure the owner-occupied housing expenditures.

The inclusion of the OOH services in the CPI and the way to measure them have been an area of controversy for several years. The house price booms observed since the turn of the century have made the controversy even acuter. There are several arguments in favour of their inclusion of the OOH expenditures in the CPI: it would extend the coverage of the household consumption accounted in the CPI, it would improve the comparability between countries where the ratio renters/owners is different and it would be consistent with the National Accounts private consumption deflator. The opponents to the inclusion emphasise the following facts: investment expenditures like purchasing a house should be excluded from the CPI calculation, there is no single valuation method, and as the CPI and the National Accounts do not share the same objectives their price indicators do not have to match.

OOH services have traditionally been included in the US CPI but not in the European HICP. The absence of consensus between the two sides of the Atlantic might somewhat evolve in the future with the development of property prices indices. In April 2013, the Inter Secretariat Working Group of Price Statistics published the Handbook on Residential Property Prices Indices (HRPPI). The Handbook describes in depth the various valuation methods but does not prescribe any of them in particular. It provides however input for the computation of the OOH price index. Based on the harmonised methodology defined in the HRPPI, Eurostat has published a Housing Prices Index since September 2012. OOH indices should be published in 2014, opening the way for their inclusion in the HICP if the quality suffices.

At the BIS, the analysis of property prices data started in the nineties because it appeared that the developments of these asset prices could bring useful information for monetary policy and financial stability. Data were collected from official national sources or commercial vendors and included in BIS Data Bank. The October 2009 Report on "The Financial Crisis and Information Gaps" submitted by the IMF-FSB to the G20 Finance Ministers and Central Bank Governors invited the BIS, in Recommendation 19, to make publicly available the collected real estate data. In this framework, the BIS has published on its website a data set covering 270 RPPIs from 48 countries. The BIS will continue to play a lead role in this area and will develop further the section of its webpage dedicated to the RPPIs.

6. Conclusion and forward-looking improvements

The various IFC workshops on the CPI organised by the IFC over the last seven years have been opportunities to discuss the evolution of the CPI methodologies, in

particular to find the best core CPI measure, how to collect inflation expectations and analyse the impact of the development of property price indices on the CPI calculation.

Improving the way the price indicators are currently compiled is certainly a very important task. But new ways to collect data are emerging on the same time. To explore these new ways, the IFC organised in February 2012 a webcast with two MIT researchers, Professors Rigobon and Cavallo from the MIT. They explained their project to the community of central banks. In their Billion Prices project, online information is collected every day from thousands of online retailers in 70 countries. Scraping technology allows them to download the prices of individual items. With the collected microdata, they calculate real-time daily and monthly indexes. The results proved to be in some countries very close to traditional indicators and in some cases even leading them. This being said, those results have not yet undergone the same meticulous scrutinising as the traditional indicators and the analysis of the potential size of the bias these new indicators would still need to be done. Anyway, price online information will grow and in the future will have to be integrated in the compilation of price indices.

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