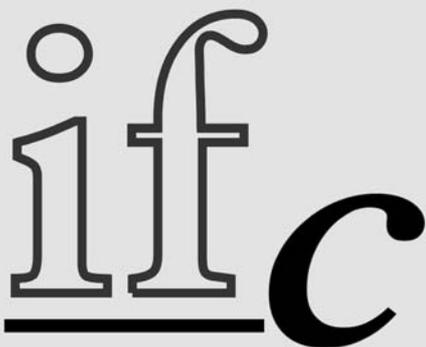# IRVING FISHER COMMITTEE ON CENTRAL-BANK STATISTICS

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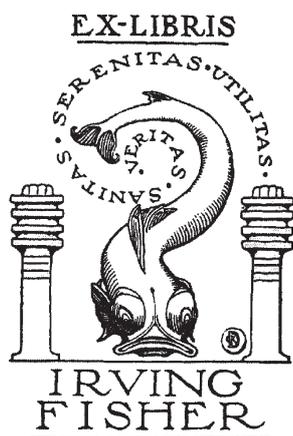
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Message from the chairman on recent and future developments of the IFC

Jan Smets (National Bank of Belgium)

In my last message in the October 2005 issue of the Irving Fisher Committee Bulletin, I emphasised that the Committee was at important crossroads. Indeed, since then several events have taken place which have had important consequences for the future of the Committee.

1. An informal meeting in Brussels

In October 2005 I invited a number of central banks from the world's major industrialised and emerging market countries to the National Bank of Belgium in Brussels to discuss the future governance and activities of the Committee. In particular, I submitted the draft statutes which were published in the October 2005 IFC Bulletin for discussion.

Since its inception, the IFC has operated successfully on an informal basis under the umbrella of the International Statistical Institute (ISI). The Chairman and members of the Executive Body served in a personal and voluntary capacity and the Secretariat was provided by the National Bank of Belgium. At the meeting, the represented central banks expressed a strong feeling that the success of the Committee could best be ensured in the long run through a more formal structure and appropriate governance rules. The draft statutes received general endorsement and benefited from a number of suggestions and clarifications made at the meeting or in the following weeks.

The new statutes clearly outline the objectives and potential future activities of the Committee. They also introduce a more transparent governance structure for the Committee with institutional members (central banks only) as well as associate ones, a Council (consisting of institutional members only) and an Executive. At the meeting in Brussels a number of central bank representatives expressed the willingness of their institutions to become formal institutional members of the new Committee. The current version of the statutes can be found at www.ifcommittee.org

The meeting also confirmed that the future support of the BIS was of crucial importance in order to guarantee the success of the Committee, in terms of technical and political support as well as global reach. Consequently, I committed to approach the relevant BIS governing bodies on behalf of the central banks present in Brussels with the request that the BIS take over the Secretariat function from the National Bank of Belgium.

2. Move of IFC Secretariat to the BIS

I officially approached the BIS at the end of 2005 regarding its hosting of the Secretariat of the Committee. On 10 January 2006 the BIS announced that it had agreed to provide the Secretariat for the IFC with immediate effect. The decision was endorsed at the January meeting of the Governors of the BIS shareholding central banks. In taking its decision, the BIS noted that statistical data and related methodological issues were becoming increasingly important to central banks, from the perspective of both monetary and financial stability. It also felt that the support for the IFC was a natural extension of a number of existing statistical initiatives which it supports such as the BIS Data Bank and its International Financial Statistics. A press statement was issued to announce the BIS support for the IFC. The IFC will henceforth function like the other BIS committees such as the Basel Committee on Banking Supervision, the Committee on Payment and Settlement Systems, the Committee on the Global Financial System and the Markets Committee.

3. Governance

In line with the proposed statutes, the new structure of the Committee is gradually being put in place. As a starting point, central banks which are shareholders of the BIS have been invited to formally become institutional members of the Committee and most of them have accepted to do

so (see www.ifcommittee.org). The first meeting of the Council, at which the institutional members will be represented, will be held on 29 August 2006 at the BIS, i.e. just prior to the Third IFC Conference. Amongst others, the Council will elect the new Executive on that occasion. Other central banks are, of course, welcome to join the Committee, as institutional or associate members. They can contact the IFC Secretariat at the BIS for more information.

4. Interaction with the ISI and its Sections

The future status of the Committee within the ISI remains to be clarified. At the ISI Session in April 2005 in Sydney, the ISI granted the IFC provisional official section status for an indefinite period. Together with Paul Van den Bergh, past chair of the IFC and senior contact for the IFC at the BIS, I have met with the ISI Executive in late April this year to discuss the future relationship between the IFC and the ISI. It was agreed that the status of the IFC in the ISI structure will be reviewed after the new governance of the IFC has been put in place and the future of the ISI's own structure has been agreed. Indeed, the ISI is currently undertaking an in-depth review of its operation and governance with the intention of presenting a number of proposals at the next ISI Session in Lisbon in August 2007.

Mr Paul Van den Bergh will continue to liaise with the ISI Permanent Office and, through it, with the ISI Executive Committee and Council. It is particularly important for the Committee to be kept informed of the ongoing consultation within the ISI community. The members of the ISI Executive have been invited to attend the Third IFC Conference in Basel and the President, Mr Niels Kleiding, as well as Vice-President Nicholas Fisher, have accepted the invitation.

5. CPI Workshop

On 20 and 21 April 2006 the IFC hosted a very successful workshop entitled "Consumer Price Index (CPI) Measures: Central Bank views and concerns". 36 CPI experts from 25 central banks and the IMF attended the workshop which took place at the BIS in Basel. Experiences and views were exchanged and lively discussions took place on a number of issues, including international methodological standards for CPI, inflation measures from the perspective of monetary policy and quantifying the measurement bias in CPIs. Issue notes and summaries of the discussions as well comparative tables are published in this issue of the IFC Bulletin. As a result of the workshop, suggestions for future work have also been submitted to the UNECE/ILO meeting in Geneva in May 2006. UNECE and the ILO are currently the leading international bodies dealing with CPI methodology.

6. Forthcoming events

The Committee has a number of initiatives planned for the near future. As this issue of the Bulletin was going to print, preparations were in full swing for the conference on the "Measurement of the financial position of the household sector" to take place on 30 and 31 August in Basel. More than 100 experts from 63 central banks have already announced their participation to the Conference, where more than 40 papers will be presented.

The IFC will also contribute to a conference organised by the International Association of Official Statistics (IAOS) in September. The IAOS has invited the Committee to organise a plenary session on "People on the Move". The topic of the IFC session will be "Financial Aspects of Migration: the Measurement of Remittances". Mr Cadete de Matos, member of the IFC Executive and Director of the Statistics Department at the Bank of Portugal, will structure and chair the session.

The Committee will organise a number of so-called "Invited Paper Meetings" at the 2007 ISI Session in Lisbon. Some of them will be co-sponsored with other ISI sections. The IFC website, www.ifcommittee.org, provides more information on all these activities.

2006 will certainly be remembered as an eventful year in the history of the IFC. I believe that the implementation of a more formal structure and appropriate governance rules will anchor the Committee as an important forum in the international statistical arena. Central banks, as compilers and users of a wide range of statistics, are certainly facing a number of interesting statistical challenges in the future. I envisage many fruitful discussions to come and look forward to the continuing active contributions from all the IFC members in the future.

Jan Smets (National Bank of Belgium)

Proceedings of the Irving Fisher Committee Workshop on: "CPI Measures: Central Bank Views and Concerns" Basel, 20 and 21 April 2006

Overview of the workshop

Jan Smets (National Bank of Belgium)

On 20 and 21 April 2006 the Irving Fisher Committee on Central-Bank Statistics (IFC) organised a workshop on "CPI Measurement: Central Banks Views and Concerns" at the Bank for International Settlements in Basel, Switzerland. Experts from 26 major central banks around the world as well as from the International Monetary Fund reviewed and evaluated developments with respect to CPI measurement from the perspective of monetary policy makers.

The workshop consisted of a number of sessions, focusing on particular themes. Session 1 looked at international methodological standards for the calculation of CPI as well as at national practices. Session 2 focused on inflation measures from the perspective of monetary policy. In session 3, the measurement of housing services in the CPI was discussed whilst session 4 examined how quality adjustments could appropriately be dealt with. Session 5 identified other measurement issues of concern to central banks and session 6 focused on measures of core or underlying inflation. In session 7 the question was addressed as to whether it was possible to quantify the measurement bias in CPIs. Finally, session 8 discussed central bank input into national and international discussions on CPI methodology. For each session, a background issue paper had been prepared and various "lead interveners" introduced the respective topics under discussion. In some cases, additional background papers were submitted. These documents, as well as a summary of the general discussion in each session are included in this special volume of the IFC Bulletin. An annotated list of references as well as some other background material collected for the workshop are also included.

A few general conclusions resulted from the workshop.

1. Reliable CPI measures are of the utmost importance to central banks, for which they constitute a yardstick to assess monetary conditions, in particular the degree of price stability. Measurement errors in the CPI might thus lead to inadequate monetary policy actions. In the current context of low inflation, in particular, significant measurement errors can have major repercussions for the conduct of monetary policy.

2. There are two basic theoretical approaches to measuring CPIs, ie a cost of goods index (COGI) or cost of living index (COLI). Some will argue that these different approaches have little impact on the practical measurement of the CPI, others consider that they have important implications with respect to practical measurement and calculation decisions (eg quality adjustments or the valuation method for owner occupied housing). Whilst there are particular advantages to individual approaches and whilst these may differ from country to country, there is broad agreement on the properties the measures should have from the perspective of monetary policy: credibility, reliability, timeliness and comparability.

3. Based on the various evaluation criteria, it is fair to say that much progress has been achieved in recent years in improving CPI measures. The preparation and publication of the "CPI Manual: Theory and Practice" with input from various international organisations has contributed greatly in this respect. The Manual describes the important concepts in constructing CPIs as well as various techniques that can be used to collect price information and to compile them into indices. While it avoids being overly prescriptive, the Manual sets out the advantages and disadvantages of individual approaches. The Manual is the basis for technical assistance by international organisations and provides a benchmark to evaluate the quality of countries' CPI statistics, thereby contributing to the international comparability of national statistics. Progress has been made, in particular, in the collection of individual price data, the use of a geometric mean to aggregate individual prices, the use of chained indices, and reliance on explicit methods for handling quality changes. Nevertheless, some further improvements can be made.

4. There is general agreement that improvements should be made with respect to the treatment of owner occupied housing in national CPI statistics. These often constitute an important share, if not the most important, of household expenditure and differences in their treatment impair the international comparability of CPI measures. However, difficulties arise because there is no consensus on the best way to deal with the valuation of owner occupied housing. Four major methods exist, which all have their advantages and disadvantages. Research carried out by central bank experts have indicated that the various valuation methods can

result in significant differences in the measurement of CPIs. More work is thus needed in this area and various international projects are currently underway. In this context the importance of improving statistics on house prices cannot be underestimated.

5. Dealing with quality adjustment is another major challenge for CPI compilers, for goods as well as for services included in the index. Here too, there are different methods, either implicit or explicit, to treat quality adjustments. More explicit methods, including hedonics, are appealing but also raise a number of issues on which there is no consensus view. Whatever methods are used, more transparency is needed on how they are used in practice (CPI compilers should be encouraged, for instance, to provide information on the hedonic functions they use to adjust observed prices for changes in product qualities). Moreover, there is no reason why quality adjustment methods should not be introduced also for services.

6. Though they may be less important than dealing with owner occupied housing and quality adjustment, there are a number of other measurement issues that are important from a central bank perspective. Keeping track of new products, for instance, is an important issue in the current economic environment characterised by globalisation and rapid technological change. Dealing with possible substitution effects is also important, for instance by using chained-Laspeyres indices at the higher level of aggregation or using geometric means at the lower level. Finally, the outlet structure should be revised regularly on the basis of surveys of household purchasing patterns and the analysis of the market share of various types of retailers.

7. Research carried out by central bank experts seems to indicate that there is a significant bias in CPI measures and that this bias tends to be positive (ie official CPI measures overstate "true" inflation). This is reflected in the fact that most central banks define price stability as a positive increase of the CPI, typically between 1–2%. It should be noted in this respect that there is also quite a degree of uncertainty about these bias estimates as well as their different components. Moreover, the estimated measurement errors may change over time and be affected by the business cycle. Central banks may have to take this evidence and uncertainty into account in the conduct of monetary policy.

8. Monetary policymakers have an understandable interest in distinguishing short-term movements or noise in CPI statistics from underlying or core inflation. The former may result from variations in the price of seasonal goods, changes in indirect taxes or various idiosyncratic shocks affecting specific markets (eg oil). The latter would be influenced by monetary conditions. A panoply of different measures of core inflation has been proposed. Statistical measures remove and/or reweigh the components of headline inflation (they include exclusion-based measures such as headline minus food and energy, trimmed means, variability-adjusted measures and dynamic factor indices). Model-based approaches try to derive core inflation from economic theory (for instance, by the multivariate analysis of past relationships between aggregate inflation and its determinants). Research indicates that none of the existing core inflation measures are fully satisfactory, in particular with respect to their forecasting properties. Not surprisingly central bankers tend to look at different measures of core inflation, as well as a combination of headline and core inflation, in order to assess price developments. In this context, it is also not clear whether CPI compilers should compute and publish official measures of core inflation or whether this should be left to individual analysts and researchers.

9. No doubt, some further improvements in CPI methodologies would be useful. The relationship between the underlying theoretical models and practical arrangements for CPI measurement could be better understood. Improvements could be made in the data collection processes as well as in the compilation methods. More information could be disclosed on particular calculation methods. All this could mean that more, and better, resources would be needed at national statistical institutes. As experience has shown, central banks themselves can be important agents for change. They can offer support to statistical institutes, for instance in terms of advising on specific issues, making concrete proposals, helping to set priorities with respect to improvements and carrying out research on CPI methodologies. This could mean that more, and better, resources may also be needed at central banks in order to fully understand CPI developments, both at home and abroad. In many cases, central banks have recruited price experts and/or established a specialised "prices" unit and perhaps the workshop could contribute to highlight the importance of CPI measurement issues.

10. Finally, a big challenge remains in terms of improving the communication on CPI issues to the general public. These are sensitive issues, as CPI measures are often used to index wages or other contracts, including for financial instruments. Moreover, inflation perception has in some cases diverged from measured inflation, even for prolonged periods

of time. More transparency will probably help, for instance with respect to the theoretical foundation and actual practices underlying CPI calculations. Anonymised micro data could also be made available to researchers, in central banks and outside. This should stimulate the evaluation of existing procedures and broaden the number of stakeholders in CPI statistics. It should also facilitate international comparability of price statistics. Though no single measure will ever be perfect, it should be clear that enhanced credibility of CPI measures will ultimately strengthen the credibility of monetary policy as well.

Jan Smets (National Bank of Belgium)

International methodological standards for CPI and national practices

Chair: William White (BIS)

Background note and key issues for discussion

Papers: **The CPI manual and IMF statistical capacity building**
Mick Silver (IMF)

International methodological standards for CPI and national practices
Marianne Collin (National Bank of Belgium)

Comparison of consumer price indices for the euro area, the United States and Japan
Gabriel Quirós (European Central Bank)

Measurement errors in the Japanese CPI
Shigenori Shirasuka (Bank of Japan)

Summary of discussion

Background note and key issues for discussion

The Consumer Price Index (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. In addition, the CPI is used to compute real economic indicators such as gross domestic product (GDP) or productivity. The CPI also plays an important role in the indexation of wages, social security allowances (e.g. pensions) and financial instruments (e.g. index-linked bonds). Important measurement bias in the CPI might thus trigger inadequate economic policies. Moreover, it is necessary that CPI statistics are not only reliable but also internationally comparable since cross-country comparisons of general economic developments are increasingly important to economic agents and policy makers in a globalised economic and financial systems.

Not surprisingly, CPI methodology has received increasing attention in recent years from policy makers, in particular from central bankers. A number of specific developments have also contributed to this. For instance, the publication of the Boskin Report in the United States in 1996 identified possible sources of estimation bias in the US CPI such as substitution bias, outlet bias, quality bias, and new products bias. The Report concluded that there was an important upward bias of about 1.1% a year in the US CPI (i.e. an overestimation of the domestic inflation rate). This finding drew substantial attention from different analysts in the academic and business community as well as from policy makers, in the US and outside. Research projects were launched in other countries, including Australia, Canada, France and the UK, in order to assess the accuracy of the national CPI statistics. Another development has been globalisation and technical innovation which have created entirely new products for consumers as well as ongoing improvements in the quality of many goods and services. This has challenged CPI compilers to find new methodologies for collecting prices and for computing price indexes. Finally, the fact that many economies are approaching or experiencing price stability means that measurement errors in the CPI may become proportionally larger than in the past when inflation was running at double-digit figures.

Reflecting the ongoing improvements in methodological standards for compiling price statistics, a new manual "Consumer Price Index Manual: Theory and Practice" was published in 2004 by the ILO, IMF, OECD, Eurostat, UN and World Bank. This publication contained a significant revision of the earlier ILO Manual on CPI which was published in 1989. The new manual is the result of the joint work undertaken by the six international organisations as well as of various recommendations and suggestions made by working groups and international meetings on CPI (ICLS[1], Ottawa Group, joint UNECE/ILO Meeting on CPI). Universities and research institutes also contributed to the new Manual.

The purpose the new CPI Manual is to assist, and provide guidelines to, the producers of CPI statistics, to international comparability of CPI statistics and to give a better understanding of CPI methodology to users of price statistics. As mentioned by Armknecht (2004), the Manual is not a "cookbook" and it does not provide a simple set of rules that CPI compilers can follow. It provides detailed information and explanations on methods used to compile a CPI whilst recognising the need to take account of given economic conditions in each country. It also deals with conceptual and theoretical issues that compilers should consider when computing CPIs such as the choice of formula, the frequency of adapting weights or updating outlets and including new products, and procedures for quality adjustment and sampling. For each topic, the Manual presents the different practices currently in use, proposes alternatives whenever possible, and discusses the pros and cons of each of them.

In Europe, the issue of international comparability of CPI measures became of crucial importance when the European Union was established and twelve member states decided to join the euro area, i.e. a monetary union with a single currency – the euro – and a common monetary policy conducted by the ECB. In this context, it became extremely important to be able to compare national inflation measures. To meet this need, Eurostat started in 1993 to develop a harmonised methodology, known as the Harmonised Consumer Price Index (HICP) for individual euro area countries as well as the euro area as a whole. The HICP was used to assess the price

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1 *International Conference on Labour Statistics.*

convergence in the run-up to the start of Stage Three of Economic and Monetary Union (EMU). Since then it has become the yardstick used by the ECB to assess price stability in the euroarea.

The methodology for the HICP has undergone a number of changes since 1993, in particular in terms of geographic coverage, sampling, inclusion of new products, and frequency of weight update. In 2000 and 2001 the CPI basket was extended to include health, education and social protection. Since then, the pace of harmonisation has slowed down noticeably: the main current priorities of Eurostat are to improve quality adjustment methods and to include owner-occupied housing in the HICP.

At the international level, the IMF had greatly contributed to foster the quality and the transparency of CPI statistics. One key contribution has been the Special Data Dissemination Standard (SDDS), created in 1996 to guide countries in the provision of economic or financial data. SDDS identifies best practices in the dissemination of data in a number of important areas: coverage, periodicity, timeliness, public access to the data, integrity of the data, and data quality.

With respect to the latter, the IMF has developed a Data Quality Assessment Framework (DQAF) to assess the quality of economic statistics[2]. The Framework spells out the different dimensions of data quality:

- prerequisites of quality (e.g. legal environment, resource available for the statistical program),
- assurances of integrity (e.g. professionalism, transparency and ethical standards),
- methodological soundness (e.g. concepts, scope, classification and basis for recording),
- accuracy and credibility (e.g. source of data, statistical technique),
- serviceability (e.g. timeliness and frequency, consistency),
- and accessibility.

In other words, it looks at the quality of the statistical agency, the statistical product and the statistical process. This framework is used, amongst others, in the context of the Report on the Observance of Standards and Codes (ROSC), which was launched in 1999. These Reports are prepared by Fund staff and provide a detailed assessment of the extent to which individual countries meet international standards and codes in 12 important areas.[3] Information on the quality of national CPIs is found under data dissemination. With the approval of the respective country, the ROSC is made publicly available. ROSCs are regularly updated, and new reports are published every few years.

The preparation and publication of the CPI Manual, the European HICP project, and the initiatives launched by the IMF have contributed to improving CPI methodologies in a number of countries and to fostering international comparability of national CPIs. In the context of the survey carried out to prepare the workshop, several central banks have reported that the use of the geometric formula at the elementary level, 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.

Although national practices and international comparability have been improved, there probably remain important challenges with respect to CPI statistics. In particular, the coverage of owner-occupied housing and the treatment of quality changes may need to be further improved. Basket weights may still need to be adjsusted more frequently than in the past: some countries such as Italy, Spain, Russia and Poland adjust their weights on an annual basis, while other economies like South Africa, China and Hong Kong do this only every 5 years. Finally, national practices with respect to geographical and population coverage (e.g. all population versus urban) as well as product classifications may need to be reviewed.

Issues for discussion

- What major improvements have been made in recent years to national CPIs? How have adjustments in national CPI methodologies tried to take account of new international standards and/or best practices?

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2 *A more detailed DQAF is available for national accounts statistics, consumer price indices, producer price indices, government finance statistics, monetary statistics, and balance of payment statistics.*
3 *These comprise accounting; auditing; anti-money laundering and countering the financing of terrorism (AML/CFT); banking supervision; corporate governance; data dissemination; fiscal transparency; insolvency and creditor rights; insurance supervision; monetary and financial policy transparency; payments systems; and securities regulation.*

- What are currently the major factors impairing the international comparability of CPIs? How could international comparability be further fostered?
- Could and should central banks be more pro-actively involved in efforts to improve national and international methodologies for CPIs?

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Web site

IMF: The IMF's Dissemination Standards Bulletin Board (DSBB) provides access to the Special Data Dissemination Standard (SDDS), the General Data Dissemination System (GDDS), and the Data Quality Reference (DQRS) sites: http://dsbb.imf.org/Applications/web/dsbbhome/

The CPI manual and IMF statistical capacity building

Mick Silver (IMF)[1]

The IMF has assisted in developing the *Consumer Price Index (CPI) Manual** (ILO et al., 2004) with a view to providing a detailed and comprehensive explanation of CPI methods and to explaining the various conceptual and theoretical issues involved in constructing such statistics. While the manual establishes international standards on CPI measurement, it extends beyond a set of rules or procedures, and explains the "how" as well as "why" of using different methods according to circumstances. The companion *Producer Price Index (PPI) Manual** (IMF et al., 2004) and the draft Export and Import Price Index Manual (IMF et al., forthcoming) also follow this approach. The process of preparing the *CPI Manual* involved an Intersecretariat Working Group on Price Indices in which the various international organizations with a key interest in price statistics are represented (ILO, IMF, ECE, OECD, World Bank, Eurostat, and UNSD). Individual CPI experts also provided input, in particular through the UN International Working Group on Price Indices, the so-called Ottawa Group.

The new *CPI Manual* was developed to deal with some shortcomings of current CPI compilation practices. These arise, for instance, in the choice of aggregation formula used at both the elementary level and the (weighted) higher level, in the treatment of quality change, of new goods and seasonal products, and in the hard-to-measure areas of services. The new *Manual* is fully integrated with the *System of National Accounts 1993*. There is ongoing work on the manuals related to the preparation of revised versions, non-English translations, shelter price indices, and core inflation. The availability of high quality CPI statistics is an essential pre-requisite for the formulation of appropriate macroeconomic and financial policies. The Fund's Statistics Department works to develop internationally accepted standards and provides technical assistance and training to promote the adoption of these standards and best practice dissemination. The *CPI Manual* is the basis of the IMF's training and technical assistance work in price statistics. The activities of the IMF's Statistics Department fall into 6 categories: (i) Data Standards; (ii) Surveillance; (iii) Technical Assistance/Training; (iv) Statistical Methodology; (v) Database Management and Statistical Publications; and (vi) International Statistical Coordination and Cooperation.

Two innovations by the IMF's Statistics Department worthy of particular note relate to dissemination and data quality assessment. The IMF's Dissemination Standards Bulletin Board (DSBB) provides information on the methodology used by countries to compile their macroeconomic statistics, including their price indices, and information on the dissemination to the public of their economic and financial data.[2] The DSBB consists of two tiers. The General Data Dissemination System (GDDS), which applies to all Fund members, is designed to help manage statistical capacity-building. The more detailed Special Data Dissemination Standard (SDDS) is for those member countries having or seeking access to international capital markets. The IMF's Data Quality Assessment Framework (DQAF) is an overall framework developed by the Statistics Department over the past several years. It focuses on five dimensions of data quality: 1. Assurances of integrity; 2. Methodological soundness; 3. Accuracy and reliability; 4. Serviceability; and 5. Accessibility. It provides a framework by which assessments can be made of pertinent aspects of a country's macroeconomic statistics.

IMF experience finds a number of problem areas with CPIs, both in terms of resource constraints and the use of inappropriate statistical techniques. Resource constraints are often observed in the areas of computing, staff, the infrequent updating of weights, insufficient coverage of rural areas, the infrequent rotation of products and outlets, and poor sampling frames for outlets. Methodological concerns pertain to the choice of formula, poor to little quality adjustment, the treatment of seasonal products, use for imputations of short-run price changes,

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the population-share weights to aggregate regional CPIs, and the introduction of new products only on rebasing.

There is some resistance by statistical authorities to methodological change. Change affects stakeholders, and can damage the long-run credibility of the series. On the side of change are often central banks, especially those initiating inflation targeting regimes. Where shortcomings are the result of resource constraints, central banks can play a role to alleviate these. Where there are root methodological concerns, such as quality change adjustments, these must be addressed by the statistical office. Where there are methodological concerns pertinent only to measures of monetary or core inflation, alternative measures can be developed, preferably by the statistical office, but if not by the central bank using raw CPI data.

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——, 2004b, *Consumer Price Index Manual: Theory and Practice* (Geneva: ILO).

Mick Silver (IMF)

International methodological standards for CPI and national practices

Marianne Collin (National Bank of Belgium)

There has been great interest in recent years in CPI measurement. Different factors account for this. Firstly, inflation has declined to a low and stable level – around 2% – in many countries, which implies that measurement errors account for a larger proportion than in the past when inflation was running at double-digit numbers. Secondly, the widespread adoption of inflation targeting by central banks makes it particularly important to measure inflation accurately. Finally, CPI measurement tends to be more difficult than in the past as a result of innovation and globalisation. In recent years, major improvements have been achieved in many countries, which are in line with international standards (i.e. "CPI Manual: Theory and Practice"). These enhancements concern the price collection and the compilation of CPIs (e.g. formulae, basket revisions). We examine these two issues in turn.

Price collection

Many countries have reported significant improvements in the collection techniques of individual prices. In Italy, ISTAT has enhanced the definition of the products and the correction procedures. In addition, the number of price quotes has been augmented by means of an increase in the number of products surveyed and of the number of quotes per product. In the United States, the collection period covers all business days of the month, compared to the first 15 or 18 days before. In South Africa, the National Institute of Statistics has switched recently from a central collection method (survey) to a direct collection method. Finally, in the Netherlands, the National Institute of Statistics has started to use scanner data in the price compilation. This is particularly important, since prices and volumes are available on a timely basis. Furthermore, information on the product attributes – available with scanner data – might be used to adjust for quality changes.

CPI compilation

Major improvements have also been achieved at this level. Different areas of progress might be distinguished:

i. Formula

At the lower level of the individual product prices that are incorporated into sub-indices, many countries[1] have in recent years adopted the geometric mean to aggregate individual prices and to deal with the substitution bias at this level of aggregation. At the higher level of the compilation of the sub-indices themselves, some countries – Spain, Switzerland, Europe[2], Italy, and Korea – have implemented an annual chained index, which allows for more frequent weight updates and facilitates the introduction of new products. In addition, superlative formulae (ideal indices) are currently used in the United States and in Sweden to resolve completely the substitution bias at the upper level of aggregation.

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1   *Argentina, Australia, Hong Kong, Italy, Singapore, US, Spain and Mexico.*
2   *For the HICPs.*

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ii. Weight and new products

A large number of countries have reported recent weight updates and the introduction of new products by CPI compilers. In addition, central bankers observe that CPI compilers do revise and introduce new products more frequently than in the past. For instance, in Europe, Thailand, Belgium, Brazil, Switzerland, Sweden, Poland, Portugal and Russia weights are revised every year or every two years.

iii. Quality adjustment

CPI compilers have recently started to use explicit methods to adjust for quality changes. In the US, Japan, Italy, Spain and Germany, hedonic methods have been used for different types of products.

Final comments

Although major changes have been implemented in recent years, some important enhancements are needed, for instance to improve international comparability. Some important divergences remain in terms of coverage (population, geographic and items). The formulae used by CPI compilers diverge, some countries are still using for instance the arithmetic means to aggregate individual prices, while other have adopted the geometric mean to cope with the substitution bias at this level of aggregation. Concerning the weight and new product revision, major divergences are observed. Some countries – Australia, Germany, Honk Kong, India, Indonesia, Japan, Netherlands and South Africa – continue to revise weights every 5 years, while in other economies, such as Belgium, Europe, US, Poland, Portugal, Russia and Sweden, CPI compilers update weights on a yearly basis or every two years. Finally, quality adjustment methods differ considerably across countries and moreover, the number and type of products subject to quality adjustment vary also significantly.

Marianne Collin (National Bank of Belgium)

Cross-country Comparison: CPI

	Argentina	Australia	Belgium	Brazil	Canada	France
Definition	IPC-GBA (Great Buenos Aires) measures the price changes of a set of goods and services representative of that population's consumption patterns	The Australian CPI measures pure price change in a selected basket of goods and services (of constant quantity and quality) typically purchased by Australian households	The CPI measures the change in the retail prices of a fixed set of goods and services used by households, residing in the national territory	CPI (IPCA) measures the change in the prices of a fixed basket of products as determined in the Household Budget Survey	Indicator of changes in consumer prices experienced by Canadians through time and obtained by comparing the cost of a fixed basket of commodities purchased in a particular year. The index reflects only pure price movements	The CPI estimates the average change in prices of household consumer goods between two given periods. It is a synthetic measurement of "pure" trends in product prices, i.e., at a constant level of quality
Coverage *Population*	Households in the Greater Buenos Aires urban area	All metropolitan private households (64 percent of private households)	All expenditures made by the residents on the Belgian territory. Expenditures made by residents abroad are excluded	Household in urban areas with monthly income, from any source, ranging from 1 to 40 minimum salaries	All Canadian families and individuals living in urban and rural private households	Residents and non-residents (such as tourists) in metropolitan France and overseas departments
Geography	Prices are collected in the GBA metropolitan area (Capital + 24 districts in the province of BA). As for travel expenditure in tourist hotels, the prices are collected in the vacation resorts most frequently visited by the reference population	"Metropolitan" is defined as consisting of households in the six Australian State capital cities, Darwin and Canberra	Whole country	Urban area in 10 metropolitan areas and 1 capital (Goiania) (31% of the entire population)	All provinces, Whitehorse and Yellowknife	French territory by residents and non-residents (such as tourists) in metropolitan France and overseas departments
Item coverage	NSA, excluding Financial Intermediation Services Indirectly measured, investment, loan amortisation,	The types of items selected for pricing are goods and services actually acquired by the reference population in the weighting base	Goods and services used by households	All goods and services actually purchased by households during the period of the Household Budget Survey	Consumer items with retail prices, excludes income taxes, donations, contributions made to pension plans, and	The theoretical field for the CPI is defined as effective tradable monetary household final consumption. It excludes

Cross-country Comparison: CPI (continued)

	Argentina	Australia	Belgium	Brazil	Canada	France
	taxes, donation and money gift	period. Items excluded are expenditure on gambling, income taxes, cash gifts, mortgage interest payments, consumer credit charges and expenditure on illegal activities			consumer savings and investments, life insurance and health services provided under publicly funded health insurance programs	private hospital services, gambling, and life insurance
Owner-occupied housing	Excluded	Included (acquisition approach)	Excluded	Excluded	Included (user cost)	Excluded
Formula						
Elementary	• Geometric mean: mainly • Arithmetic mean: public water supply, cable television	• Geometric mean: mainly • Ratio of arithmetic mean: sometimes	Arithmetic mean	Geometric mean	Geometric mean	• Unweighted arithmetic average of prices: homogenous products • Geometric average of relative prices: other varieties
Higher level	Chained-Laspeyres	Laspeyres	Laspeyres	Chained-Laspeyres	Laspeyres	Chained-Laspeyres
Update interval						
Weight	Every 10y	Every 5 years	Every 2 years	Monthly Today it is around 6–7 years. In the future it will be continuously	Every 4 years	Every year
New products	Not regularly	Every 5 years	Every 2 years		Every 4 years	Every year
Outlets	Not regularly	n.a.	No update since 1996	As needed (end or opening of a new saler will be considered as it occurs)	Annually for many CP basic classes. All outlet samples are reviewed at least every 2 to 3y	every year
Classification	COICOP	COICOP	COICOP	COICOP	COICOP	COICOP
Periodicity	monthly	quarterly	monthly	monthly	monthly	monthly

Cross-country Comparison: CPI

	Germany	Hong Kong SAR	India	Indonesia	Italy	Japan
Definition	The CPI measures the average change in the prices for all goods and services purchased by households for consumption purposes	The CPI measures the relative change over time in the total cost of a specified basket of consumer goods and services-fixed in terms of quantity and quality – generally purchased by households in Hong Kong	The CPI measures the price of change over time in the level of retail prices of a fixed set of goods and services on which the Working Class families make expenditures	The CPI measures the price of change in a fixed market basket of constant quality, consumed by general population	The CPI measures the temporal change in the prices of a basket of goods destined to final private consumption	The CPI measures the price movements of goods and services which are purchased by consumer throughout the country. It reflects changes in the cost of purchasing goods and services in a fixed market based at current retail prices, but it is not designed to measure changes in the cost of living attributed to changes in the consumption structure of consumers
Coverage						
Population	Households, irrespective of nationality or residence status	All Households, excluding the highest and lowest expenditure bracket	Industrial workers	Low, middle and high income, pensioners, wage and salary workers type of households	Final private consumption of families on the whole Italian economic territory according to ESA 95	Households with two persons or more
Geography	Economic territory	Hong Kong	70 cities/town	Urban areas (45 cities)	The Italian economic territory; in particular outlets and tenants in 87 Italian chief towns are sampled and then surveyed	Whole country

Cross-country Comparison: CPI (continued)

	Germany	Hong Kong SAR	India	Indonesia	Italy	Japan
Item coverage	Consumption expenditures which are incurred in monetary transactions; the price changes for some 750 exactly specified goods and services are combined. Such goods and services are selected with the goal to represent the consumption by households with a sufficient degree of accuracy	Goods and services purchased by households for final consumption. Bettings, income taxes, endowment policy premiums, mortgage payments, investments and savings are excluded	On the basis of the expenditures incurred by the working class in 1981–1982	–	Private consumption except gambling, lottery and life insurance	All goods and services normally purchased for consumption; cash gifts and remittances are excluded
Owner-occupied housing	Included (rental equivalence)	Included (rental equivalence)	Included (rental equivalence)	Excluded	Excluded	Included (rental equivalence)
Formula						
Elementary	Ratio of arithmetic means	• Geometric mean: heterogeneous products • Ratio of arithmetic means: homogenous goods	Ratio of arithmetic mean	• Average of price relatives • Geometric mean: seasonal goods	Geometric mean	Ratio of arithmetic mean
Higher level	Laspeyres	Laspeyres	Laspeyres	Laspeyres	Chained-Laspeyres	Laspeyres

	Germany	Hong Kong SAR	India	Indonesia	Italy	Japan
Update interval						
Weight	Every 5 years	Every 5 years	Generally every 10 years but currently 23 y	Every 5 years	Every year	Every 5 years
New products	Every 5 years, or sooner if necessary	Every 5 years		At the same time as the cost of living survey	Every year	Every 2–3 years
Outlets	Every 5 years, or sooner if necessary (if an outlet closes, it is replaced by another)	Every 5 years		Adjusted if sample outlet is not active anymore	Every year (partial rotation of the sample)	Every year
Classification	COICOP	Local classification scheme: 9 sections, 97 groups, 237 sub-groups, 984 items		COICOP	COICOP	COICOP
Periodicity	Monthly	Monthly		Monthly	Monthly	Monthly

Cross-country Comparison: CPI

	Korea	Mexico	Malaysia	Netherlands	Poland	Portugal
Definition	The CPI measures the average change in prices for a fixed-market basket of goods and services of constant quantity and quality purchased by urban consumers	The CPI measures the evolution over time of a constant basket of goods and services taken as representative of consumption habits for urban households	The CPI measures pure price changes over time in a fixed basket of goods and services commonly purchased by a majority of private households	The CPI measures the average price changes of goods and services purchased by households	The CPI measures the average change in the prices of goods and services purchased for consumption purposes by the resident households in Poland	The CPI measures pure price changes in fixed-market basket of constant quantity and quality for the general population
Coverage						
Population	All urban consumer units, excluding one-person households, farmers and fisherman's households. Covers about 83.2 percent of the total urban population	All households in cities with more than 20 000 inhabitants	The target population includes the whole population living in urban and rural private households	All private households in the Netherlands	All private households residing permanently in Poland, excluding institutional households and foreign households	All population, without restrictions
Geography	36 cities were selected to represent the all urban areas in Korea. The indexes for each city are published every month	Sample of 46 cities representing small, medium and large cities in seven regions of the country	All states in Malaysia. Prices collected in 116 centres of price collection represent those most frequented by consumers for purchases of goods and services	Whole country	Entire area of the country. Prices are collected in 209 price survey regions. The region may be a small town or a part of a city (e.g. a district). A purposive selection of regions was based on the size of population, density of a shop network and price	Entire country (included the Madeira and the Azores islands)

	Korea	Mexico	Malaysia	Netherlands	Poland	Portugal
Item coverage	The goods and services included are limited to consumption expenditures and exclude items that are difficult to estimate such as interest, damage insurance, contributions and membership fees, but include rent deposits	All commonly used goods and services bought by the covered population for consumption purpose, including taxes	All goods and services commonly purchased by target population for consumption purposes. Excludes income taxes, charitable donations and statutory contributions such as employee provident fund and consumer savings, investments and life insurance	All goods and services essential to household consumption, paid out of the net spendable income. Direct taxes and social insurance premiums are not included in the CPI	All goods and services bought within the territory by the reference population for purposes of consumption. Expenditures for cash gifts, life insurance, imputed rents, illegal activities and some professional services, such as tax advising and consulting	Goods and services considered representative of the structure of expenditure in private consumption by residents within the whole country
Owner-occupied housing	Excluded	Included (rental equivalence)	Excluded	Excluded	Excluded	Excluded
Formula						
Elementary	Ratio of arithmetic mean	• Geometric average: food products • Arithmetic: the rest of the basket	Ratio of arithmetic average of prices	Ratio of arithmetic mean	Geometric mean	Geometric mean
Higher level	Laspeyres	Chained-Laspeyres	Chained-Laspeyres	Laspeyres	Chained-Laspeyres	Chained-Laspeyres
Update interval						
Weight	Every 5 years	According to the Income-Expenditure Survey	Every 5 years	Every 5 years	Every year	Every year
New products	Every 5 years	Every year	Every 5 years	Every month	Every year	As weight >0.1% of households' consumer expenditures
Outlets	Every 5 years	Every year	When necessary	Every month	Every year	n.a.
Classification	Commodity Classification System was developed the National Statistical Office		Classification of Household Goods and Services (CHGS) in the 1968 SNA	COICOP	COICOP	COICOP
Periodicity	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly

Cross-country Comparison: CPI

	Singapore	Russia	South Africa	Spain	Sweden	Switzerland
Definition	The CPI measures the change in the prices of a fixed basket of goods and services commonly purchased by a majority of households over time	The CPI measures the changes over time in the overall level of prices for goods and services purchased by public for non-production consumption	The CPI shows the average price level of all those goods and services (a fixed basket of goods and services of unchanging or equivalent quantity and quality) bought b a typical consumer or household in South Africa changes over time	The CPI is a statistical measurement of the evolution in the overall prices of goods and services consumed by the population living in family dwellings in Spain	The CPI measures the average change in prices of goods and services available for private consumption in the economic territory of Sweden	The CPI measures the pure change in prices of goods and services bought for the purpose of consumption by the resident households in Switzerland
Coverage *Population*	Central 90% in the distribution of households (excluding single person households) by household expenditure	All household with various income levels	The target population includes all South African households living in the metropolitan and urban areas (56% of the total number of South African households)	All private households resident in Spain. It does not cover the expenditure of person resident in institutions, barracks and other non-private households.	All households consuming goods and services for the purpose of private consumption in Sweden	All private households residing permanently in Switzerland
Geography	Whole of Singapore	Urban population centres (266 cities)	Nine provinces monitored in retail and service outlets in two broad geographical areas: "main metropolitan" or "other urban" areas within each province	Pricing take place in 18 regions; 50 provinces and two autonomous cities: Ceuta and Melilla; 141 municipalities	All of Sweden	All of Switzerland; sample of 16 regions nationwide (town built-up area) selected among the 7 major regions

	Singapore	Russia	South Africa	Spain	Sweden	Switzerland
Item coverage	All goods and services commonly purchased by the index population for consumption purposes; expenditure on direct taxes, cash gifts, gambling and illegal activities are excluded	—	Goods and services purchased by the reference population determined mainly from the Income and Expenditure of Households Survey. Items excluded are income taxes, contributions to pension plans, consumer savings and investments, gambling and expenditure on illegal activities	All goods and services bought by the reference population for the purposes of consumption; direct taxes, expenditures on capital assets/investments, donations, gambling and illegal activities are excluded	All goods and services bought within Sweden for the purpose of private consumption except child care and care of the elderly, fees for hospital care, life insurance	All goods and services bought by the reference population for the purposes of consumption; expenditure on direct taxes, cash gifts, gambling and illegal activities are excluded
Owner-occupied housing	Included (rental equivalence)	Excluded	Included (user cost)	Excluded	Included (user cost)	Included (rental equivalence)
Formula						
Elementary	Geometric mean	Geometric mean	Geometric mean	Geometric mean	Geometric mean	Geometric mean
Higher level	Laspeyres	Chained-Laspeyres	Laspeyres	Chained-Laspeyres	Walsh	Chained-Laspeyres
Update interval						
Weight	Every 5 years	Annually as weight >0.1% of households' consumer expenditures	Every 5 years	Every year	Every year	Annually
New products	Every 5 years		Every 5 years	Every year	Every year	• Weighted level: Every 5 years • Un-weighted level: Continuously
Outlets	Every 5 years	As rarely as possible	Every 5 years	Every 5 years	Every year	Regularly
Classification	Singapore's Classification of Expenditure Items	COICOP	COICOP	COICOP	COICOP	COICOP
Periodicity	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly

Cross-country Comparison : CPI

	Thailand	United Kingdom	United States	Europe
Definition	The CPI measures the change in prices of a fixed basket of goods and services purchased for consumption by the average households in the urban areas throughout the country	The CPI measures the average change in prices of goods and services bought in the UK for the purpose of consumption by all UK households, foreign visitors and residents of institutional households. Prior to 10 December 2003, the CPI was published in the UK as the Harmonised Index of Consumer Prices	The CPI measures the pure price change in a market basket of goods and services of constant quality. The cost-of-living concept is the measurement objective	HICP measures the average price changes of goods and services available for purchase in the economic territory of the Member States for the purpose of directly satisfying consumer needs. Weighted average of members states' HICPs
Coverage *Population*	Includes households with one to five persons, households' income 3,000–60,000 bahts per month (in 2002)	All private UK households, foreign visitors to the UK and residents of institutional households	All urban consumer units, which represent about 87% of the total population	All households, include expenditure by foreign visitors ("domestic concept") and expenditure by individuals living in institutions, but exclude the expenditure by residents whilst in a foreign country
Geography	Urban areas in 37 provinces (including Bangkok)	All of the UK i.e. England, Scotland, Wales and Northern Ireland	All urban areas of 2,500 or more population within the 50 states; excludes U.S. territories	Economic territory

	Thailand	United Kingdom	United States	Europe
Item coverage	All goods and services bought by the reference population for the purposes of consumption; expenditure on income tax, cash gifts and donations are excluded	All monetary expenditure on goods and services bought within the domestic territory and covered by Household Final Consumption Expenditure (HHFCE) as defined for the UK's National Accounts	Includes all consumption purchases by the reference population; excludes gambling and illegal activities	Private consumption except gambling, lottery and life insurance
Owner-occupied housing	Included (rental equivalence)	Excluded	Included (rental equivalence)	Excluded
Formula				
Elementary	Arithmetic means of relative prices	Geometric mean of price relatives	61% geometric means and 39% weighted average of relative prices (=modified Laspeyres)	Ratio of arithmetic mean or ratio of geometric mean prices
Higher level	Chained-Laspeyres	Chained-Laspeyres	Chained-Laspeyres	Chained-Laspeyres
Update interval				
Weight	Every 4 years	Every year	Every 2 years	Weights must reflect the expenditure pattern in a period ending no more than seven years before the preceding December. Furthermore, each year a review of weights needs to be carried out, and weights have to be adjusted if

Cross-country Comparison : CPI (continued)

	Thailand	United Kingdom	United States	Europe
				the review indicates that change in the weights would affect the all-item HICP by more than 0.1 percentage points on average of one year against the previous year. Country weights for euro area HICPs are updated in annual intervals
New products	Every 4 years	Every year, as weight >0.1% of households' consumer expenditures	Each year (on a rotating basis) for 25% of the index	Each year, when new goods account for at least 1/1000 of all expenditure, new goods have to be included
Outlets	Seldom	–	Each year (on a rotating basis) for 25% of the index	No specific HICP standards, but HICPs are constructed from target samples which are representative, reliable and comparable
Classification	The classification system corresponds to the household expenditure survey conducted by National Statistics Office (NSO)	COICOP	COICOP	COICOP
Periodicity	Monthly	Monthly index	Monthly	Monthly index

Comparison of consumer price indices for the euro area, the United States and Japan

Gabriel Quirós[1] *(European Central Bank)*

1. Introduction and policy relevance

Inflation rates are one of the main indicators used in the analysis and communication strategy of the European Central Bank (ECB), the Federal Reserve System (FED) and the Bank of Japan (BoJ). Using the Harmonised Index of Consumer Prices (HICP) as a reference, because of its predominant role in the ECB, this note analyses the differences with consumer price indices (CPIs) used in the United States (US) and Japan.

The **US** indicator that is most comparable to the HICP is the national CPI that is published by the Bureau of Labor Statistics (BLS). However, since February 2000, the headline reference indicator for the FED, used in the semi-annual forecasts, has become the Personal Consumption Expenditure (PCE) deflator in its core version, that is excluding food and energy. Since last December this indicator has been published by the Bureau of Economic Analysis (BEA) on a monthly basis at the end of the following month. When justifying the preference given to deflators, the FED mentioned the "superlative" index formula, which avoids the potential upward bias of the "fixed basket" CPI due to changes in the consumption pattern, the more comprehensive set of expenditure weights, and the more consistent time series due to the fact that the PCE is revisable and changes to statistical methods are retrospectively introduced to the series.

The comparable indicator in **Japan** is also the CPI. The BoJ focuses its projections on the overall CPI excluding fresh food.

2. Statistical differences between the euro area HICP and the consumer price indices for the United States and Japan

The data for all three consumer price indices are collected and compiled on a monthly basis. Some statistical differences, however, affect their comparability.

- Measurement objective: The HICP is a Laspeyres type index that aims at measuring the pure price changes of the same consumption basket between the current and base period (a "cost-of-goods" index or COGI). The Japanese CPI is constructed with the same theoretical framework. The measurement aim of the US CPI is a "cost-of-living" index (or COLI), measuring the minimum cost to maintain a constant utility over time. The COLI measures price changes after allowing for consumer substitution as a reaction to relative price changes, e.g. it is not reflecting the pure price change of a given consumer good basket. Although these two approaches differ theoretically, the application shares many common aspects. Therefore, in practice the difference in measurement objectives hardly matters.
- Expenditure and Consumer coverage: The HICP is defined on the base of the Household Final Monetary Consumption Expenditure (HFMCE), which is the expenditure on goods and services, in monetary transactions by households on the territory of the euro area. In the United States and Japan the national concept is used and resident households are surveyed, including their expenditure abroad. In addition, the US CPI only covers 87% of the population

as it excludes households living in rural areas. These differences are relevant if both weights *and* prices of the items concerned differ.

- Product coverage: The main statistical difference is the exclusion of owner-occupied housing (OOH) from the HICP. This is not the case for the United States and Japan CPIs, which both include the OOH costs using the rental equivalence approach (imputed rent). This difference with the United States is quite important as the US share of expenditure on imputed rents is around 20% of the total. Inclusion of OOH in the HICP using the net acquisition approach[2] is currently being considered by Eurostat.

    Regarding the treatment of medical care and education, the treatment of "out-of-the-pocket" expenditure is very similar in the HICP and US CPI. Slight differences exist in the treatment of private health insurance premiums (the BLS allocates most of consumers' expenditures on health insurance premiums to the weights for the healthcare goods and services; the HICP differentiates between the latter an explicit insurance service charge).

- In the United States, the resampling is done on a rotating basis so that the sample is fully refreshed every 4 years. Additional resampling every two years is done when deemed necessary, particularly if new goods are introduced at a high pace. In the euro area, the situation varies, whereby in six countries (including Spain, France and Italy) the resampling is done annually. In all euro area countries, new goods and services need to be introduced in the sample as soon as they reach a non-negligible share of household consumption. In Japan, the resampling is done every five years along with the base revision. An interim review is conducted after three years.

- Furthermore, the euro area HICP differs from the CPI measures as regards the updating of its expenditure weights to avoid that they become less representative. In more than half of the euro area countries the weights are updated annually with new expenditure data and in two to five yearly intervals in the other countries. The BLS carries out biennial weight updates. In Japan, the weights are updated every five years. At aggregate index level, the possible effect of these differences between the United States and euro area appear to be small.

- An additional difference can be found in the methods of quality adjustment. The US CPI uses more extensively hedonic methods for quality adjustment, in particular, of electronic household equipment. They often (but not always) lead to stronger price decreases than traditional measurement methods. Within the products covered by the Japanese CPI personal computers, PC printers and digital cameras are adjusted for quality difference by hedonic methods.

- Sales prices and price reductions are treated differently in the three measures. In the HICP they are included in principle. In the United States the price reductions are included only if at least 50% of the sales for the affected item are discounted. In Japan short-term bargain prices are not collected for the calculation of the CPI. However, winter and summer sales for clothing and footwear seem to be reflected in the index. These differences affect the comparability of the short-term price changes in some sub-indices, but their effect on long-term comparisons is small.[3]

- Differences in the publication and dissemination of consumer prices arise particularly with the United States, where the seasonally adjusted figures play a predominant role in the BLS press release. The euro area HICP is seasonally adjusted by the ECB's DG-S and published in the ECB Monthly Bulletin. Besides, the HICP is revisable in case that new available information becomes available. There are also differences in the release calendars. A flash estimate for the overall HICP is published by the European Commission (Eurostat) on the last working day of the reference month, and the full breakdown 17 days after the reference period. The US CPI is published by the BLS 14 days after the month while the Japanese CPI is published by the Statistics Bureau around four weeks after the month.

3. US and Japan consumer price indices being most comparable to the HICP

The BLS has recompiled the available US CPI data excluding imputed rents and aggregated them with a Laspeyres chain index formula following the classification used for the HICP

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2   *The net acquisition approach is a transaction approach for owner-occupied housing that reflects changes in the price level of dwellings acquired by households in the reporting period. The "net" concept limits the coverage to monetary transactions of the household sector with other sectors, which mainly concerns new dwellings. The imputed rent approach is considered unsuitable for the HICP, since it values the imputed flow of consumption rather than the purchase price of goods.*

3   *In addition, the different timing of entering goods and services prices in the index also affects the comparability of some sub-indices. This is particularly evident in the analysis of detailed components (e.g. package holidays, seasonal items).*

(COICOP). The result is a rough proxy of the HICP for the United States. For Japan, the series CPI excluding imputed rents can be used as best available proxy to the HICP. The following chart compares these indices over the period from 1999 to April 2006.

Chart – Euro area HICP and proxy measures for the United States and Japan (annual growth rates)
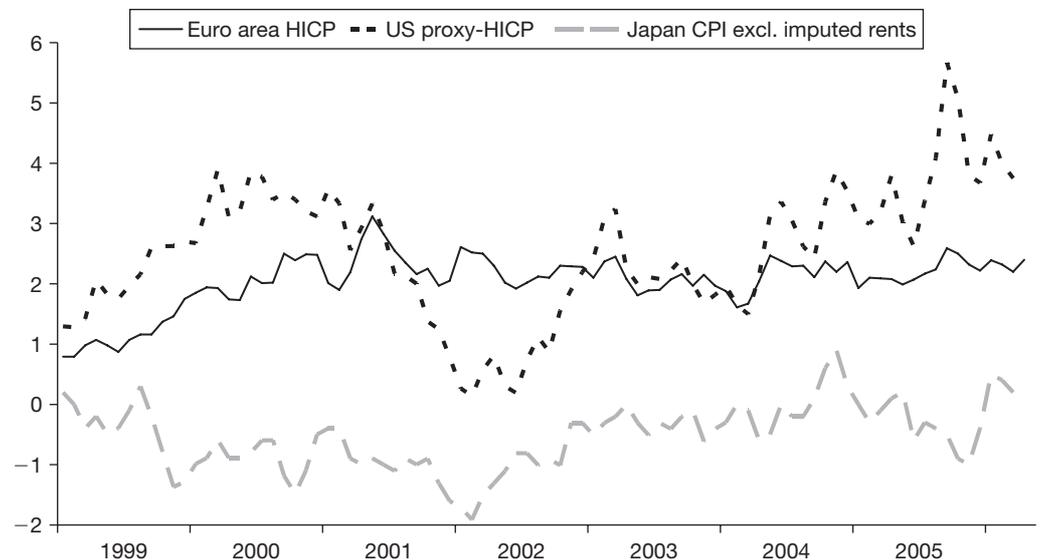
Source: Eurostat, Bureau of Labor Statistics (BLS) and Japan Statistics Bureau.

4. Other reasons which may affect the comparability of the HICP and the US CPI

Various other factors may also affect the comparability of the euro area results with the United States, of which only few are mentioned for illustration. In particular, the US CPI is constructed using largely centralised, and thus very homogeneous statistical procedures. The BLS central office manages the sampling as well as all the quality adjustments, based on item descriptions provided by the price collectors. The HICP procedures are still – despite all the harmonisation achieved – very heterogeneous and highly decentralised.

In addition, the average structure of health expenditures in the euro area is very different from that in the United States. In the euro area, the public sector spends around 74% of total healthcare outlays,[4] while this proportion equals 44% in the United States. Correspondingly, the weights for health care are lower in European indices.

Moreover, even if the statistical treatment is the same in the euro area HICP and in the US CPI, a higher or lower taxation level can influence the inflation rate. As a prominent example, the taxation of petroleum products is around 70% of the fuel price in the euro area, while it is only around 20% in the United States. Consequently, energy outlays have a much larger expenditure share in the euro area, which also affects the overall inflation rate. Conversely, if excise taxes are higher, the euro area energy-related price index series react less to crude oil price changes.

Gabriel Quirós (European Central Bank)

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4 *DG-S estimates based on the results for nine euro area countries (excluding Belgium, Greece and Portugal).*

Measurement errors in the Japanese CPI

Shigenori Shiratsuka [*] *(Bank of Japan)*

I. Introduction

In this paper I will summarize the recent developments in the measurement of the Japanese Consumer Price Index (CPI).

The CPI is widely used as a measure of inflation around the world. In explaining monetary policy to the public, central banks employ price indexes that cover goods and services consumed by households, and especially the CPI, as their principal indicators.

The CPI, however, is generally thought to overstate changes in the true cost of living.[1] In examining the problems of price measurement, a distinction is needed between the measurement of individual prices and the aggregation of those prices into the overall price index.

Aggregation introduces biases, because the CPI assumes that households purchase the same representative consumption basket over time, although, in fact, they substitute some goods for others when relative prices change and as new products and services are introduced. The problems of aggregation, however, are well understood by economists, and workable solutions are within reach.

Contrary to the intuition, the measurement of individual prices presents difficult conceptual and practical problems. Quality adjustment is a one significant problem: with rapidly-changing product features and characteristics, defining the unit of output and adjusting an item's price for improvements in quality become increasingly difficult. These problems are thus pervasive in modern economies. In fact, quality changes/new products bias has been identified as the largest source of the upward bias in the CPI in major industrial countries.[2]

The upward bias in the CPI has a direct implication to monetary policy makers, whose major mandate is to maintain price stability. Particularly, the importance of accurate price measurement is apparent in a country like Japan where CPI inflation is running close to zero.

The remainder of this note is composed as follows. In section II, I will assess the magnitude of the upward biases in the currently available 2000-year base index. In section III, I will review two major problems remaining in the Japanese CPI: treatment of owner-occupied housing and one-specification for one-item policy. In section IV, I will give some concluding remarks.

II. Magnitude of the upward biases

In this section, I first show the limitation of the fixed-weight Laspeyres index formula used in constructing the CPI, and then examine the magnitude of upward bias in the current 2000-year base index.

A. Sources of measurement errors

The adoption of the fixed-weight Laspeyres formula to compile the CPI is the primary source of measurement error. Within the framework of the Laspeyres formula, the CPI aims to trace price fluctuations by assuming that all households continue to purchase a given consumption basket fixed in the base year. The CPI is thus unable to account for changes in consumer behavior

Figure 1 – Sources of measurement errors in the CPI
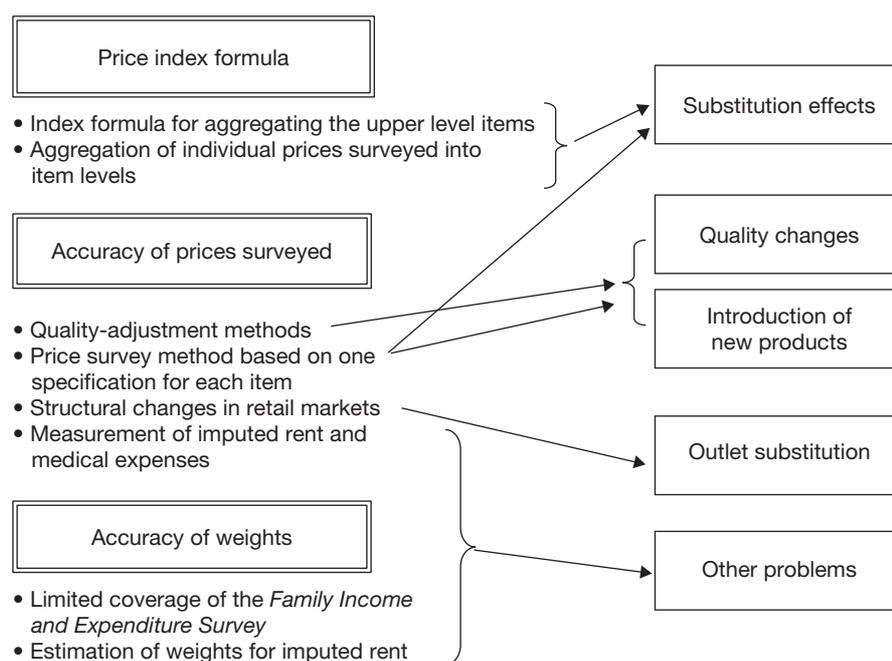
Notes:
1. *Substitution effects: The CPI weights are fixed at the base year, and therefore the effects of items whose relative prices are falling or rising are undervalued or overvalued.*
2. *Quality changes: It is difficult to accurately grasp changes in the quality of items and reflect them in the CPI, and therefore such insufficient quality adjustments cause upward bias of the CPI.*
3. *Introduction of new products: Consumers purchase a new product when they regard it as relatively less expensive than an old one on a quality-adjusted basis, and therefore a delay in including the new product in the CPI basket causes upward bias.*
4. *Outlet substitution: It is difficult to reflect in the CPI the impact of consumers' shift to discount outlets, because outlets surveyed are fixed for a certain period of time.*

in response to relative price fluctuations, the introduction of new goods, and the disappearance of old goods.

The limitations of the Laspeyres formula mentioned above result in the introduction of measurement errors in the CPI through three components of the index formula: (i) accuracy of sample prices, (ii) accuracy of the weights, and (iii) appropriateness of the index formula. These components are influenced by four sources of measurement errors below: (i) substitution effects induced by relative price changes, (ii) effects of quality changes, (iii) effects of the introduction of new products, and (iv) technical problems in constructing the statistics.

Figure 1 illustrates the sources of measurement error in the CPI. It should be noted that the limitations of the Laspeyres formula are likely to produce an upward bias in the CPI.

B. Currently available estimates for the upward bias

Regarding the measurement errors in the Japanese CPI, the comprehensive quantitative assessment currently available is just my point estimate of 0.9 percent, as shown in Table 1.[3,4] Two points below should be noted as qualitative conclusions for the upward bias in the Japanese CPI:

3 *See Shiratsuka (1988, 1999b) for the details.*
4 *In contrast, a large number of studies are available in the United States. So-called* Boskin Report *(Advisory Commission to Study the Consumer Price Index, 1996) presented its best estimate of the upward bias as 1.1 percentage points per year based on the detailed examination of past studies. In response, the U.S. Bureau of Labor Statistics (BLS) implemented some measures to improve the accuracy of the U.S. CPI, such as wider application of hedonic method, introduction of geometric mean method in lower level aggregation. The follow-up studies, such as GAO (2000) and Lebow and Rudd (2003), shows that the upward bias in the U.S. CPI has narrowed, compared with that in the* Boskin Report.

Table 1 – Point Estimates of the upward bias in Japan and the U.S. (*Unit: Percent*)

	Japan	USA		
	Shiratsuka (1999)	Boskin Report (1996)	GAO Report (2000)	Lebow-Rudd (2003)
Upper level sub.	0.00	0.15	0.10	0.30
Lower level sub.	0.10	0.25	0.05	0.05
Quality changes / new products	0.70	0.60	0.55	0.37
Outlet sub.	0.10	0.10	0.10	0.05
Weighting	–	–	–	0.10
Total	0.90	1.10	0.80	0.87

Table 2 – Recent major revisions in the Japanese CPI

Category	Measures

Quality adjustment	• Application of hedonic method to:
	   – PCs [at the revision of the base year to 2000]
	   – Digital cameras [at the interim review in 2003]

Frequency of review on the items surveyed	• Introduction of interim review [decided at the revision of the base year to 2000]: – Introduction of PC printers and Internet connection charges [at the first interim review in January 2003]
Index formula	• Monthly publication of the chained Laspeyres index and midpoint-year basket index [starting from the revision of the base year to 2005 (scheduled in August 2006)]
Range of outlets surveyed	• Inclusion of more large suburban outlets [at the revision of the base year to 2000]
Weighting	• Publication of a reference index for all households including one-person households [starting from the revision of the base year to 2005 (scheduled in August 2006)]

(i) upper level substitution bias is negligible because of small relative price variability under low inflation;[5] and (ii) quality changes/new products bias is the largest source of the upward bias. It should be noted, however, that the estimate is based on the compilation procedures and weights for 1990-year base index, which is no longer used.

The latest 2000-year base index reflects many improvements in price measurement especially at the time of base-year revision to 2000 in the summer of 2001 (Table 2). Important improvements include: (i) PCs are included by employing a hedonic quality adjustment method; (ii) The items surveyed are reviewed and potentially changed at the mid-year to the next base-year revision (interim review);[6] and (iii) The outlets for the price survey are more flexibly set to cover large-scale suburban stores.

As a result, the upward bias in the Japanese CPI becomes substantially narrower, compared with my estimate about the 1990-year base index mainly due to considerable improvements in quality adjustments/new products bias. In fact, the CPIs for both desktop and notebook PCs continuously decline at an annual rate of 20–30 percent, as shown in Figure 2. Sum of the weights for the two types of PCs are 0.54 percent, thus inducing decline in the overall CPI by 0.1–0.2 percentage points. The figure also shows that such declines in the CPI for PCs in Japan are almost comparable with those in the United States.

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5 *"Upper level substitution bias" arises when aggregating prices surveyed into item levels. This corresponds to the problems of index formula.*
6 *A base-year revision of Japanese CPI is made every five years: the last digit of the year is equal to one or six. An interim review is made at the mid-year of adjacent base-year revisions: the last digit of the year is equal to three or eight.*

Figure 2 – CPI for PCs
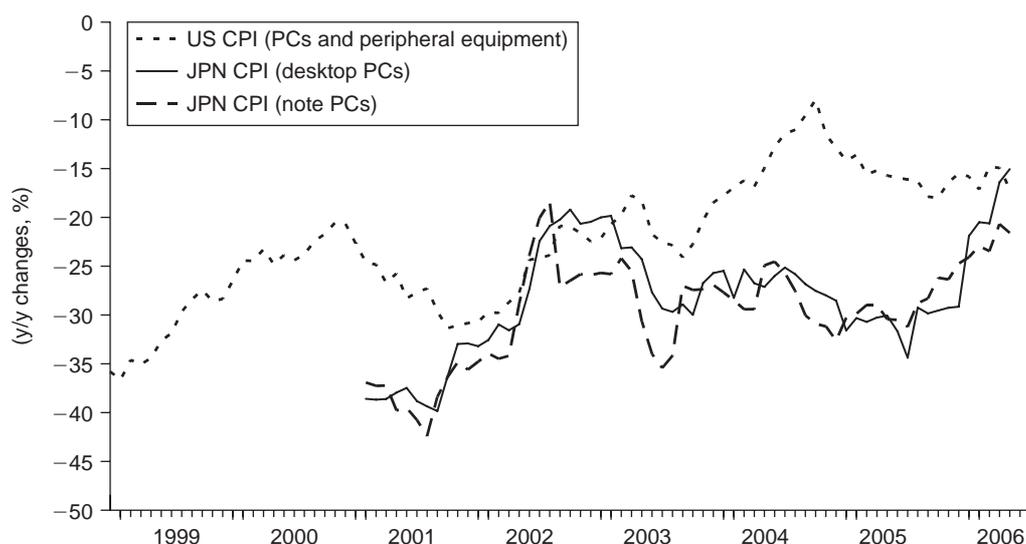
Sources: Japan: Ministry of Internal Affairs and Communications, *Consumer Price Index.*
      US: Bureau of Labor Statistics, Consumer Price Index.

Figure 3 – Penetration of major durables
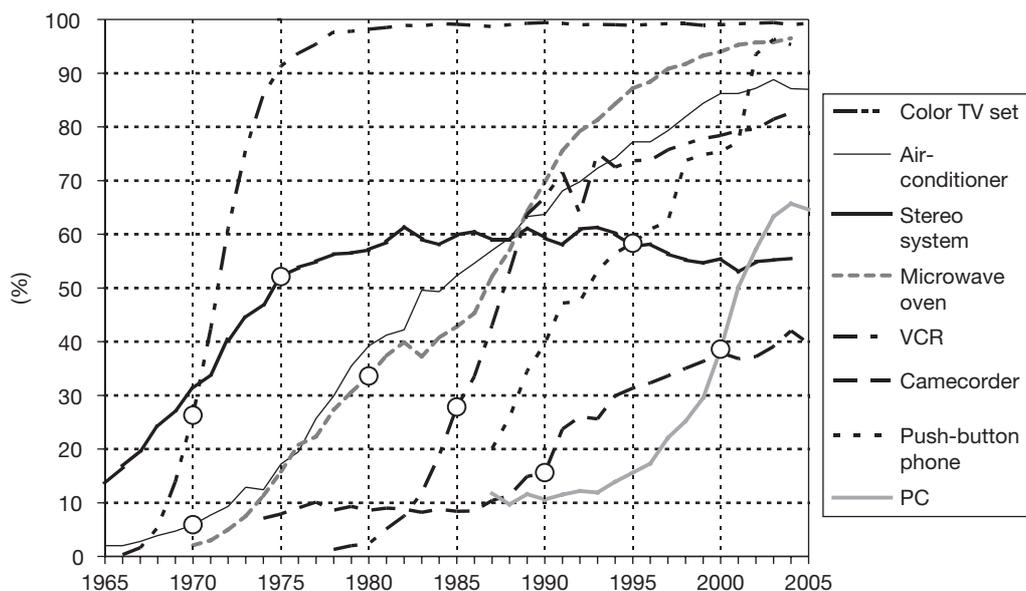
Note: Circles indicate the year which the products were introduced to the CPI basket. Therefore, the products without circle, personal computers and fax machines, are products excluded from the CPI basket.
Source: Cabinet Office, *Consumer Behavior Survey.*

    In addition, introduction of interim review of the items surveyed also makes it possible to include new products in a timelier manner. At the interim review conducted in 2003, for example, PC printer and internet connection charge were included. In the past, new products and services are not brought into the CPI basket immediately, but only with a substantial time lag after their appearance in the markets, as shown in Figure 3.

    In the meantime, upper level substitution bias continues to be negligible at the moment. Table 3 shows the rate of changes in three index formulas to examine the magnitude of upper level substitution bias: fixed weight Laspeyres formula, chained weight Laspeyres formula, and midpoint-year weight Laspeyres formula. The latter two formulas update weight every year: Chained weight Laspeyres index uses weight based on the expenditure share of the previous year, and midpoint-year weight Laspeyres formula for that of the midpoint year between the

Table 3 – Rate of changes in alternative index formulas

	Fixed weight		Chained weight		Midpoint-year weight	
	Overall	Core	Overall	Core	Overall	Core
(y/y changes)						
2001	−0.7	−0.8	–	–	–	–
2002	−0.9	−0.9	−1.0	−1.0	–	–
2003	−0.3	−0.3	−0.4	−0.4	−0.4	−0.4
2004	0.0	−0.1	−0.1	−0.3	−0.2	−0.3
2005	−0.3	−0.1	−0.4	−0.2	−0.5	−0.3
(Deviations from the fixed basket)						
2002	–	–	−0.1	−0.1	–	–
2003	–	–	−0.1	−0.1	−0.1	−0.1
2004	–	–	−0.1	−0.2	−0.2	−0.2
2005	–	–	−0.1	−0.1	−0.2	−0.2

Notes: Chained Laspeyres index and midpoint-year index update weight every based on the expenditure share of the previous year and that of the midpoint year between the current year and the base year.

Figure 4 – Distribution of price changes for individual items in the CPI
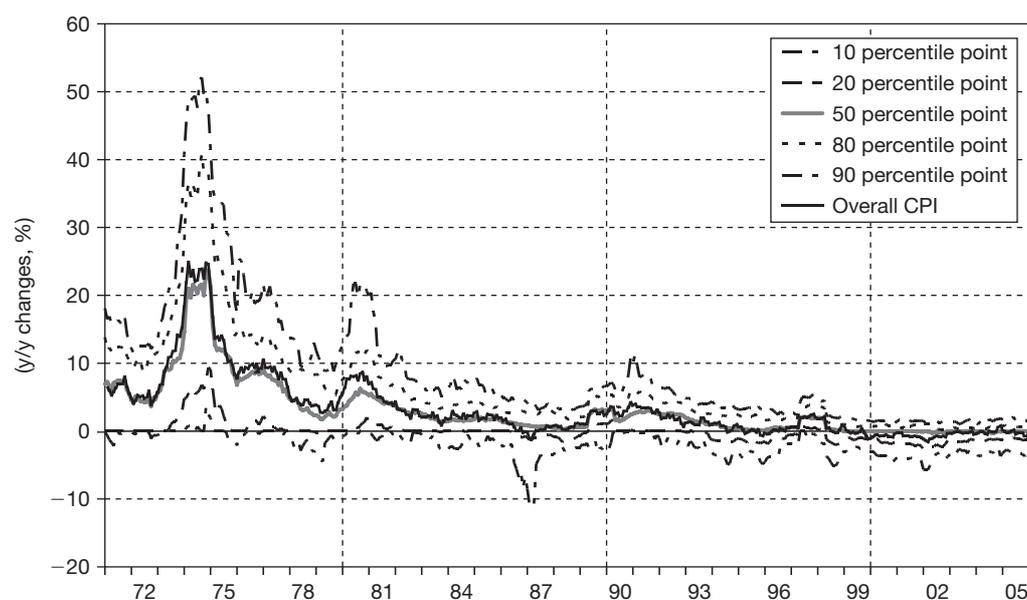
Note: X percentile point shows the rate of price change of the item whose cumulative weight is equal to X%.
Source: Ministry of Internal Affairs and Communications, Consumer Price Index.

current year and the base year. The lower panel in the table shows that deviations of the two formulas from the fixed weight formula stay around 0.1–0.2 percentage points per year.

One possible explanation for the small impact of upper level substitution bias in Japan is that the variability of relative prices remains low under low inflation, and, as a result, consumers have less scope for substitution between items. The distribution of price changes for individual item remains relatively tight after the mid-1980s, as shown in Figure 4. The figure plots 10, 20, 50, 80, and 90 percentile points, which is the rate of change of the item with cumulative weight being equal to 10, 20, 50, 80, and 90 percent.

It should be noted that, as pointed in Shiratsuka (2005), cumulative effect of upper level substitution bias slightly increases, reflecting the increased variability of relative prices due to increases in items with rapid price declines, including PCs. This observation suggests that improvements of individual price measurement also require an assessment of the impacts of individual improvements on the system of consumer price index as a whole. That is, better

Figure 5 – Distribution of the floor space
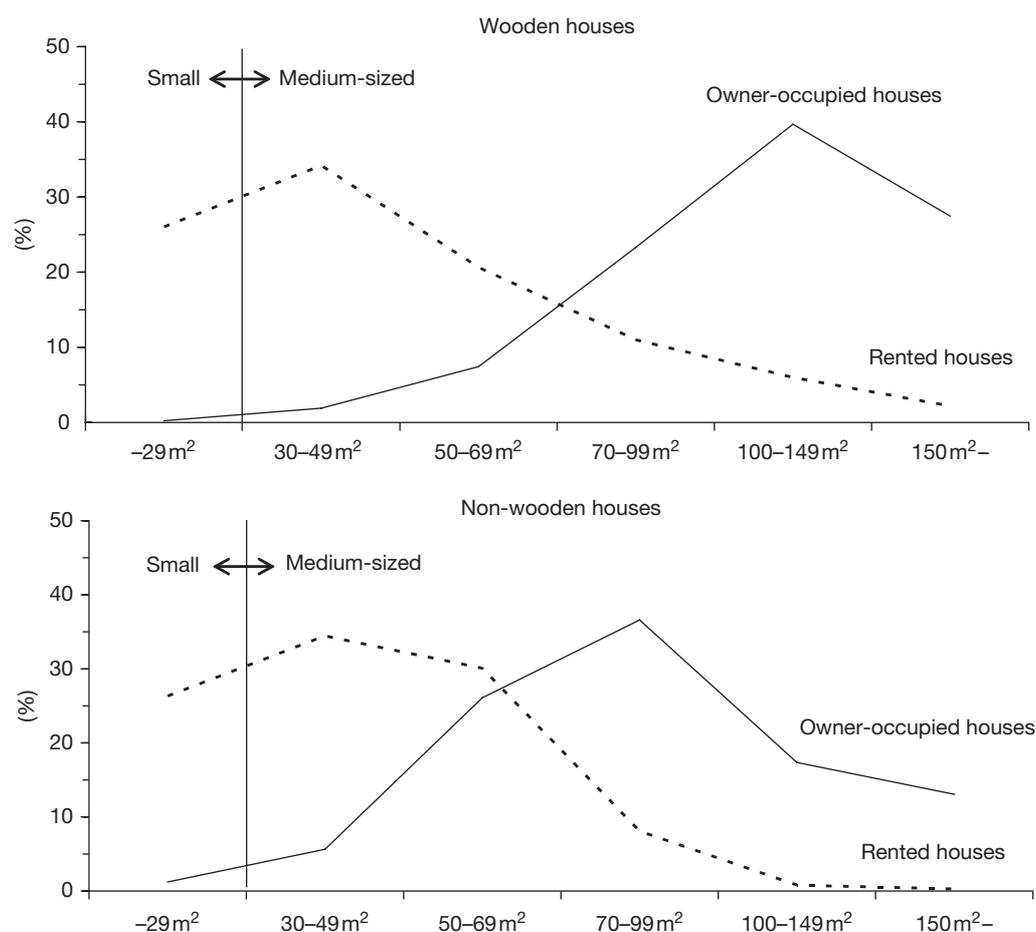
Source: Ministry of Internal Affairs and Communications, *The Housing Survey of Japan.*

measurement of individual prices is likely to expand the variability of relative prices, thus requiring an aggregation formula more robust to upper level substitution.

III. Remaining problems

In this section, I review two major problems remaining in the Japanese CPI: treatment of owner-occupied housing, and the one-specification for one-item policy.

A. Owner-occupied housing: rental equivalence

The Japanese CPI applies the rental equivalence method to include the cost of privately owned houses. The rental equivalence method measures the change in the value of the owner-occupying housing service by using the rents paid by tenants for similar rented houses.

The Japanese CPI surveys average rent per residential area on four classifications of houses: (i) wooden small size houses (residence area less than 30 square meters), (ii) wooden medium size houses (residence area over 30 square meters), (iii) non-wooden small houses, and (iv) non-wooden medium size houses.

Application of the rental equivalence method in Japan implies that the value of the owner-occupying housing service is assumed to moves in line with the average rents for the above rough classification. However, it should be noted that there exists a large difference in facilities and comfort between rented houses and owner-occupied houses.[7]

As shown in Figure 5, distribution of the floor space, which can be deemed as a proxy for comfort of the house, differs substantially between rented houses and owner-occupied houses

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7 *In addition, problems pertaining to the calculation of the weight of imputed rent have been pointed out.*

Figure 6 – One-specification for one-item
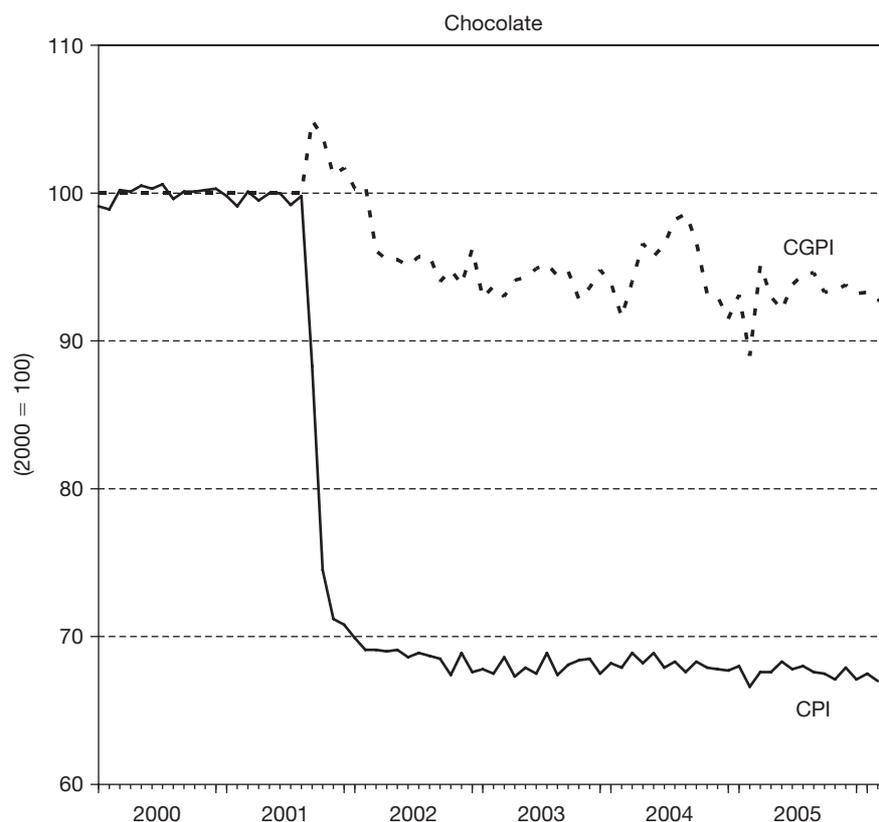
Chocolate

regardless of construction materials (wooden or non-wooden). Therefore, the current CPI provides a poor gauge of the actual owner's equivalent rent for larger owner-occupied houses.

B. One-specification for one-item policy

The Japanese CPI employs the "one-specification for one-item" method in surveying individual prices. This method specifies a single and generally most popular specification for each item, and continuously surveys its prices.

The method's obvious disadvantage is that the specified item is not necessarily representative of all items in a particular expenditure category. It is therefore likely to fail to trace overall price movements of the highly diversified and differentiated products, just by surveying the single and tightly-defined specification.[8] For example, "mobile audio equipment" surveys only portable MD player, and does not cover similar products such as MP3 player (either those with a flash memory or those with a hard disk), and the "iPod."

In addition, the tightly-defined specification can sometimes introduce a significant noise when there is major specification change. Figure 6 plots the price indexes for chocolate for the CPI and the CGPI (corporate goods price index). The CGPI surveys average prices for readily available products, while the CPI makes a very detailed specification of products: "Meiji milk chocolate" or "Lotte Ghana milk chocolate." The figure shows a significant downward shift in 2001 when major specification changes occurred for these two products. Just ignoring the sharp downward shift in the CPI caused by these changes, and linking the trend before and after the specification changes, the movements in the CPI are very close to those in the CGPI.

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8   *It should be noted that changes in price survey method of multiple specifications for one item is likely to expand the lower level substitution bias, suggesting the importance of jointly introducing robust method in aggregating individual prices into item price index.*

IV. Concluding remarks

In this paper I have summarized the recent developments in the measurement of the Japanese CPI.

In recent years, Japan's Statistics Bureau has made a constant effort to improve the CPI, by for example enhancing its quality-adjustment methods and increasing the frequency with which goods and services included in the CPI are reviewed. As a result, the upward bias in the Japanese CPI has substantially narrowed and is now insignificant.

Despite the efforts of statistical agencies in constructing accurate statistics, measurement errors are unavoidable to some extent. This is because the economy is constantly changing. Statistical agencies are thus required to regularly access whether their data properly reflect dynamic changes in the economy, thereby allocating their limited resources efficiently to create better statistics.

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Summary of discussion

A key theme to emerge from the presentations was the need for greater comparability across national measures since there are significant statistical differences in CPI compilation methods across countries. These pertain mainly to the treatment of owner-occupied housing, quality adjustment, as well as to the updating of the weights of different items. It was mentioned that the CPI Manual does a good job in terms of defining best practices but that these are not always followed, for example with respect to the timely updating of weights. There is often a disconnect between the theory that is clearly laid out in the Manual and the actual practice undertaken by statistical offices. Adopting a more direct compliance strategy could be a solution.

Another recurrent theme in the presentations related to the role of central bankers in affecting change to national CPI methodologies and compilation practices. As central banks are some of the main users of CPIs, it is in their interest to assist their respective national statistical offices to produce high quality data through the use of sound methodologies. It was suggested that the role of central banks should be to help determine which product components of the CPI should be improved. For instance, the large weight of imputed rents suggests that this should be a priority. Effective cooperation between central banks and national statistical offices, which typically are in charge of CPI compilation, is required in order to determine priorities in improving CPI data. Such cooperation does not always world in practice. Moreover, CPI compilers cannot be approached with too many requests such as improving their index or making it more comparable globally. Such requests are generally resource intensive.

In the context of their interaction with their national statistical offices, central bankers could insist that appropriate resources are made available for the compilation of CPI statistics. In certain circumstances, they could also assist in providing resources, for instance by sponsoring a particular survey. Providing resources on an ongoing basis was seen to be more problematic as care has to be taken not to compromise the independence of the national statistical office (or even the perception of its independence).

Further with respect to the relationship between central banks and statistical offices, one possibility could be to establish a "CPI Board" consisting of representatives from the central bank, the statistical office, the ministry of finance as well as academics. This has been done in Sweden, for instance, where such a Board meets four times a year to make CPI-related decisions. Such a framework could make it easier to handle particular issues, even sensitive ones such as the coordination of the activities of price collectors in order to avoid bias and to improve the representativness of the CPI.

Finally, the question was raised as to whether CPI compilers should be persuaded to share their underlying data. In some cases statistical offices are reluctant to share their data and central banks have to be sensitive to this and respect the compilers' independence if they do not want to compromise their working relationship with the national statistical institutes.

SESSION 2

Inflation measures from the perspective of monetary policy

Chair: Shigenori Shiratsuka (Bank of Japan)

Background note and key issues for discussion

Papers: **Inflation measures from a monetary policy perspective**
Laurent Bilke (European Central Bank)

Alternative measures of inflation
Jeremy Rudd (Federal Reserve Board)

**Inflation measures from the perspective of monetary policy:
The case of Brazil**
Jose Ricardo da Costa e Silva (Central Bank of Brazil)

Summary of discussion

Background note and key issues for discussion

There is a new general consensus that the prime mandate for central banks is to conduct monetary policy with the aim of achieving and maintaining monetary or price stability. Though there is no universally accepted definition of the latter, it is usually interpreted as a low, slightly positive and stable level of inflation. In fact, in recent years many central banks have taken the approach to publish a figure (or a range) for a target, objective, guideline, indicator, benchmark or reference rate of inflation that they use in formulating and conducting monetary policy (see Table 1). In all cases, this is based on an official price measure of consumer expenditure.

Perhaps somewhat surprisingly, there is so far no consensus on which price index should be used by central banks in their conduct of monetary policy. In this perspective, Camba-Mendez (2003) has argued that any such index should display at least the following characteristics: credibility, reliability, timeliness and comparability. A credible index should have a direct link to households' welfare, both in theory and practice. To be reliable it should be exempt of significant measurement errors and be subject to few revisions. Moreover, information should be available on a timely basis and be comparable internationally.

In terms of statistical measures, the starting point is whether monetary policymakers should prefer a consumer price index or a GDP deflator. The major advantage of a consumer price index (CPI) is that it is a well-known indicator used by economic agents in a broad range of economic transactions such as wage negotiations and contract indexations. This greatly facilitates the communication of monetary policy. In addition, the CPI is considered to be a credible indicator, as it is available at a high frequency, on a timely basis, and is subject to few revisions after its first publication. Finally, household consumption is considered to be the ultimate source of welfare.

The CPI is, of course, a statistical measure, which, like all such measures, is based on a number of assumptions and methodological choices with respect to the measurement, collection, compilation, weighting and aggregation of the underlying empirical observations. The first important question is whether a CPI should be defined as an index of the cost of buying a particular basket of goods and services (COGI) or as a true cost of living index (COLI), which would track changes in the level and the structure of expenditures required to maintain the same consumer utility[1] (or welfare). Most national statistical institutes satisfy themselves with calculating the CPI as a COGI, although the CPI defined as a COGI displays a number of potential measurement errors. For instance, consumers may switch from a relatively more expensive product to a cheaper one when relative prices change (substitution bias). They may change from high to low price retailers (outlet bias), and start purchasing new goods or services that are not in the CPI basket (new product bias). Finally, measured price changes may not be properly adjusted to take account for changes in the quality of the respective consumer goods or services (quality bias).[2]

Developing a COLI measure of the CPI requires the development of a more rigorous theoretical framework than for a fixed basket CPI. As the COLI is not directly observable, a number of assumptions also have to be made in order to translate the theoretical concept into a statistical measure. Nevertheless, as mentioned by Hall (2004), opting for a COLI has important implications with respect to practical measurement and calculation decisions. In practice, the COLI is treated as a measurement-free, unbiased concept or measurement goal for consumer price inflation, and the CPI compiler uses it as a benchmark for making operational decisions about improvements to the CPI. Moreover, the concept of COLI provides the CPI's measurement objective. For instance, the US Bureau of Labor Statistics, which uses a COLI concept as framework

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1   *A COGI measures the price of a fixed basket of goods and services over time, but as the basket might become less representative of consumers' habits over time, it differs significantly from a cost of living index. In particular, unlike a COLI, a COGI does not account properly for product substitution associated with changes in relative prices, for quality changes, for outlet substitution and for the introduction of new goods. Although a COLI is in theory exempt of such measurement errors, there are in practice different problems associated with this concept. [First, a COLI depends of the reference utility unlike the preference are homothetic. In reality, such an assumption is barely verified, as rich people for instance do have different preferences than poor people. Second, unlike the COGI, it assumes the existence of a representative consumer.] A COGI is generally considered to be an upper bound for the COLI.*

2   *For more details, see also the background notes "Dealing with quality adjustments" of session 4 and "Other measurement issues of concern to central banks" of session 5.*

Table 1 – Inflation measures and their use by central banks

Central Banks	Inflation measure	Target, objective, guideline, reference rate, indicator, benchmark	Other price indices[3]
Argentina	CPI	benchmark	• Wholesale price index • Greater Buenos Aires Construction Index • Export and Import prices • Index of Commodity prices
Australia	CPI	Target	• PPI • International Trade Prices Index (import and export prices)
Belgium	HICP	Index of reference in the definition of price stability (to compute the euro area average)	• National CPI (indexation) • PPI • Import prices • Labour costs
Brazil	IPCA	Target	• INPC (CPI for low income) • IPC-Fipe (CPI for the Sao Paulo – Region) • IGP-DI and IGP-M (general price – indices, including CPI, construction index and wholesale price index) • Import and Export prices
Canada	CPI	Target	• PCE • GDP deflator • Commodity price index
China	• CGPI (corporate goods price index) • CPI	–	• retail prices • ex-factory price Indices of industrial goods • purchasing price indices of raw materials • fuel and power • price indices of investment fixed assets • price indices for real estate
Euro Area – ECB	HICP	Index of reference in the definition of price stability (to compute the euro area average)	• Producer Prices • National account deflator • Labour costs • Unit labour costs • World market commodity prices
France	HICP	Index of reference in the definition of price stability (to compute the euro area average)	• Producer Price Index • Unit Value Index • Cost index in the construction • House prices
Germany	HICP	Index of reference in the definition of price stability (to compute the euro area average)	• Producer Price Index • Construction Price Index • Index of retail prices • Index of wholesale prices • Price index for telecommunication services • Foreign trade price indices

3   *Refer only to headline inflation. Core inflation measures are listed in the background note to Session 6 on "Measures of core or underlying inflation".*

Table 1 – (continued)

Central Banks	Inflation measure	Target, objective, guideline, reference rate, indicator, benchmark	Other price indices[3]
Hong Kong SAR	CPI	Not used by the Central bank for the monetary policy (objective: exchange rate stability, currency board)	• PCE • GDP deflator • Property prices/Rental Index
Indonesia	CPI	Target, objective, benchmark	• Wholesale price index • Producer price index • Construction price index • Unit value index
Italy	HICP	Index of reference in the definition of price stability (to compute the euro area average)	• Input-output prices • Producer Price Index
Japan	• CPI • Core inflation (CPI excluding fresh food)	• CPI is the benchmark to assess price stability in the long run • Core inflation is the benchmark to assess price stability in the current and near future	• Corporate Goods Price Index (domestic, import, export) • Corporate service Price index • GDP deflator
Korea	CPI excluding energy prices and agricultural products (exc. Grains)	Target	• Producer price Index • Import and Export price Indices
Malaysia	Headline CPI	Benchmark	• Producer Price Index • Import/Export value Index • House prices
Mexico	CPI	Target	• Producer Price Index • CCI (Construction Cost Index) • ITPI (International Trade Price Index)
Netherlands	HICP	Index of reference in the definition of price stability (to compute the euro area average)	• Producer Price Index • Import Prices • House values
Poland	CPI	Target	• Agricultural Price Indices • Import price Index • Industry, services and construction price indices
Portugal	HICP	Index of reference in the definition of price stability (to compute the euro area average)	• Producer Price Index
Russia	CPI	Objective	• Wholesale price Index • Cost Indices • Import/Export prices

Table 1 – (continued)

Central Banks	Inflation measure	Target, objective, guideline, reference rate, indicator, benchmark	Other price indices[3]
Singapore	• Headline CPI • MAS underlying inflation (CPI excluding private road transport and accommodation costs)	Both inflation measures are used as a benchmark for monetary policy	• Import and Export Prices • Domestic Supply Index • Manufacturer Price index
South Africa	CPIX (CPI excluding interest rates on mortgage bonds)	Target	• PPI for imported goods, for domestically produced goods and for exported goods • Nominal unit labour cost • GDP and PCE deflator
Spain	HICP	Index of reference in the definition of price stability (to compute the euro area average)	• PPI • Quarterly labour costs • Import and Export prices • Agricultural prices
Sweden	CPI but in practice, UND1X is used (CPI excluding mortgage interest payments, indirect taxes, and subsidies)	Target	• Producer Price Index
Switzerland	CPI	Reference rate in the definition of price stability	• Producer Price Index • Import Price Index • GDP deflators • Unit labour costs • Unit value Indices
Thailand	Core inflation (CPI excluding raw food and energy products)	Benchmark	• Producer Price Index • Import/Export Price index
United States	PCE excluding food and energy	Guideline/indicator	• Producer Price Index • Import and Export Prices

for the US CPI, tends to make more adjustments for quality changes, to use a geometric mean at the lower level of aggregation[4] and a rental equivalence approach for measuring owner-occupied housing (see below and background notes for other sessions).

National account deflators may have fewer bias problems as their coverage is broader than that of the CPI. At the same time, they suffer from important shortcomings, especially in terms of timeliness and reliability. Indeed, national account deflators are typically only available on a quarterly basis and they are frequently revised. There is also the question of which national account deflator to use. The GDP deflator should measure the price of all goods and services produced domestically. However, as noted by Diewert (2002), imports – which account for a

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4   *The use of the geometric mean allows for substitution in contrast to a simple arithmetic average.*

growing proportion of the household expenditures as a result of globalisation – have a negative weight in the GDP so that a rise in import prices tends to lower the GDP deflator. One alternative would be to focus on GDP plus imports, sometimes referred to as "total domestic final expenditure" (Hill, 1996). However, this measure will include prices from the government sector (e.g. health and education), which are difficult to measure or estimate. It also includes investment, which does not reflect current consumption expenditures (Diewert, 2002). This would mean that the personal consumption expenditure index (PCE) would be most the suitable candidate amongst the national account deflators. This price index has been favoured by the Federal Reserve in the conduct of monetary policy, as it allows for substitution[5] across expenditure items and has a broader coverage than the traditional CPI. While the CPI's coverage is essentially limited to out of pocket expenditures, PCE also includes free financial services (e.g. checking/deposit accounts), employer-funded medical care and insurance as well as the prices of goods and services funded by the government such as medical services.

There has been much debate over whether asset prices, such as those for equity and real estate, should be included in official inflation measures from the perspective of monetary policy. As argued by Alchian and Klein (1973), an intertemporal consumption approach in the Irving Fisher tradition would require the inclusion of present and future prices of consumption. As the latter are not observable for most goods and services, asset prices could be used as an approximation of the cost of future consumption. As mentioned by Camba-Mendez (2003), this is not free from controversy. In particular, financial assets are claims on the capital of firms and consumption prices are not directly affected by changes in financial asset prices. As pointed out by Gilchrist and Leahy (2002), there are different factors which might create asset prices' fluctuations. According to the dividend discount model, asset prices might change, if economic agents expect higher profits for the future, while interest rates remain unchanged. Thus, asset prices might fluctuate for other reasons, unrelated to the cost of future consumption. For this reason, most economists would agree not to include equity prices in official inflation measures.

Some economists, like Goodhart (2001), argue that house prices should be included in the CPI. One argument is that fluctuations in house prices are more closely related to future output growth and future goods and services inflation than equity prices.[6] Another is that housing prices may be a good approximation of owner-occupied housing (OOH), which represents one of most important components of households' expenditures, but they are not often included in the CPI. The difficulties related to the measurement of OOH will be discussed in more detail in session 3. It should be noted here that the inclusion of house prices as a measurement of OOH might be problematic, as it is difficult to distinguish between its investment (asset) and consumption components. Moreover, the extension of the CPI basket to include house prices might affect the reliability, timeliness and the frequency of the inflation measure, as house prices are often subjects to important statistical revisions and are in general not available at the same frequency of CPI's (mostly monthly). The inclusion of housing assets in the CPI (as other measures of OOH) might also increase the level and the volatility of inflation, which might pose challenges for the conduct of monetary policy.

To overcome the difficulties related to the fact that measures of headline CPI may be rather volatile as they include prices for individual goods and services that are highly sensitive to special or transitory factors, central banks in a number of countries prefer to focus on so-called core or underlying inflation measures. These will be discussed in more detail in session 6. Whether such measures are useful for monetary policy depends crucially on the purpose for which such adjusted measures of inflation are calculated as well as on their statistical properties. It may not always be so clear at this stage how they are to be assessed against the criteria mentioned above, namely credibility, reliability, timeliness and comparability.

One way in which policymakers can avoid possible difficulties in choosing the most appropriate measure of inflation for monetary policy purposes would be to focus on a set of different inflation indicators rather than a single indicator, as a number of central banks do. Whatever approach is taken, it is imperative that central banks become fully knowledgeable of the methodologies used in calculating the various official price statistics in their country as well as how these compare internationally. Most central banks have therefore established a specialised unit to monitor and analyse domestic price statistics and also work closely with experts at national statistical institutes to understand particular methodological questions and how they can be

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5 *The PCE is constructed with a chained Fisher Index (superlative index, or ideal, for more information see session 5), defined as a geometric mean of, on the one hand, a Laspeyres, which uses the past year structure of purchase to weight disaggregated price indices and on the other hand, a Paasche index, which in contrast uses the current period quantity.*

6 *See also Cechetti et al. (2000) and Goodhart and Hoffmann (2000).*

resolved in the national context. As can be seen from the list of published papers compiled in preparation for the workshop, central bank researchers have produced and published an increasing number of analytical and academic papers on CPI statistics in recent years. More efforts may be needed, however, to further improve the transparency on the methodologies used in individual countries and to understand how these compare internationally.

Issues for discussion

- Which properties of official inflation measures are the most important from a point of view of monetary policy: credibility, reliability, timeliness, comparability, other? Should central banks favour CPI or GDP deflator measures? With respect to CPI, what are the advantages of having a COLI compared to a traditional COGI?
- Should asset prices be included in official price measures from the perspective of monetary policy? If so, in which ones and how?
- Should central banks focus on one single measure of inflation as a target, indicator, objective, guideline, benchmark or reference for monetary policy? What indicators other than CPI or GDP deflators would be most relevant?

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Inflation measures from a monetary policy perspective

Laurent Bilke (*European Central Bank*)

The ECB has chosen to formally define price stability and this relies on a single measure: the Harmonised Index of Consumer Prices, a Laspeyres-type index which does not include asset prices. The HICP meets the properties a central bank can expect from such an index (Camba-Mendez, 2003), i.e. credibility, reliability, comparability (notably across countries), and timeliness. In particular, the consumption deflator is not available at a frequency higher than quarterly in the euro area and it would therefore not have been suitable, at least for this reason. In practice, the European statistical institutes have adopted a pragmatic approach for the HICP, which aims at maintaining the representativity of the index, with regular updates of coverage and weights, chain-linking, and some quality adjustment. In addition, the ECB monetary policy strategy takes also into account the possibility of some measurement errors affecting the HICP.

Regarding the coverage of the index, housing rents are included, but not owner-occupied housing services. There are pros and cons to the inclusion of owner-occupied housing and a pilot project is currently conducted by Eurostat. Financial assets are excluded from the index, but this does not mean that they are not relevant for the assessment of risks to price stability in the context of the monetary analysis. The assessment of risks relies also on a broad range of price and cost indicators relevant for the economic analysis. In addition to a sectoral decomposition of HICP inflation, the ECB usually refers in its Monthly Bulletin to prices at earlier production stages (PPI-consumer prices, for instance). So-called core inflation measures have to be used with a particularly high degree of caution, since they are not considered to provide reliable leading indication of overall inflation developments (see "Diverse patterns in headline and underlying inflation" in the November 2005 ECB Monthly Bulletin).

Laurent Bilke (*European Central Bank*)

Alternative measures of inflation

Jeremy Rudd (Federal Reserve Board)

There are two principal measures of consumer price inflation in the U.S.; both are available at a monthly frequency. The first measure is the *consumer price index* (CPI), a modified Laspeyres index that is constructed by the Bureau of Labor Statistics (BLS). The CPI mainly covers out-of-pocket expenditures on consumer goods and services – owner-occupied housing is an important exception – with weights computed from a survey (the Consumer Expenditure Survey, or CEX). The second consumer price measure is the *chain price index* for personal consumption expenditures (PCE), a chained Fisher index produced by the Bureau of Economic Analysis (BEA) for use in the national accounts. The scope of this index is wider than that of the CPI (it seeks to capture the price for all consumption), and includes a number of imputed prices for various components of PCE. At the most disaggregated level, many of the individual prices come from the CPI (some also come from the PPI), and are combined using the PCE weights from the national accounts.

In addition to the CPI and PCE price index, the statistical authorities in the U.S. produce a number of other inflation measures. These include a producer price index (PPI) for goods at various stages of processing and selected services; import and export price indexes; and prices for construction output. These are combined to yield various broad inflation measures, including the *GDP chain price index*.

How does the Federal Reserve use these various measures? The Fed does not have an explicit inflation target, nor does it rely on a single principal inflation indicator. Rather, Federal Reserve staff monitor and forecast most major price indexes and their components; these projections are reported to the Board of Governors and the FOMC (who use them to assess the path of inflation). However, in the Fed's semiannual Monetary Policy Report to the U.S. Congress, the Board of Governors and Federal Reserve Bank presidents submit a range of projections for a single price measure.

The projected inflation measure reported in the Monetary Policy Report has changed over time. Originally, the FOMC's forecasts were in terms of the overall (headline) consumer price index (CPI). Starting in February 2000, the FOMC began reporting forecasts for the PCE chain price index. Finally, in July 2004, the FOMC moved to the core PCE price index (PCE prices excluding food and energy).

The FOMC identified several advantages of the PCE price index relative to the CPI. First, the PCE price measure uses a superlative index number formula, and so reflects the changing composition of spending. Second, the PCE price index's weights are based on a more comprehensive measure of expenditures. (Some analysts also criticised the accuracy of the CEX weights used in the CPI, though the effect of mismeasured weights is likely to be small.) Third, the PCE price index can be revised historically to reflect new source data and improved estimation techniques. In addition, the switch to the *core* PCE index was justified on the grounds that it was "…better as an indicator of underlying inflation trends" than overall PCE prices.

Nevertheless, the PCE chain price index also has an important disadvantage that affects its use in real time and at higher frequencies. Specifically, the imputed or "nonmarket" prices in the PCE can be quite volatile, and the source data for several nonmarket components are not available in a timely manner. Therefore, Board staff also monitor a "market-based" PCE measure that strips out the nonmarket price components (note that owner-occupied housing is considered a "market" good for this purpose). Originally, a market-based series was constructed by Board staff for internal use; later, the BEA began reporting an official series. However, even this alternative measure must be interpreted with caution, as the exclusion of the nonmarket components of overall PCE could make the market-based series' weights unrepresentative of the aggregate consumption bandle.

In assessing the merits of alternative inflation measures, it is important to recognise that many commonly used U.S. inflation series tend to move together in the long run. *Inflation rates* for consumer price measures tend to be cointegrated (though price *levels* are not), while GDP price inflation appears cointegrated with headline consumer price inflation (but perhaps not with core inflation). That said, in the short run, these inflation measures can differ significantly. Hence, it remains necessary and useful to monitor various measures and explain any discrepancies as they arise. Indeed, when the FOMC moved to reporting the PCE price index in the Monetary Policy Report, they clearly indicated their continued reliance on "... a variety of aggregate price measures, as well as other information on prices and costs, in assessing the path of inflation."

Jeremy Rudd (Federal Reserve Board)

Inflation measures from the perspective of monetary policy: The case of Brazil

Jose Ricardo da Costa e Silva (Central Bank of Brazil)

This paper describes the type of inflation measure central banks would prefer to monitor, with special focus on the Brazilian experience in the last couple of years.

The Central Bank of Brazil, like many other central banks and monetary authorities, is mainly a user of CPI measures. Nonetheless, the long period of high inflation rates, in addition to the experience with many economic plans to stabilize prices in the economy, made the central bank take a lot of interest in the concepts around the CPI that were useful during their implementation of the inflation targeting regime, almost eight years ago.

CPI inflation (12 months)
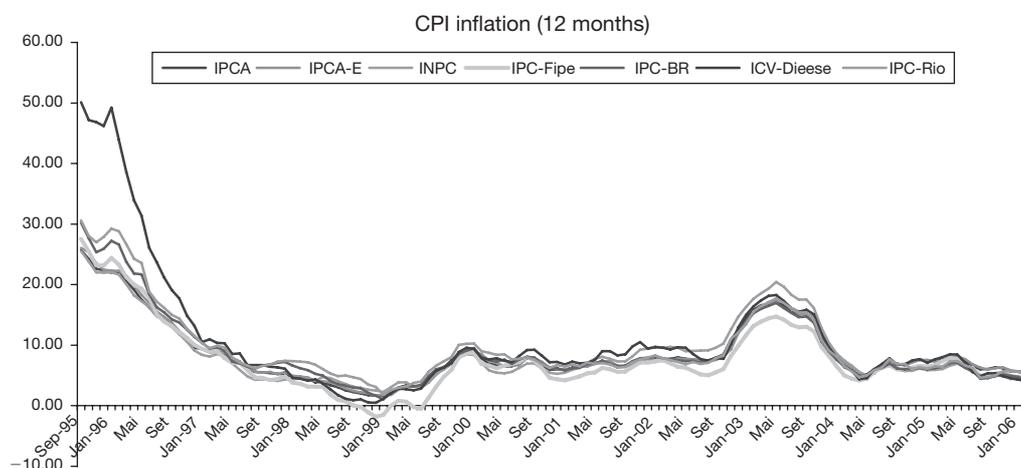
Owing to the long period of high inflation, various CPI measures started to proliferate in Brazil. Besides the indexes published by the official bureau of statistics, the IBGE, some CPI measures were created by private institutions, as occurred with DIEESE – (an institution linked with labour unions), FIPE (a think-tank of University of São Paulo) and FGV (a private think-tank). This phenomenon provided Brazil with several consumer price indexes, as can be seen in the above graph. This abundance, in association with some discredit of the price indexes themselves, created a problem during the time of choosing which price index would be used as a reference measure of inflation when the inflation targeting regime was being implemented, in 1999.

Additionally, there was the issue of using headline or core inflation measure. This second issue was more important and easy to solve. The Central Bank of Brazil and the Minister of Finance agreed that the main pillar of the new monetary policy regime should be transparency and credibility. They also agreed that the adoption of a core inflation measure would bring the perception that the inflation followed by the Central Bank of Brazil was not necessarily the one that people read in the price indexes of the economy. They then decided to use headline inflation. The alternative of using a GDP deflator instead of a consumer price index was easily discarded, once our GDP deflator is mainly calculated yearly, and the quarterly measures are gross approximations. Furthermore, there was (and, in fact, still there is) a lack of theoretical and empirical support for using a GDP deflator.

Summing up the above thoughts, the problem reduced itself to a choice of which CPI headline inflation should be monitored. In turn, the solution was to use IPCA, a CPI measure that is used to involve a large amount of population, both in terms of geography and income range. This is calculated by IBGE, the Federal Bureau of Statistics, and embraces households with monthly income, from any source, ranging from 1 to 40 minimum wages, living in 11 urban areas, 9 of with metropolitan areas (such as São Paulo and Rio de Janero) and two cities (Brasília and Goiania) and one, a state capital (Goiânia). One alternative CPI would be INPC, which is

also calculated by IBGE, but it contains a lower range of wages, the same being true for all other available CPIs.

A stylized fact about price indexes is that over the time they tend to converge on a closer movement. In the Brazilian economy this is not different, as one can observe in the previous graph. Furthermore, one can see that the IPC-Fipe presents the lowest change over the recent past.

General and whole price inflation
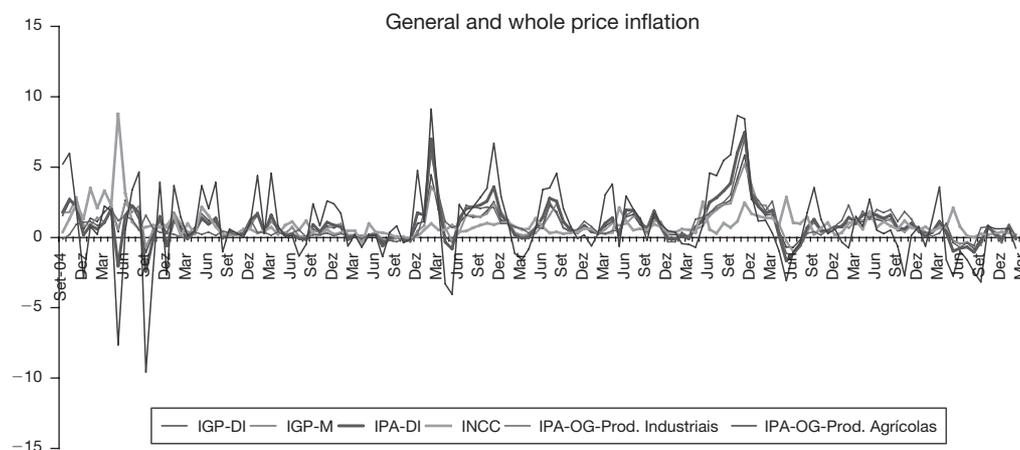
As pointed out earlier, the Central Bank of Brazil closely monitors the developments of the IPCA in order to subsidize its monetary policy decisions. However, it also looks at the behaviour of several other price indexes, since they are expected to bring some antecedent information useful to policy decisions. Good examples of these are the general and whole price indexes shown in the above graph. The evidence suggests that the IPA, the whole price index calculated by Getulio Vargas Foundation and the most important component of the IGPM, the general price index also calculated by this think-tank, shows some degree of causality (in Granger's sense) with regard to IPCA, mainly its industrial part. By the way, a bivariate VAR using IPA and IPCA indicates that the behaviour of the IPA should be closely monitored in order to understand better what may happen in the future with the IPCA. Besides this, a multivariate VAR using the components of IPA (raw materials, intermediate goods and final goods) also support this evaluation.

IPA-PI × IPCA
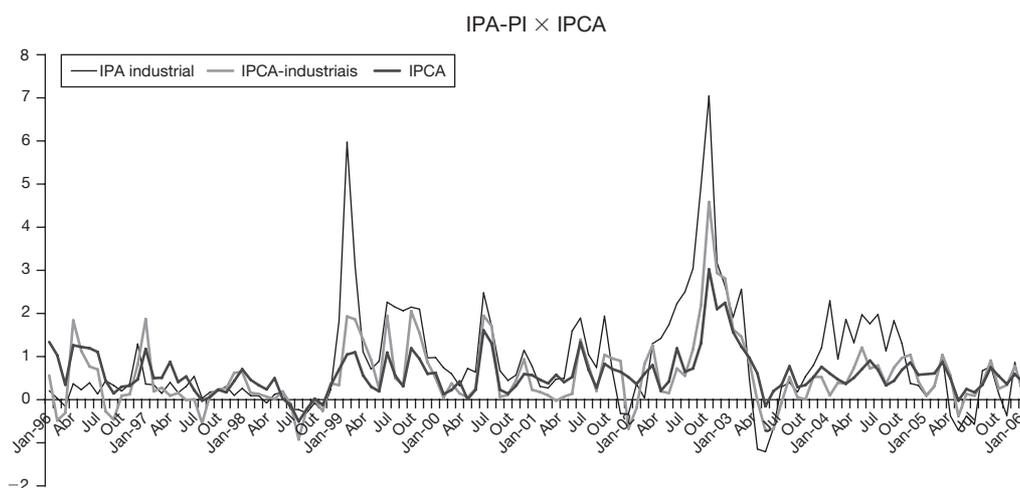
In another dimension, the Central Bank of Brazil monitors several measures of core inflation (using trimmed means and exclusions). Despite being somehow useful, they have not given the expected information, in theoretical terms, regarding to headline inflation trends in medium and long term.

Monthly core inflation measures

IPCA

Exclusion

Smoothed trimmed mean

Trimmed mean
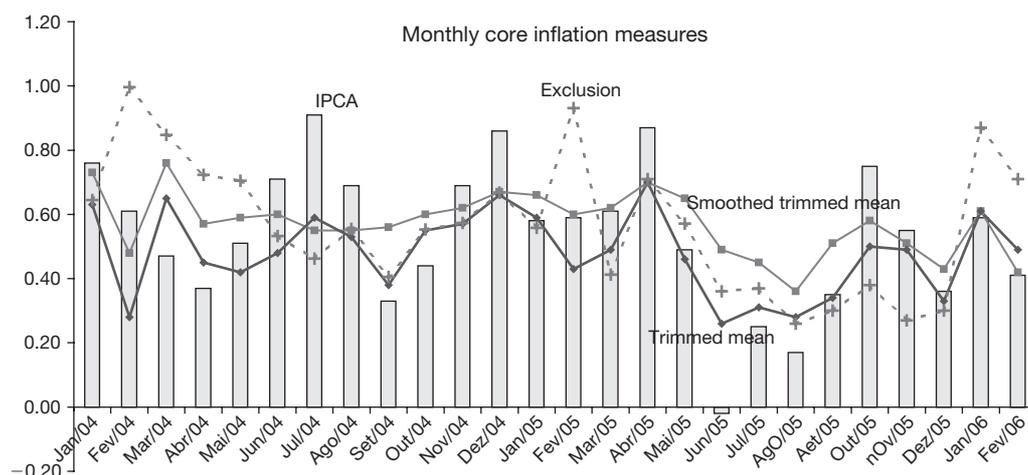
Finally, one aspect associated to price indexes in Brazil is the relationship between monitored and market prices. Monitored prices have been increasing faster than market prices for a long time and are out of reach of monetary policy decisions in the short term, since they don't answer the traditional transmission mechanisms, but the exchange rate channel. Some important monitored prices, such as gasoline, follow international prices and so, present a great pass-through from the exchange rate. Due to their contractual arrangements, they also show a backward-looking behaviour stronger than the market prices. Therefore, the Central Bank of Brazil uses market prices in most of its forecasting models. These forecasts are then put together with the previews of the monitored prices made by specialists (both from the public or private sectors) and published as IPCA inflation forecasts that guide the monetary policy decisions.

Jose Ricardo da Costa e Silva (Central Bank of Brazil)

Summary of discussion

The *desirable properties* of inflation measures were discussed, namely: credibility, reliability, timeliness, and comparability. While most tend to think of these properties as being consistent (if a property is more reliable, then there is the assumption that it is also more credible), there are trade-offs. For example, enforcing quality adjustment reduces measurement bias, but it increases perception bias. Because economic agents do not see prices being corrected for quality adjustments, the prices can influence their perception and can result in a trade-off between reliability and credibility.

In the past, an argument was made that the conceptual framework for HICP reflects its origin as a compromise between statistical agencies and is in fact in many ways internally incoherent. This is because in order to perform quality adjustments, one must make reference to welfare and utility, in which case one moves towards a cost of living concept. Yet the HICP manual explicitly states that a cost of living index is not being aimed at. How can quality adjustments be justified unless one thinks in terms of welfare and utility? This raises questions about the value of the HICP.

The question whether one can make sensible intertemporal comparisons of prices unless quality adjustments are made was discussed. The CPI manual takes a theoretical cost of living approach to this matter. A formal theoretical framework is necessary for an ideal benchmark. It is vacuous to argue that there are no substitution bias and quality changes simply because they were measuring a fixed basket of goods, where the basket of goods could be measuring something that is no longer relevant. There are two schools of thought: in the Cost of Living approach, one argues about quality changes, and this corresponds to the argument regarding the worth of a good in the Cost of Goods approach. Between these two perspectives (approaches), analogous arguments are also made for utility vs. the standard of living, and substitution bias vs. consumer preferences, respectively. Even though the conceptual frameworks are at odds with one another, in practice it does not matter which concept is chosen because the manual ensures that the practical outcomes are consistent with one another. The cost of living approach provides a solid theoretical benchmark for assessing consumer price indexes; however, in practice one cannot produce an exact cost of living index. Such an index instead provides a very good theoretical benchmark for assessing consumer price indices.

Regarding the treatment of *asset prices*, concern was expressed as to whether adding asset prices in the CPI would add volatility to the index, on the grounds that property price increases would have an effect on the perception of wealth, which in turn has an indirect impact on consumption. Since the CPI is rooted in the SNA concept, it deliberately excludes asset prices. One reason why many central banks monitor the CPI despite its exclusion of asset prices, rather than the GDP deflator, is because of its high profile, its timeliness, reliability, and the confidence it brings. It is these pragmatic reasons (and not conceptual ones) that underline the use of the CPI. It is difficult to argue in terms of monetary policy the advantages of using the GDP deflators over the CPI, or vice versa.

A paper by Alchian and Klein was discussed, which described the intertemporal index as an extension of the Cost of Living Index (COLI). This is a static maximisation problem which the household extends to a dynamic intertemporal maximisation problem. The COLI covers current goods and services prices, and asset prices as a source for future expenditure by consumers. These asset prices include not only marketable asset prices, but also intangibles like human capital which are considered to be sources of future income for the household. This poses a practical concern as it is difficult to cover such a broad range of asset prices in a precise manner.

Focusing the discussion of asset prices onto house prices, it was noted that because of the huge differences in housing characteristics in the Euro area, introducing a housing component into the index in order to compare inflation dynamics across countries would add to its variability. With regards to communication, the issue arises whether households really understand what inflation is and how it relates to them. In fact, the Bank of Italy is currently working on a research project which surveys households on this exact question. Preliminary results are not encouraging and the final results will be available after this summer. On this subject, it was argued that the similarly structured Harmonized Index of Consumer Prices (HICP) allowed for more comparability. The weights of HICP components were country-specific, and this addressed the issue of varying housing structures across the Euro area which would make it unnecessary to remove the housing component to compare HICP figures across the area.

Regarding whether only *one measure of inflation is sufficient*, it was noted, with reference to the United States, that because of the communication issue, only one number is discussed before Congress, even though internally there are over twenty pages of price forecast tables which are tracked on a monthly basis. The monthly PCE index, which lags two weeks behind the CPI, can be revised substantially over the course of the GDP production process. If one were to focus on that only one measure, one has to choose the best measure possible, and to be able to justify why that particular measure was chosen over another. Whether the general public or Congress understands the reasoning behind the measure selected is uncertain. The monthly CPI number is still more popular than the PCE. Some analysts and others who follow the PCE understand the difference between the two. The significance of the PCE has to do with how it feeds into the Monetary Policy process; however, the CPI is important for indexation issues that concern many economic agents.

SESSION 3

The measurement of housing services in the CPI

Chair:	Javier Salas (Banco de Mexico)
	Background note and key issues for discussion
Papers:	**The treatment of owner-occupied housing in the harmonised index of consumer prices** Martin Eiglsperger (European Central Bank)
	Measurement of housing services in the CPI: **The measurement of owner-occupied housing in Sweden** Jesper Johansson (Sveriges Riksbank)
	The measurement of housing services in the CPI: **The case of Hong Kong** Li-Gang Liu (Hong Kong Monetary Authority)
	Summary of discussion

Background note and key issues for discussion

The proper measurement of housing services in the Consumer Price Index has been an area of intense controversy for decades and still constitutes one of the most important challenges facing CPI compilers at this moment. The accurate calculation of this CPI component is of major importance, as it accounts for a large, if not the single largest, share of total consumption expenditures. Housing services include rents and owner-occupied housing, but also other expenses such as maintenance and repair costs. Incorrect valuation methods might therefore impair considerably the reliability and credibility of the CPI. Furthermore, significant differences in the way in which housing services are included in the CPI may weaken significantly the international comparability of CPI measures.

Rental values

In general, the measurement of rental values tends to be broadly similar across countries, as CPIs compilers rely, to a large extent, on surveys of households or on information from private rental companies to track the evolution of rents for non-social housing. For rents of social housing, information is obtained from administrative records or from social housing institutions. The weight of rental values is generally determined on the basis of Household Expenditures Surveys. It varies considerably across countries, reflecting in part consumer preferences but also housing/rental market regulations. For instance, the rent index currently represents 2.3% of the total CPI in Spain, while in Argentina it accounts for 12.7%.

Measuring rental values accurately is nevertheless a complex process. This arises from the heterogeneous nature of dwellings, since rents depend significantly on the characteristics of dwellings such as their size, age and available equipment. Location also plays an important role. Moreover, deprecation and renovation tend to affect the quality of homes/flats over time. The difficulties of appropriately measuring rental values in the CPI have been illustrated by various studies. In the US, Cron et al. (2000) have reported evidence that housing costs in the US have been underestimated for the rental values over the period 1985–1998 in the official CPI statistics. In Germany, Hoffmann and Kurz (2002) have also found evidence of an understatement of the rent inflation component for West Germany in the early 1990s.

Owner-occupied housing

The measurement of *owner-occupied housing* (OOH) is coming under close scrutiny in most countries, in the US and in Europe in particular, given recent house price booms. There is so far no consensus among CPI compilers, economists and central bankers, whether to include this item of housing costs or not in official CPI statistics, and, if so, how to account for it. There are indeed substantial differences in the treatment of OOH across countries. Reflecting probably the difficulty to accurately measure OOH, this component of housing costs is simply not included in the CPI in many countries, even when it constitutes a significant proportion of households' expenditures (see Table 1). In addition, in countries where OOH is included, there are important differences in the methods used to value this cost. Furthermore, the measurement of OOH has changed over time in various countries, including in the United States where the Bureau of Labor Statistics has modified the measurement of OOH on several occasions.[1]

The four main conceptual approaches to record OOH in the CPI are the user cost, rental equivalence, net acquisition and payment methods. The user cost and the rental equivalence methods refer to the "use" or "consumption" of housing services. They are based on the idea that consumers buy

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1 *Before the 50's, OOH was not included in the US CPI, but the after the World War II, there was a substantial rise in homeownership, so that about half of the households owned a dwelling in the early 1950. At this time, the BLS opted for an asset approach—which included the price of the asset and the cost of money used to purchase the asset. In January 1983, the BLS, under the recommendations of the Price Statistics Review Committee (PSRC) of the National Bureau of Economic Research, decided to switch to a rental equivalence approach. Since then, the BLS has adjusted this approach several times to capture rental-equivalence OOH.*

Table 1 – The treatment of housing services in the CPI

Central banks	Rental values			Owner-occupied housing		
	Collection practices	Weight (%)	Is OOH included?	Valuation methods for OOH	Weight (%)	
Argentina	• survey carried out in a sample of rented houses	12.70	No	–	–	
Australia	• survey obtained from real estate agents for privately owned dwellings in the metropolitan areas of capital cities. The sample is stratified based on geographical location, size and wall type • rent for government housing are derived from information provided by housing authorities	5.22	Yes	Acquisition approach (excluding land, new dwellings)	11.21	
Belgium	• weight is based on the household survey • social rent index is based on data collected from a representative number of social housing institutions in each province • non social rent index is computed on the basis of a monthly survey of a fixed sample of 1800 accommodations	6.39	No	–	–	
Brazil	• survey from house to house (not very important) • survey from major private rental companies	3.80	No	–	–	
Canada	• monthly survey of tenants, based on the framework of the Labour Force survey (15,000 dwellings)	6.14	Yes	User cost approach	15.98	
China	n.a.	13.00[2]	Yes	User cost approach	n.a.	
Euro Area-BCE	• weighted average of the member states	6.32	No	–	–	
France	• survey of households	6.14	No	–	–	
Germany	• price survey	21.17	Yes (only national CPI)	Rental equivalence	n.a.[3]	
Hong Kong SAR	• public rental values: administrative records • private rental values: survey	29.86	Yes	Rental equivalence	n.a.	
India	–	–	–	–	–	
Indonesia	• survey (Cost of Living and routine survey of prices)	26.25[4]	No	–	–	
Italy	• *Ad hoc* quarterly surveys (large sample of houses, 12,000)	2.70	No	–	–	
Japan	• monthly price survey for selected areas for 22,000 rental units (rotation over time)	3.48	Yes	Rental equivalence	13.60	
Korea	• rents are collected monthly from households as a part of the Family Income and Expenditure survey	13.14	No	–	–	

Table 1 – (continued)

Central banks	Rental values		Owner-occupied housing		
	Collection practices	Weight (%)	Is OOH included?	Valuation methods for OOH	Weight (%)
Malaysia	• quarterly survey	n.a.	No	–	–
Mexico	• samples of rents and cost of residential construction • direct sampling on the households (5,000 monthly)	2.52	Yes	Rental equivalence	11.97
Netherlands	• yearly mail survey (panel of 3,500 dwellings)	6.69	Yes (only national CPI)	Rental equivalence	9.13
Poland	• based on actual household expenditures	4.54	Yes	Rental equivalence	11.97
Portugal	• rents are administered	2.02	No	–	–
Russia	• price survey to households and real estate firms	12.53[5]	No	–	–
Saudi Arabia	–	–	–	–	–
Singapore	• rent survey conducted by DOS • data obtained from relevant public sector agencies	14[6]	Yes	Rental equivalence	–
South Africa	• prices survey done a private-sector research agency (house rent, flat rent and town house rent)	4.27	Yes	User cost approach	13.94
Spain	• survey (sample of dwellings which covers the whole country, selected and updated on the basis of the Labour Force Survey)	2.31	No	–	–
Sweden	• quarterly mail survey to landlords (rents for apartments). Annual re-sampling	10.75	Yes	User cost approach	16.07
Switzerland	• quarterly survey of about 5,000 residences, with an 1/8 of the sample renewed each quarter	18.72	No	–	–
Thailand	• survey of a housing sample divided into six sub-groups and prices are obtained every 6 months	16.74[6]	Yes	Rental equivalence	–
United States	• survey to a sample of households (50,000 landlords and tenants) • rental values are quality adjusted	5.83	Yes	Rental equivalence	23.44

2 *This figure represents the component "Residence", which contains among others water, electricity and fuels, house construction and decoration materials and house renting. No breakdown is available for the sub-components.*
3 *OOH is included in actual rent.*
4 *This figure includes rental values but also water, electricity, gas and fuels.*
5 *Includes rental values, water, electricity, gas and other fuels.*
6 *Includes rental values and owner-occupied housing.*

a dwelling at the beginning of the period, consume it and sell it at the end of the period. They therefore tend to measure the costs of using or consuming the housing stock for shelter purposes. These two methods differ nevertheless in their practical implementation. The *rental equivalence approach* approximates the cost of OOH by estimating the rent that consumers would pay if they had to rent their residence instead of owning it. In principle, the coverage of OOH should be relatively complete

under this method, though it requires a broad and well-developed rental market, with broadly similar types of dwellings as in the non-rental housing market and which is not subject to strong regulation or government controls (e.g. rental price setting and contract conditions). The *user cost approach* tries to include the most relevant items of the cost of house ownership such as interest payments on mortgages, depreciation, opportunity cost of owning rather than earning income by investing elsewhere, unrealised capital gains, repairs and maintenance, taxes and insurance. While this method covers all relevant costs associated with OOH, it presents some drawbacks. First, imputed opportunity costs are considered to be outside the scope of the CPI. Second, from the perspective of monetary policy, the inclusion of mortgage interest payments might be problematic. Indeed, if the central bank decides to increase short-term interest rates to reduce inflation, the presence of mortgage interest rates in the CPI basket might result in an initial increase in measured inflation rates. This effect might be important in countries with a large share of variable-rate mortgages and with significant indexation mechanisms that could exacerbate the initial shock.

The *payment approach* measures the outlays actually made during the period under consideration regardless of whether the owner-occupied dwellings were delivered (acquired) or consumed during this time. It includes funds used for acquiring the dwelling (purchase price, including the price of land) as well as mortgage interest payments and repayments. Similar to the user cost approach, the inclusion of the mortgage interest payments may not be welcome from the perspective of monetary policy.

Finally, the *net acquisition approach* measures the average price changes of purchased owner-occupied dwellings acquired by households, regardless of whether the dwelling is actually paid for. In that regard, it differs significantly from the payment approach. This approach mainly includes the price of newly constructed properties[7], as it covers the transactions between households and other sectors of the economy, and excludes purchases of existing dwellings from other private households (from there the "net" concept). It also includes repairs and maintenance costs, insurance and fees for real estate agents. Under this approach, the coverage is by definition limited, and the movement of this component will reflect to a large extent construction and maintenance costs, in particular when the price of land is excluded. Most CPI compilers, opting for the net acquisition approach, do prefer to exclude the land, as it is often argued the land is not consumed and that it represents an investment. However, it might be rather difficult to exclude the land from house prices, as it requires relatively detailed data on the land prices. That the coverage is rather limited is an important disadvantage of this approach as is the fact that it is difficult to distinguish between the asset/investment component of the purchase of newly constructed properties and its the consumption component.

Various studies[8] have shown that these different methods deliver, in general, different results, not only in terms of price evolution but also in terms of weights. In particular, under the net acquisition approach, the weight will be relatively small compared to the other three valuation methods, since it represents the net purchases of the household sector of houses from other institutional sector in the base period. For rental equivalence, on the other hand, weights are in general taken from the national household budget survey and thus, they are derived from owner-occupied assessment for owner-occupied housing. For the user cost approach, statistical agencies usually impute the weights based on repairs and maintenance, taxes, insurance and mortgage interest rates. Finally, under the payment approach, weights are derived from all the actual payment made in the base period, irrespective of the moment of the purchase.

Therefore, the use of different methods across countries might also weaken cross-country comparisons of CPI measures. It would be useful if more consensus could be achieved on the best or, at least, the most appropriate practice to measure OOH. This would also contribute to improving the credibility of CPIs. Leifer (2006) has argued that the choice of the method for capturing OOH depends on whether the basket of goods is formed by goods that have been "used", "acquired" or "paid" in the base period. In particular, if the objective is to measure the cost of living, then the rental equivalence or the user cost approach should be used. If, in contrast, the goal of the CPI is to measure household monetary expenditures, then the (net) acquisition approach should be preferred. It should be recognised, however, that there is currently no consensus on this issue at the international level.

Whether to include OOH in national and, in particular, in the harmonised CPIs of member states is currently being extensively debated in the European Union. Homeownership costs are so far not included in the HICP, which might considerably impair cross-country comparison as

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7 *It might in some cases also include second-hand dwellings from other sectors. For instance, a local government may sell rental dwellings to the occupying tenants.*
8 *See for instance ECB (2005), R. Johanessen (2004).*

the share of tenants varies significantly among EU countries. In addition, the non-inclusion of OOH in the inflation measure might affect the credibility of the (H)CPI, in particular in countries with a high share of tenants. On the other hand, it has also been argued that the inclusion of OOH in the HICP might impair timeliness, the reliability and frequency of the HICP. In addition, concerns have been raised that including OOH might increase the level and volatility of inflation and to some extent, inflation differentials in the euro area. To address this issue, Eurostat is conducting a feasibility study to assess the impact of including OOH in the HICP based on the net acquisition approach, which is seen to be most consistent with the conceptual framework of the HICP (a price index for final household monetary expenditures). The first results of the pilot study are expected to become available in 2008 and, based on these, a decision will be made whether to include OOH in the HICP.

It is unclear how significant the question of OOH is for countries outside the EU. As already indicated, the measurement of OOH in the US CPI has undergone a number of revisions in the past and a rental equivalence approach is currently used to calculate this CPI component. This approach is also used in Japan, Hong Kong, Mexico, Switzerland, The Netherlands and Thailand. In Australia, a net acquisition approach is used. In China, Canada and South Africa, OOH is valued according to a user cost approach. In many other countries such as Argentina, Brazil, Indonesia, and Europe (HICP), the OOH is currently not included in the official CPI. Given recent and prospective movements in house price indices in many countries, the measurement of housing services in the CPI, and OOH in particular, is likely to continue to remain an important issue for CPI compilers as well as monetary policymakers.

Issues for discussion

- How satisfied are central banks with the quality of the measurement of rental values in the housing component of the CPI?
- What would be the best or most appropriate method to capture OOH? Can a consensus be found on this at all or does it depend on the structure of the housing market or on the CPI concept used? Is a particular approach to be preferred from the perspective of monetary policymakers?
- What are, or would be, the implications of the inclusion of OOH for the level and volatility of CPI measures (i.e. user cost and payment approach)? Does the inclusion of mortgage interest payments in the OOH cause particular problems for monetary policymakers?
- Would a more generalised inclusion of OOH in the CPI of individual countries improve or impair international comparisons of CPI measures?

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The treatment of owner-occupied housing in the harmonised index of consumer prices

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1. Background and current situation

The Harmonised Index of Consumer Prices (HICP) plays a prominent role in the monetary policy strategy of the European Central Bank (ECB), which defines price stability as a year-on-year increase in the HICP for the euro area of below, but close to 2%. As a consequence, the ECB has closely monitored and assessed the impact of conceptual changes on the HICP. A very important and difficult conceptual issue which has not been finally decided upon is the treatment of expenditure on housing by homeowners. While the HICP already covers the expenditure of tenants (mainly rents), most of the expenditure of owner-occupiers on housing (OOH), i.e. expenditure by the homeowner for purchasing or using a dwelling, for major maintenance and repair, and for related insurance costs, are not included in the HICP at present. This can be traced back to the different practices of treating OOH in national consumer price indices (CPIs), reflecting structural differences between national housing markets and also – to some extent – the different purposes for which these non-harmonised national indices have been constructed.

Since September 2000, Eurostat has carried out a pilot project that aims at developing estimates for the OOH component in the HICP. Eurostat is targeting the year 2008 for a final decision. At the same time, given that housing prices in some euro area countries (e.g. Spain, France, Ireland, Italy) have increased markedly in recent years, concerns have been raised that including OOH in the HICP could have a substantial impact on the overall HICP. Moreover, depending on the method chosen for treating expenditure on OOH, its coverage in the HICP may increase the volatility of this index. In this context, the potential impact of including OOH in the HICP was recently estimated in various studies, conducted by e.g. the OECD and commercial banks.[2]

2. Covering owner-occupied housing in the HICP or excluding it?

Three arguments are typically put forward *in favour* of including OOH in a consumer price index. First, a broad coverage of household consumption is considered important for the relevance and credibility of any CPI, in particular for a basic need and service as housing. Second, the share of households that occupy their own house is substantial in the euro area (60%) but varies considerably across countries, so that including only rents in euro area and national HICPs significantly reduces their comparability. Third, as the household consumption and the household consumption deflator concepts used in the national accounts include a component for owner-occupied housing, including it as well in the HICP would facilitate a consistent analysis and forecasting of economic growth and inflation, and of the HICP and the private consumption deflator.

However, these arguments are less clear-cut than it might appear at first sight. First, there are national CPIs with a high credibility that do not include OOH. Second, against the EU cross-country comparability argument it can be objected that different owner-occupier shares reflect different preferences and institutional arrangements across countries, and these are to be reflected in HICPs. Moreover, there is no single method of implementing OOH into the HICP that ensures a full international comparability, since the methods used in (non-EU) countries'

CPIs vary widely. Finally, while consistency with the national accounts is desirable, one may also point to the different purposes of national accounts and CPI statistics.

The main arguments that are mentioned *against* including OOH are that investment expenditures for purchasing a house and the recurrent costs of owning it (e.g. mortgage interest payments) are considered to be outside the scope of a CPI. A further argument is that its measurement is relatively cumbersome and that comparable methods are hard to achieve.

However, these arguments are at least equally disputable. First, it may harm the credibility of a CPI if the single most important purchase of a household (and one which is made for the purpose of consuming housing services) is excluded from the CPI's coverage. The distinction between other consumer durables which are covered by all CPIs (e.g. furniture, cars) and a dwelling is also not clear-cut. Second, if the purchase of a house is considered an investment, then the related use of owner-occupied services should be treated as household consumption. Finally, if measurement issues were considered to be of overriding importance, many other items could be excluded from CPIs (e.g. various types of services).

Since the start of the HICP in 1995, the ECB has supported the coverage of OOH mainly in view of the desirable broad coverage of HICPs and the cross-country comparability of housing cost coverage. The following chapter explains the main alternative methods to cover OOH.

3. Methods of including owner-occupied housing in consumer price indices

There are three main approaches to include OOH in the HICP, the use, the payment and the net acquisition approaches.[3] Moreover, some "hybrid" practices exist, which are added for the sake of completeness. Since the three main approaches are based on a different understanding about what an CPI-component on OOH should encompass and at which point in time OOH costs become relevant for homeowners, they "… should not be regarded as rivals, they are different answers to different questions."[4] Against this background it is clear that the main purpose for which a consumer price index is constructed also plays a role when deciding on how to treat OOH.

3.1 Use approaches (consumption approaches)

Generally, the use approaches – also denoted as the consumption approaches – aim at quantifying each month the costs of consuming a product, covering the life-time of the product, in which it provides services to its user. For most goods and services, user costs are quantified by referring directly to purchaser prices, because the timing of the purchase and the consumption virtually coincide. However, according to this approach, consumption costs for durable goods have to be distributed over the whole period in which the product is used.

For OOH, the use approaches require an estimation of the costs of *using* the housing *stock* for shelter purposes. An owner-occupied house or flat provides a permanent flow of shelter services which is consumed by its owner over the time of its use. The use approaches abstract from *when* actual expenditures are made, and *whether* expenditures are made at all, i.e. they do not provide direct information about the development of transaction prices. Instead, the user cost approaches distribute actual and imputed costs borne by homeowners over the time of its use. In particular for CPIs used for compensation purposes (e.g. indexing wages), a use approach is often preferred.[5]

Quantifying user costs requires the estimation ("imputation") of the value of monthly consumption flows. Thus, the shelter prices derived from these values are not necessarily related to market transactions and cannot be directly derived from matching observed price data. Instead, these components are quantified by modelling the costs for owner-occupation (user cost approach), or by referring to observed rent prices (rental equivalence approach).

3.1.1 User cost approach

The user cost approach adds up each month's actual and imputed costs for owner-occupation. In a simplified formula, user costs (*UC*) can be written as follows:[6]

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3   *The literature on owner-occupied housing does not always use the same terminology and classification. For our remarks we refer to the international consumer price index manual, chapter 10: "Some special cases" in: ILO et al. (2004), pp. 179–205. Further information is included in chapter 23 "Durables and user costs".*
4   *Turvey, Ralph (2000), p. 159.*
5   *See, e.g. Leifer, Hans-Albert (2001), p. 311.*
6   *The formula is taken from ILO et al. (2004), p. 180.*

$$UC = rM + iE + D + RC - K.$$

In this comprehensive version, user costs encompass interest payments on mortgages (rM), opportunity costs in the form of the foregone income that could have been realised if funds tied up in the house had been invested in a financial asset (iE), depreciation (D), other recurring costs (RC) like taxes, payments of insurance premiums and expenditures on minor repair, and – with a negative sign – capital gains (K) which reduce user costs in case of an increasing market value of the dwelling. These costs can be interpreted as the costs borne by the household for purchasing the dwelling at the beginning of a period (i.e. month) and living in it during the period, less the returns for re-selling the dwelling at the end of the period.

Homeowners' total payments on mortgage interest (rM) are usually estimated by making simplifying assumptions about the share of the purchaser price, including the price for land,[7] financed by a mortgage, the mortgage profile and the respective interest rates for making this approach operational in a monthly and timely CPI.

Depreciation is usually estimated by multiplying the current market value of the dwelling stock used for OOH by a standard depreciation rate which tends to be held constant over a long period. A commonly used source for updating the value of dwellings are house price indices which also provide information about unrealised capital gains and losses. When calculating the value of depreciation, land prices have to be excluded, as land is not used up over time.[8] Deriving the value of the housing stock and its development over time from house price indices usually requires the assumption that *transaction* prices for dwellings provide representative information about the value of the entire dwelling *stock*.

The main advantage of the user cost approach is that it covers all relevant costs, since opportunity costs for the funds tied up and potential capital gains or losses may also be relevant when deciding about purchasing a dwelling for owner occupation. As a consequence, the CPI weight for OOH is typically high when the complete user cost approach is applied. However, inclusion of imputed and opportunity costs are outside the concepts used for treating other CPI items. An argument against the consideration of mortgage payments is that for all other CPI items consumer financing costs are not taken into account.[9]

Although the depreciation component is closely related to house prices actually paid, a user cost index can show a significantly different development from that of a house price index. For example, if mortgage interest rates increase, user costs would also increase due to higher mortgage interest payments. By contrast, the demand for houses would most likely be negatively affected, i.e. house prices may decline.

The coverage of interest payments, foregone interest revenues and non-realised capital gains implies a potentially high volatility of a user cost index. User costs may even be negative in times of high house price inflation, due to the component for non-realised capital gains.[10] Implementing a user cost approach in practice requires a comprehensive data set on house prices – with and without land – depreciation rates, profiles of outstanding mortgages, etc. Some countries therefore use simplified versions of the user cost formula, usually excluding opportunity costs for non-realised capital gains and equity.[11]

Box 1 – The user cost approach in selected national CPIs: Canada and the UK

Statistics Canada's variant of the user cost approach comprises costs on depreciation, mortgage interest payments, property taxes, homeowners' insurance premiums and homeowners' repair.[12] Additionally, transaction and condominium charges and payments on mortgage insurance are covered. Capital gains and foregone interest income are not covered, because it is regarded that such notional costs are only relevant when deciding on an investment, but not for consumption purposes.

The national statistical institute of the *UK* applies the user cost approach for its Retail Prices Index (RPI), which was the headline consumer price index before 2004.[13] The flow of services provided by dwellings to their owners is quantified by adding up mortgage interest payments,

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7 *For a detailed presentation in formula terms see Diewert, Erwin (2003), pp. 27–28.*

8 *See, e.g. Diewert, Erwin (2003), p. 28.*

9 *The same argument applies to the payment approach (see section 4.2), which also covers expenditures on financing. Covering financing costs only for dwelling purchases but not for other (durable) consumer goods is, however, not consistent. See Goodhart, Charles (2001), p. 350.*

10 *See Johannessen, Randi (2004), p. 9.*

11 *The South African and the Swedish CPI are examples of applying the user cost approach including foregone interest income for funds tied up in the value of the dwelling. Non-realised capital gains are not covered by any user cost index implemented in CPIs. See Baldwin, Andrew and Mansour, Emad (2003), p. 4 and Ribe, Martin (2003), pp. 2–3.*

depreciation and council tax payments. The profile of outstanding mortgage payments is derived from a time series of house price data covering the past 23 years. The interest rates applied for quantifying mortgage interest payments are derived from market data and aim to represent the predominant types of mortgage. Weights are reviewed on an annual basis and revised, if necessary. The weight of user costs on OOH within the RPI is 14% in 2005. Chart 1 shows the effect of OOH on the RPI, which has been quite significant in several years.

Chart 1 – The UK: RPI and RPI excluding user costs on OOH
(annual percentage changes)
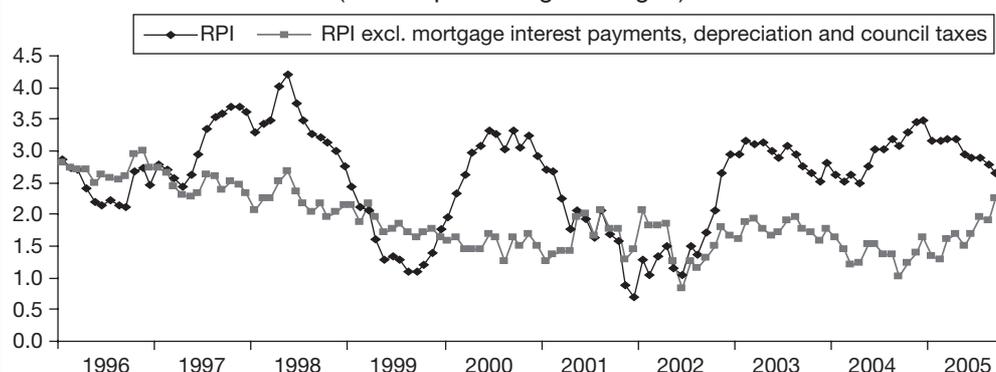
Sources: Office of National Statistics and ECB calculations.

12 *For this and the following see Baldwin, Andrew and Mansour, Emad (2003), p. 3.*
13 *For the following see Office of National Statistics (2005), pp. 50–56.*

3.1.2 *Rental equivalence approach*

The rental equivalence approach estimates the costs for owner-occupied housing services by referring to rental payments for similar dwellings. Deriving imputed rental payments by home-owners from the market rents of similar dwellings requires that:

- the market for rented dwelling is significant and, in particular, a sufficiently large amount of rented dwellings with similar characteristics to owner-occupied dwellings exists,
- rental price setting and contract conditions are not fully regulated, and
- dwellings for rent or used for own shelter are not treated very differently as regards taxes and subsidies.

In this case, a rental equivalence index can be obtained by identifying the segments of the rental market which resembles the market for OOH. Weights are obtained correspondingly. However, if rented and owner-occupied dwellings are poor substitutes, the calculation of the price devel-opment, and possibly as well the weights of imputed rents for OOH, requires the adjustment of actual rental payments for relevant differences. For this purpose, information about the system-atically different characteristics and their value is required.

The weights of imputed rents are quantified by referring to all dwellings used for owner-occupation, regardless of *when* they were acquired, and *whether* they were acquired from out-side the household sector or from other private households. Hence, rental equivalence CPI weights tend to be higher than the weights of the acquisition and payment approaches.

A rental equivalence index can move quite differently from house prices actually paid (by new homeowners). Rents usually show a smooth pattern due to the stabilising effect of longer-term rent contracts and market regulations.

If the market share of rented housing is very small, it may be cumbersome or almost impos-sible to collect reliable rental equivalent data (by type of dwelling, location, etc). In addition, regulated rent markets or the existence of separated dwelling markets for rent and for owner-occupation imply challenges to applying a rental equivalence approach in practice, namely if the development of actually paid rents observed by price statisticians cannot be considered fully representative for the change in rents imputed to homeowners. Within the EU, there are eleven countries with rental markets of less than 25% of the housing markets and six countries with shares less than 10% (these shares include social rents).

Box 2 – The rental equivalence approach in selected national CPIs: Germany and the US

For the *German* CPI, imputed rents are derived from actual rentals payments observed for three types of privately financed apartments.[14] Weights are obtained from National Accounts data on households' consumption expenditure. Given that owner-occupied dwellings are typically of a higher quality, the weight on imputed rents is higher than the weight of actual rents, although the share of owner-occupiers is only slightly above 40%. In the latest CPI expenditure scheme, referring to the year 2000, imputed rents account for about 12% in the total CPI and for 58% of the total rents (imputed + actual rents). Data on rents are collected only for apartments, but not for houses, though these are intensively used by owner-occupiers.

In order to compile the OOH component in the *US* CPI, the Bureau of Labor Statistics (BLS) enlarges the weight for actual rental payments.[15] Before 1999, the BLS collected data on imputed rents by drawing a sample of owner-occupied units, directly asking homeowners which rent they would pay for their dwelling. This unique approach aimed at avoiding potential representativity issues. However, the representativity of the sample of owner-occupied units had become less sufficient over time. Additionally, the matching of owned and rented dwellings had proved to be very complicated. Returning to the "reweighting"-approach in 1999 was accompanied by implementing a new sample design, mainly based on geographical stratification, because location characteristics were found to be most important for the identification of representative equivalent rents. [16]

Chart 2 compares the US CPI and the unpublished and experimental US-HICP calculated by the Bureau of Labor Statistics. The main difference between these indices is that the CPI covers imputed rents, whereas the experimental US-HICP excludes expenditures on OOH. Currently, the weight of imputed rents in the total CPI is about 23%. The chart above shows that the impact of OOH on the CPI was quite substantial in the second half of 2001 and in 2002.

Chart 2 – US: CPI and experimental US-HICP excluding imputed rents
(annual percentage changes)

Source: Bureau of Labor Statistics.

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14 *For this and the following see Kurz, Claudia and Hoffmann, Johannes (2004), pp. 4–5.*
15 *For this and the following, see Bureau of Labor Statistics' website publications "Consumer Price Indexes for Rents and Rental Equivalence" and "Revision of the CPI housing sample and estimators".*
16 *Another example of the use of the rental equivalent approach outside the euro area is Norway. Though the rental market is relatively small (about 25%) it is assumed to be sufficiently representative. For details see Johannessen, Randi (2004).*

3.1.3 *Relationship between user cost approach and rental equivalence approach*

In a perfect housing market, the user cost and rental equivalence approach are closely linked. Owner-occupied and rented dwellings with the same characteristics are then considered to be perfect substitutes. A private household has two options which equally satisfy its needs for shelter, namely to acquire or to rent a dwelling. The determinants for the decision are fully covered by the comprehensive user cost approach, encompassing actual and opportunity costs to be borne over the period the dwelling is used. In a perfect housing market the user costs per period are equal to the period's rental payment for a dwelling with the same characteristics. Otherwise,

owner-occupiers would sell their dwellings and rent similar ones (or vice versa). Consequently, identical results would be obtained by applying a comprehensive user cost approach or a rental equivalence approach. However, this only holds if opportunity costs for the funds tied up are taken into account (which in practice is often not the case).

In reality, the rent actually paid may differ from the total user costs of living in an owned dwelling, indicating that owned and rented dwellings are not perfect substitutes. Obvious reasons are rent regulations, the conditions for cancelling rental contracts, different taxation or subsidy regimes, but also imperfect information and transaction costs. Home-ownership provides various additional conveniences. Owners normally spend more time and money to adapt their dwelling to their needs and wants and many households regard living in an owned dwelling as a value of its own. In such cases imputed rents do not (fully) approximate user costs.

Transaction costs and binding financing contracts are reasons not to sell owned dwellings even if medium and long-term rates of return of alternative investments have become more favourable. Households which decide whether to purchase or to rent a dwelling typically take a long-term view and try to make a reasonable estimate of the value of rental payments saved each month. By contrast, expected capital gains are subject to substantial uncertainty. As a result, potential homeowners may regard their expectations of the future development of house prices as less relevant for their decision making, whereas avoiding rental payments is seen as the most important motivation. The values underlying such a decision are appropriately approximated by the imputed rents approach.

Empirical evidence on the relationship between both use concepts is thin. For the US, Verbrugge (2004) uses a modification of the official CPI for rents in order to compare it with the user costs, covering mortgage interest payments, depreciation, maintenance and expected appreciation of the value of the house.[17] His results for the period 1978 to 2001 confirm that user costs indices are much more volatile than indices on imputed rents. He also finds that the two approaches show a diverging trend over time. For Canada, the study by Baldwin and Mansour (2003), comparing the results of alternative approaches for the period 1982 to 2000, reveals substantial differences between the development of imputed rents and of user costs that mainly cover mortgage interest payments and depreciation.[18]

3.2 Payment approach (outlay approach)

Generally, the payment approach reflects the outlays actually made by private households over the period a consumer good is used. In the case of OOH, the monetary payments for owning a dwelling for shelter purposes should therefore be reflected. Mortgage interest payments and repayments, as well as the funds used for acquiring a dwelling refer to the purchaser price, including the price of land. A variant of the approach excludes payments which do not result in a net change to household balance sheets, e.g. down payments.[19] This view implies, that the purchase of a house is treated as an investment that – by definition – only changes the composition and not the total of the asset side of the household balance sheet, whereas consumption – by definition – reduces the assets available to households. The most important components of this variant of the payment approach are then payments for mortgage interest, taxes and maintenance costs, so that it only differs from the simplified version of the user cost approach in the treatment of major repair and maintenance. The payment approach directly refers to actual money outlays for goods and services, whereas the use concept distributes the costs over time by estimating the depreciation. The weight of an OOH index applying the payment approach is typically smaller than the weights resulting from the full user cost approach or the rental equivalent approach.

Box 3 – The payment approach in selected national CPIs: Ireland and the UK

In the *Irish CPI* expenditures on owner-occupied housing are covered by referring to payments on mortgage interest rate, house maintenance services, house insurance, local authority charges, repairs and decorations.[20] In order to quantify mortgage payments, the costs of a fixed profile of mortgages of up to twenty years duration are calculated. As the Irish national statistical institute considers mortgage capital repayments and down payments as an investment, these components are not covered by their OOH index.

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17 *See Verbrugge, Randal (2004), pp. 11–13.*
18 *See Baldwin, Andrew and Mansour, Emad (2003), p. 44.*
19 *See ILO et al. (2004), p. 181.*

Before 1995 the national statistical institute of the *UK* applied for their RPI a version of the payments approach which covered only mortgage interest payments. Following a recommendation by the RPI Advisory Committee, the coverage of OOH was extended and has since then included a depreciation element, that made the new RPI concept a version of the user cost approach (see Box 1).

20 *See Central Statistics Office (2003).*

3.3 Net acquisition approach

Generally, the acquisition approach measures the prices actually paid by consumers for acquiring goods and services through monetary transactions. For OOH, this means the quantification of the expenditures of new owners for acquiring a dwelling for shelter purposes, also covering all additional expenditures related to acquisition and maintenance. This method includes OOH based on transaction prices actually paid by private households; the expenditures enter the index at the time when they occur. Hence, the conceptual treatment of purchasing a house is the same as for durable consumer goods. Hill (1996), in his contribution to the development of the HICP, argued that the purchase of the house is an input for the own-account production of housing services, and that for measuring inflation the prices of these inputs are to be covered in a consumer price index.[21] By referring solely to actual market transactions, the acquisition approach comes closest to the HICP conceptual framework as laid down in the basic HICP Council regulation, which refers to "household final *monetary* consumption *expenditure*".[22]

The net acquisition approach excludes purchases of dwellings bought from other private households (therefore it is called "*net*"). This is in line with the treatment of durable consumer goods in CPIs, as it is argued that purchases and sales of goods cancel out within the household sector.

It has not yet been commonly agreed upon whether or not a net acquisition approach on OOH should include the land price component. The HICP Task Force on the treatment of OOH in the HICP recommended not to cover land prices, arguing that land is not consumed.[23]

Basically, a net acquisition index on OOH excluding land comprises the following components:[24]

- acquisition of newly built dwellings,
- acquisition of second-hand dwellings from the non-household sector,
- major repairs and conversions, and
- other costs related to OOH, such as transfer costs, insurances, estate agent charges, etc.

According to tentative estimates, the OOH component would on average account for about 7.5% of the total HICP coverage. It is worth noting that only about half of this share reflects the expenditure on house purchases, while maintenance costs and all other costs related to the ownership of dwellings contribute the other half of the weight. The relatively low weight for house purchases is due to the net acquisition concept which excludes both the purchases from other private households and the part of the purchaser prices paid for the land. In practice, the net acquisition approach covers expenditures on *new dwellings excluding land*, while almost all second-hand dwelling purchases are excluded. Due to fact that the net acquisition approach reflects the price changes of purchased dwellings new to the household sector, the weight of the net acquisition approach in a consumer price index is usually smaller than the weight that results from the use approaches. These approaches value implicit consumption flows from the entire housing stock used by owner-occupiers. Diewert (2002) showed that the net acquisition approach is likely to lead to about half the expenditure weight that a user approach would yield.[25]

It is sometimes argued that the net acquisition approach involves including an asset or investment component in a CPI, and that this may also cause more volatility of the CPI results. Given that there are controversial views whether the purchase of a house is – totally or partially – to be seen as an investment and to which extent house prices are influenced by asset market fluctuations, these concerns cannot be dispelled on a purely theoretical basis. However, the practical relevance of such a potential impact is limited by the fact that the pure house price component

21 *Hill, Peter (1996).*
22 *Council Regulation (EC), No 1687/98, Article 3, in: Eurostat (2001), p. 255; italics by the author.*
23 *For this and the following see Eurostat (2000), pp. 8–9.*
24 *For the following see Eurostat (2003), p. 7.*
25 *See Diewert, Erwin (2002), p. 62.*

is only a part of the net acquisition costs. Additionally, if land prices are excluded, the movement of this component tends to resemble the (less volatile) changes of construction costs and maintenance costs.

Applying the net acquisition approach in practice implies a great challenge to many countries. In many cases the availability of representative data is very limited. Recent information on house prices has often not been provided in as timely a fashion as would be needed for implementing a net acquisition index on OOH into a CPI. Excluding the land component from purchaser prices is quite complicated. Furthermore, in small countries, the number of transactions in a given month may be very small. However, the difficulties to obtain and compile proper house price data also apply to other approaches which make use of such price indices, e.g. for estimating mortgage interest payments or depreciation.

Box 4 – The net acquisition approach in selected national CPIs: Australia and New Zealand

The *Australian Bureau of Statistics* introduced the net acquisition approach in 1998 after reviewing their CPI concepts.[26] It covers expenditures on the purchase of dwellings excluding land, local rates and charges, repair and maintenance and house-related insurances. Price data are observed for so called newly constructed "project homes" which are used quite frequently in Australia. Additionally, alterations and additions of these homes are considered.

For the CPI in *New Zealand*, which is compiled at quarterly frequency, the national statistical institute has adopted the net acquisition concept since 1975.[27] The rationale for not considering expenditure on acquiring a dwelling for owner-occupation as an investment is seen to be that the main motivation for new homeowners is the security of tenure. The purchase component only covers newly built dwellings, because purchases of used dwellings from outside the household sector have shown to be negligible. The expenditure weight is obtained by subtracting the revenues from households' sales of residential dwellings from the sum of total expenditure for acquiring and constructing new homes for owner-occupation. Following the conceptual idea of a net acquisition approach, mortgage interest payments are not covered by the OOH index. In the first instance they were moved to a different category, namely credit services; then, from June 1999 onwards, they have been excluded from the CPI's coverage. At that time, land prices have been excluded as well. Within the weighting structure of New Zealand's CPI, which has been implemented in June 2002, OOH accounts for about 14% of households' consumption expenditure. Chart 3 shows that the OOH component had an upward effect on CPI inflation in recent years, but had a very small effect in the 1990s.

Chart 3 – New Zealand: CPI and CPI excluding the net acquisition index on OOH (annual percentage changes)
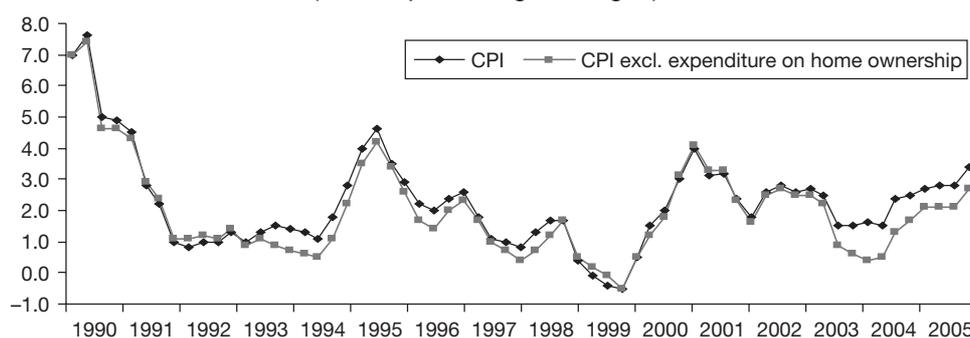
Source: Statistics New Zealand.

26 *This and the following information is taken from Eurostat (2000), p. 10, Statistics New Zealand's website publication "Developments in price indexes – article" and Woolford, Keith (2005), pp. 4–5.*
27 *This and the following information is taken from Eurostat (2000), p. 10 and Woodhouse, Tom (1997), pp. 15–16.*

3.4 Other methods

In addition to the three main approaches there are some other methods of treating expenditure on OOH in national CPIs. In particular, these include all expenditures on repair, maintenance, extensions, insurance or transaction costs related to the purchase and use of a dwelling. However, they neither include an estimate for other user costs nor the dwelling value and therefore cover

only part of the costs. This approach is currently applied by the NSIs of Hungary and Slovakia for compiling their CPIs. Austria follows a related approach but also includes mortgage interest payments and repayments for apartments (but not houses).

4. Overview of practices in EU countries and major non-EU countries

The most widespread treatment of OOH in EU-country CPIs is to exclude these expenditures from the coverage (14 countries). The rental equivalent approach is used by five EU countries, the US and Japan. The user costs approach is used by Sweden, Finland (up to 2005) and Canada, and the net acquisition approach by Australia, New Zealand and Finland (from 2006). The payments approach is used only in Ireland while three EU countries use a partial coverage of expenditures on repair and maintenance. This confirms that OOH is a main source for non-comparability of CPIs.

5. Tentative estimates of the effect of including OOH in the euro area HICP

At the current stage, only rough estimates of the potential impact of including an index on OOH costs in the euro area HICP can be compiled, as reliable information on prices, price-determining characteristics and weights is not yet commonly available. This applies to all methods introduced in section 4. Nevertheless, some estimations have been conducted recently by the OECD and two financial institutions.[28] The preliminary estimates below (see chart 4) have been compiled by the OECD for the user cost approach and by the ECB for the rental equivalence approach and the net acquisition approach. The latter estimates have been based on the limited information on residential property and construction prices currently available at the ECB, and are highly tentative.

The user cost estimate

OECD estimates of a user cost index for the euro area indicate that including OOH using this approach would significantly increase the volatility of the total euro area HICP. This mainly reflects the movement of mortgage interest rates and house prices which constitute the main components of the OECD method to estimate users' costs. On average between 1996 and 2004, the annual growth rate of the HICP including OOH was 0.4 percentage points higher than the officially published HICP inflation. In 2000, this difference even reached 1.7 points.

Chart 4 – HICP including OOH: experimental results with different methods
(annual percentage changes)
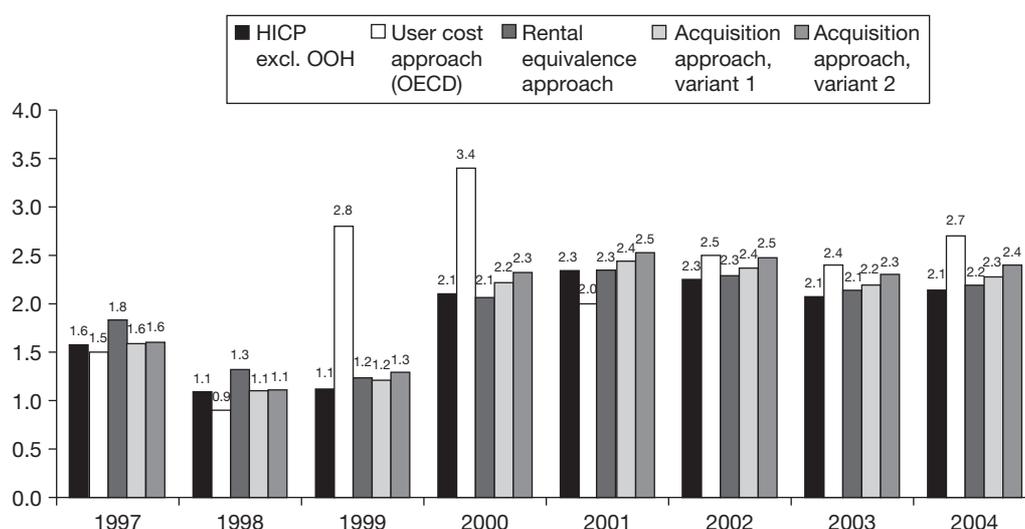
Sources: ECB, Eurostat and OECD.

28 *OECD (2005), Morgan Stanley (2005), and Deutsche Bank (2005).*

Table 1 – Treatment of expenditure on owner-occupied housing in CPIs

	EU countries	Other
User cost approach	FI (to 2005), SE	CA
Rental equivalence approach	CZ, DE, DK, CY, NL	CH, JP, NO, US
Net acquisition approach	(pilot study for HICP), FI (from 2006)	AU, NZ
Payments approach	IE	–
Other methods	HU, AT, SK (repair, maintenance, construction material and services)	–
Exclusion of OOH	BE, GR, EE, ES, FR, IT, LU, LV, LT, MT, PL, PT, SI, UK*	–

* The UK RPI (which was the national headline index until 2004) includes OOH, applying the user cost approach.

The rental equivalence estimate

HICPs including rental equivalents of OOH costs have been estimated by the ECB. As there is currently no comprehensive information on differences in characteristics between rented dwellings and owner-occupied houses and flats, the weight on rents was increased by a component for imputed rents taken from the 1999 European household budget survey. This simplifying method leads to results that are similar to the inflation rates of the HICP excluding OOH, because rent inflation has not significantly differed from overall HICP inflation. The difference between the annual growth rates of the experimental HICP covering OOH by means of the rental equivalence approach and the HICP excluding OOH was on average slightly below 0.1 percentage point between 1996 and 2004. The highest differences appeared in 1997 and 1998, and equalled about 0.2 percentage point.

The net acquisition estimate

This approach mainly requires data on residential property prices, construction costs and maintenance costs, and it aims to exclude the effect of land prices. As these data are not yet available, non-harmonised ECB residential property price indicators and Eurostat construction price data have been used, with equal weights.[29] Two very rough euro area estimates were compiled, assuming that expenditures on purchasing owner-occupied dwelling represent 5% (variant 1) or 10% (variant 2) of households' total spending on consumer goods and services. This is a plausible range for the potential weight of the net acquisition approach (see table 1 which showed a country average of 7.5%). On average, the annual growth rates of an HICP including a net acquisition index for OOH were 0.1 to 0.2 percentage point higher than the published rates between 1996 and 2004. A significantly higher difference only appeared in 2004 and if a weight of 10% is applied (variant 2).

The analysis of the results indicates that the inclusion of expenditure on OOH using the rental equivalence or the net acquisition approach would have led to roughly equal or slightly higher annual HICP growth rates in the last eight years, whereas applying the OECD method for the user costs approach might have altered total inflation figures in both directions. The latter approach would have led to the most volatile results.

6. Eurostat's pilot project

When the HICP was introduced in 1995 and again when its coverage was extended in 1998,[30] OOH was excluded from the initial HICP coverage, but not from its principle scope. The HICP framework Council Regulations of 1995, as well as the amendment regulations adopted in 1998 specified the HICP coverage in terms of "household final monetary consumption expenditure" as "that part of final consumption expenditure that is incurred by private households in monetary transactions". While the user cost and rental equivalence approaches include in their models transaction prices of e.g. past house purchases or current rental contracts, they do not reflect

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29 *It should be noted that residential property prices include prices for land which should be excluded when applying the net acquisition approach. In addition, the available data can only be seen as a rough approximation mainly because for most countries the movement of residential property prices has not yet been properly adjusted for changes in quality characteristics, and covers different market segments.*

30 *Council Regulation (EC) No 2494/95 and Council Regulation (EC) No 1687/98, in: Eurostat (2001).*

actual transactions or transaction prices faced by homeowners. The work of Eurostat, after consulting the EU national statistical institutes (Statistical Programme Committee: SPC) and the ECB in 1997 and 2000, has therefore focused on a pilot project for the net acquisition approach. From 2006 onwards, twelve EU countries are expected to participate in the compilation of dwelling price indices. Furthermore, the national statistical institutes of three EU countries will investigate the separation of the land component by constructing a specific land price index. It is currently expected that first pilot results for the OOH component in the euro area HICP will become available in 2007. A final decision on HICP coverage is then planned for 2008 or 2009.

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Martin Eiglsperger (European Central Bank)

Measurement of housing services in the CPI: The measurement of owner-occupied housing in Sweden

Jesper Johansson (Sveriges Riksbank)

The Swedish owner-occupier housing sector consists only of single family houses (including row houses). A user-cost approach has been adopted for the measurement of hosing services. In the present version of this approach, several components are included such as mortgage interest, depreciation, repairs, insurance, water, sewage and property tax. Heating and energy costs are added as separate items. These components are discussed in greater detail below. Capital gains (or losses) resulting from home-ownership do not enter the index. The weight is based on direct estimates of different components of user costs, from a survey of owner-occupiers.

Mortgage interest

Most sub indexes for owned housing are fairly straightforward, but the calculation of the mortgage interest sub index is more complex. This sub index takes up more than half of the weight for owner-occupiers, in all around 15 per cent. It is composed of two indexes which are multiplied together: an index of average interest rates and an index of purchase values, i.e. the amounts paid for the properties, when they were last purchased. The mortgage interest index monitors the interest, paid or foregone, on the capital invested in the home, so both borrowed and own capital are covered by the weight for this index. The mortgage interest index is thus computed as a product of two separate indexes. The interest rate index measures the change in the average nominal interest rate paid for borrowed capital and the capital stock index measures the change in the total capital invested in homes. For the change in the average nominal interest rate, the average is defined over all outstanding loans taken for the purpose of financing single-family homes. The average interest rate is weighted over different types of housing loans made by banks and mortgage institutions. Different types refer primarily to loans with fixed rates of different lengths and to loans with flexible rates for which the rates follow the short-term interest rate. The practical computation is a moving average of those fixed rates that were set in the months over the fixed period duration. For loans with flexible rates, day to day movements are followed directly.

Depreciation

Depreciation refers to the physical deterioration of houses. The weight for the depreciation sub index is estimated to be 1.4 per cent of the total market value of all owner-occupied homes, excluding land value (as given by tax records). The sub index is set equal to the weighted average of an index for wages in the construction sector (adjusted for productivity growth) and the sub index for maintenance and repair (see below).

Maintenance and repair

In this sub index, the prices of some 20 commodities used in construction, including kitchen and bathroom appliances as well as construction material, are measured. Price collectors monitor these prices in DIY stores.

Jesper Johansson (Sveriges Riksbank)

The measurement of housing services in the CPI: The case of Hong Kong

Li-Gang Liu (Hong Kong Monetary Authority)

The two main objectives of this paper are: (1) to give a brief overview of the measurement of housing services in Hong Kong's consumer price index (CPI), and (2) to explain the role that housing services plays in inflation measures for Hong Kong.

Housing services make up the largest component of the CPI. The weights are determined by a household expenditure survey conducted once every five years. The CPI housing component consists of public and private housing rentals, management fees, and other miscellaneous housing charges. Public housing refers to subsidized rental housing provided by the Government, while private housing covers both rented dwellings and owner-occupied dwellings. A rental equivalence approach is adopted for owner-occupied dwellings; the rental data on public housing are based on administrative records. Private housing data for new, renewed and continued lettings are collected from a monthly sample survey on private housing renter households.

Housing services has a weight of 29.9 per cent in the CPI – the largest weight of any single component making up the CPI. Of this 29.9 per cent, private housing accounts for 24.6 per cent and public housing accounts for 2.1 per cent. The remaining 3.2 per cent are for management fees and other miscellaneous housing charges (see Figure 1). These current weights are based on the Household Expenditure Survey (HES) conducted in 1999–2000. The next round of releases is expected in mid-2006.

The impact that price changes has in different household groups may vary considerably since households in different expenditure ranges have distinctively different expenditure patterns. Table 1 provides a breakdown of the three separate CPI series relating to households in

Figure 1 – Weights of CPI components
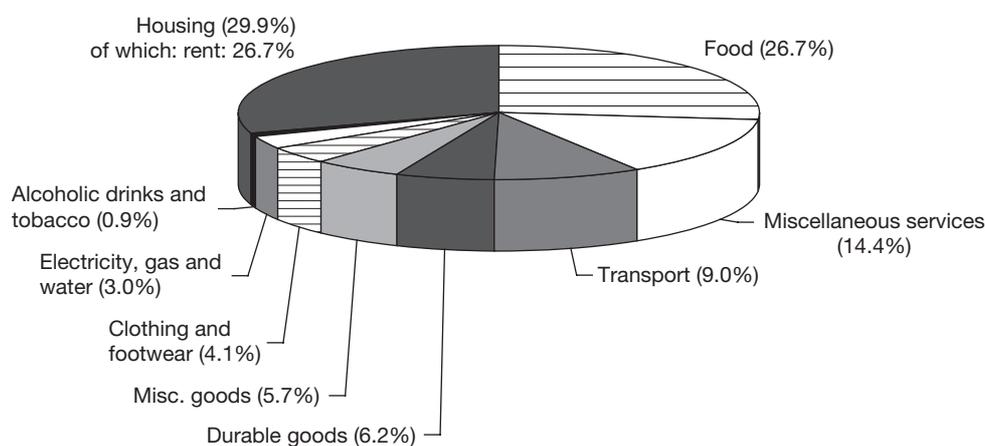
Source: CS&D, Hong Kong, SAR

Table 1 – Weights of housing services by households in different expenditure ranges

Index	Approximate % of households covered	Average household expenditure during 99/00 based CPI (HK$)	Weight of housing	Of which: rent
CPI (A)	50	$4,500–$18,499	29.1	*26.8*
CPI (B)	30	$18,500–$32,499	29.7	*26.5*
CPI (C)	10	$32,500–$65,499	31.2	*26.7*
Composite CPI	90	$4,500–$65,499	29.9	*26.7*

Source: CS&D, Hong Kong, SAR

different expenditure ranges. There are three categories: high CPI (A), medium CPI (B), and low CPI (C) expenditure range, each accounting for around 50, 30, and 10 per cent of households covered, respectively. The weight for housing services is higher for households in the higher expenditure range. This is due to the fact that a larger proportion of households in the lower expenditure range are accommodated by public rental housing where rents (including management fees) are subsidized by the Government.

Figure 2 – Weight of the housing services by selected countries
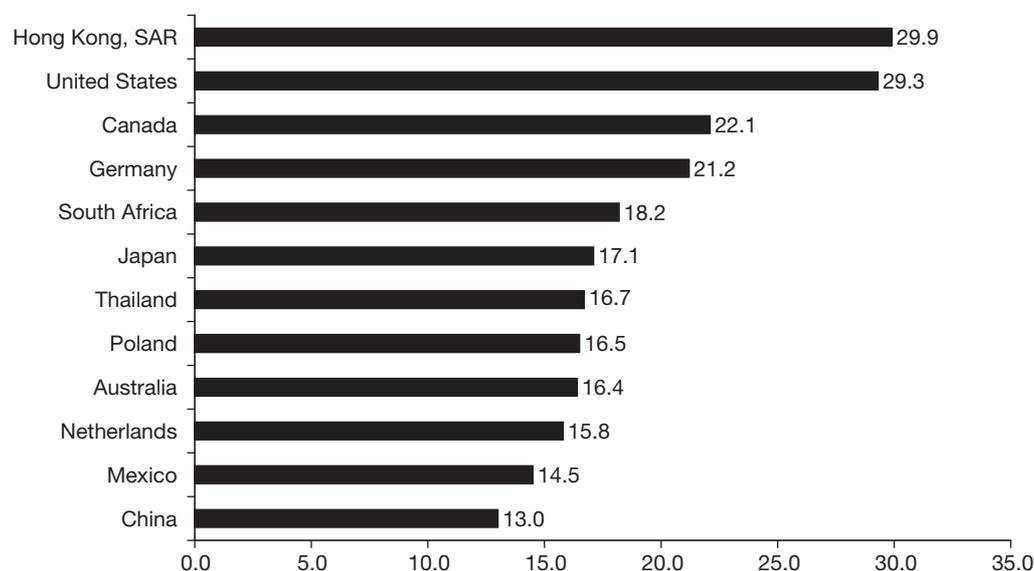
Source: BIS-IFC and Census and Statistics Department, Hong Kong, Special Administrative Region

The weight of housing services in the CPI basket in Hong Kong is amongst the highest in the world. This is reflective of the relatively high land prices and population density in Hong Kong.

Figure 3 – CPI rental component and market rents
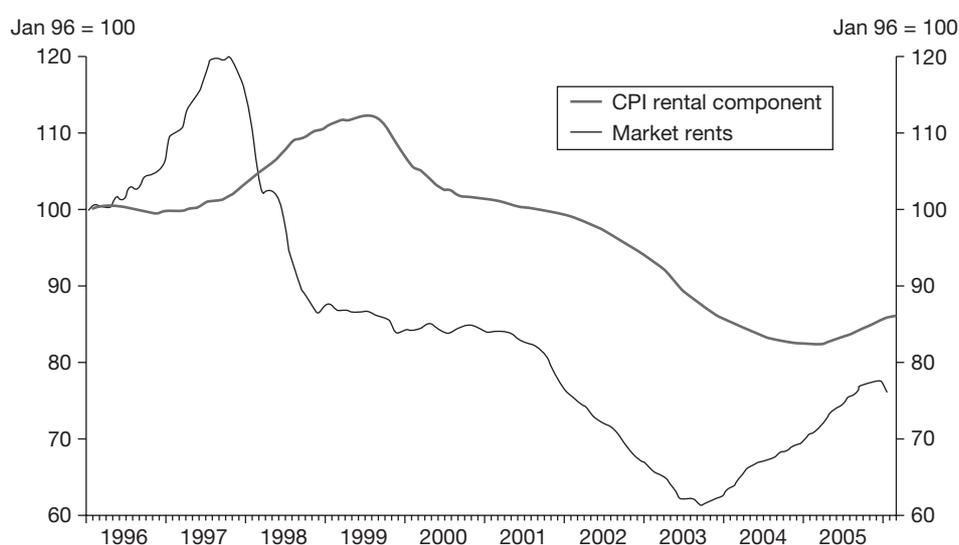
Source: Staff estimates, Hong Kong Monetary Authority

Because the CPI rental component includes new and existing lettings, its movement tends to lag behind market rents owing to fixed-term rental contracts that last typically for two years in Hong Kong. For example, market rents and residential property prices declined in 1998 as a result of the Asian financial crisis, but CPI rental component continued to increase until late 1999. A more recent example is the recent recovery of market rents which began autumn 2003, while the CPI rental component only picked up in 2005.

Figure 4 – Alternative CPI measures
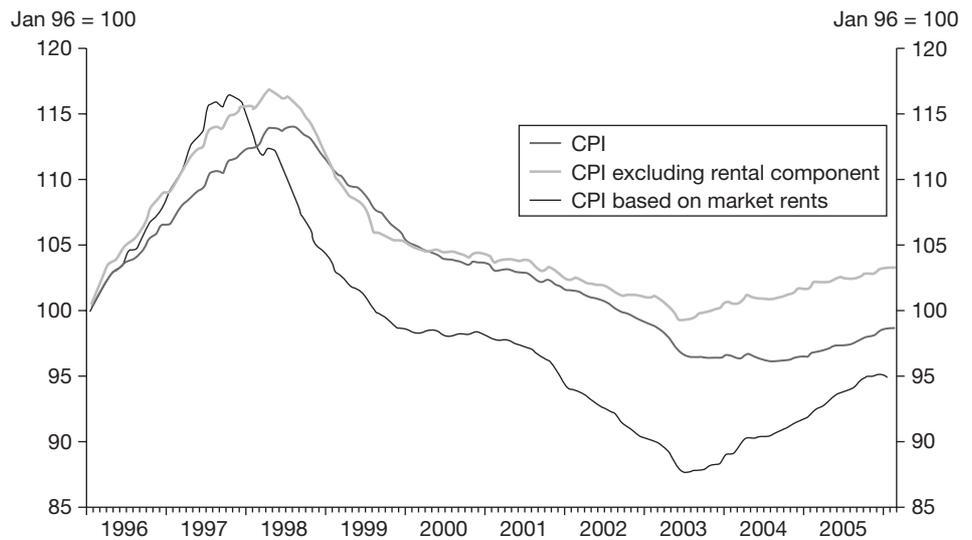
Source: Staff estimates, Hong Kong Monetary Authority

Movement in the overall CPI also lagged behind the movement in the CPI excluding its rental component. The CPI excluding its rental component started to pick up in the summer of 2003 along with a strong recovery in the economy, while the overall CPI remained broadly stable before rising modestly in late 2004. Replacing the rental component with market rents captures a sharper turnaround in 2003 and faster increases in subsequent years.

Both measures are important inflation indicators as the CPI based on market rents appears to reflect the underlying inflation pressures in a timely manner, while the CPI based on rental component is more representative of the average movement of actual rental values for all dwellings in the economy.

Figure 5 – Alternative inflation measures
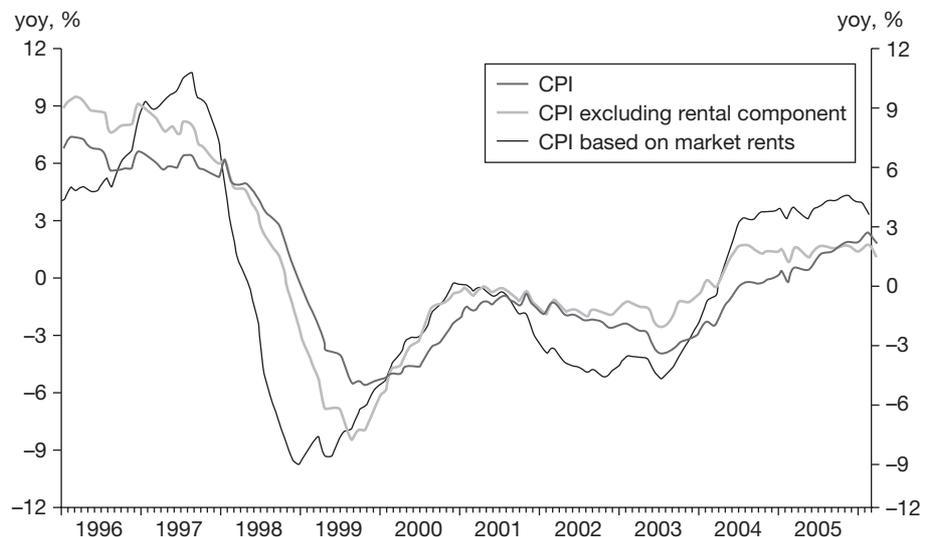
Source: Staff estimates, Hong Kong Monetary Authority

While the year-over-year (yoy) change of the CPI based on market rents is more volatile than that of the overall CPI, and also more volatile than the CPI excluding its rental component, it is able to provide early indications of turning points in the inflation rate.

Li-Gang Liu (Hong Kong Monetary Authority)

Summary of discussion

The discussion focused on four main themes: national experiences, the use of OOH information by policymakers, implications for monetary policy and other issues.

Regarding national experiences with the choice of methodology, the IMF manual was seen as relatively neutral as to the choice of method. Arguably, rental equivalence may be best from a theoretical point of view, although the payments method may be easiest to implement from a practical point of view. The acquisition approach is of little use if the necessary adjustments for home quality could not be implemented. France and Germany are using hedonic regression techniques for performing these quality adjustments. The US has removed the ageing bias from house prices through such hedonic methods. It was argued that the current US methodology (rental equivalence) did not introduce a downward bias into the index.

The choice of incorporating OOH or not as well as the way of incorporating has implications for the ways in which policymakers can use this information. On this subject, OOH was viewed as improving the information quality of the CPI. The question arose whether OOH should be used *in addition to* the HICP or *incorporated into* the HICP. The case was made that because of cross-country differences in the methodologies being used, OOH should be removed from all CPI indices for international comparisons. However, it should not be disregarded for domestic analysis.

Monetary policy is a key area in which policymakers can use information on the cost of housing services. Thus, monetary policy objectives should not determine the choice of the method for incorporating OOH into CPI. On the issue of the inclusion of interest payment costs into the CPI through OOH, it was noted that a raising of policy rates had, in the short run, a direct positive effect on the CPI (the contrary of the sought long-term monetary policy objective of an interest rate hike). However, this counter-intuitive short-term outcome does not warrant an exclusion of OOH from the CPI altogether, as it has to be included to preserve the credibility of the central bank.

The session ended with a discussion of the following related issues: the treatment of owner-occupied houses as assets or as durable consumer goods, the CPI volatility introduced by the inclusion of volatile housing service prices, government controls on prices or transaction costs, the distinction between new and second-hand houses (and between new leases and the overall index), the inclusion or not of domestic workers' wages into the owner-occupied housing component.

SESSION 4

Dealing with quality adjustments

Chair:	Johannes Hoffmann (Deutsche Bundesbank)
	Background note and key issues for discussion
Papers:	**Adjustments for quality change and new goods** Mick Silver (IMF)
	The US experience with quality adjustment Jeremy Rudd (Federal Reserve Board)
	Summary of discussion

Background note and key issues
for discussion

The treatment of quality changes constitutes one of the greatest challenges for CPI compilers. It is sometimes called the "house-to-house combat of price measurement" (Shapiro and Wilcox, 1996). The issue is not new, of course, but it has become more important in recent years. On the one hand, it has gained in importance as a result of the high pace of innovation observed for many goods and services. Innovation is now a widespread phenomenon and generates improvements in product characteristics on an ongoing basis. On the other hand, the opening of markets and increased competition have widened the range of product quality offered on the market, especially for many services. For example, low-cost airlines set on-flight services to a minimum, and competition has forced the incumbent carriers to forego their traditional level of on-flight services. Similar observations can be made for apparel. Measuring the constant-quality-price trend for a particular (broadly defined) product can be particularly demanding if characteristics are changing rapidly or are difficult to measure, as in the case of services.

The problem of quality adjustment arises if a specific item sampled for price observation is no longer available on the market or has lost importance for consumer purchases. Then a replacement has to be chosen for price observation, and the difference in characteristics between the old and the new item has to be valued and accounted for in order to obtain the "pure" price change of the product. Quality adjustment is thus "the procedure of making an allowance for a quality change by increasing or decreasing the observed current or reference prices by a factor or an amount equivalent to the value of that quality change" (Eurostat, 2001). Sometimes the choice of a replacement is straightforward, if, e.g. a car manufacturer introduces a new car model with better safety features. Then the value to the consumer of these new features should be subtracted by CPI compilers from the observed price for the new car model. Sometimes the choice of a replacement item is less straightforward, if, e.g. a product is withdrawn from the market and no new product variant replaces it directly. Finally, additional new products may be introduced. The question arises whether the prices of these new products can be linked in any meaningful way to the prices of existing products (consider, e.g. the case of microwave ovens and traditional ovens, or of mobile phones and fixed-line phones). Therefore, truly new goods, which are not simply improvements of existing goods, are brought into a CPI often only when the index is rebased. Then, however, the welfare gain to consumers arising from the introduction of new goods is lost for inflation measurement. This issue refers to the new product bias in CPIs and will be discussed in Sessions 5 and 7.

There exist a number of procedures to handle quality changes in CPI compilation. The CPI Manual classifies them under explicit or implicit methods. Implicit methods rely heavily on the assumption of perfectly competitive markets, whereas explicit methods try to value the difference in product attributes directly.

Implicit methods account for quality changes by implicitly attempting to value the new characteristics of products. When old and new versions of a particular good exist in an overlapping period, it may seem to be straightforward to infer the monetary value of the difference in quality between the two product variants from the price difference in that particular period. The so-called *overlap method* scales the price in the current period for the ratio of the price of the previous version of the product and the one for the new version (like treating a break in series or linking an old and new time series for the same variable). It implicitly assumes that price differences are caused by quality changes. When no overlapping prices exist for old and new versions of a particular good, the so-called *class mean imputation* might be used. This method presumes that the true quality adjusted price change between two product variants can be read from the price development of similar products but without changes in characteristics. The major weaknesses of the overlap and the mean imputation methods are the following. Firstly, there is no reason to expect that the prices of disappearing and newly emerging products are on the equilibrium price-quality locus. Secondly, with respect to the class mean imputation method, it has to be kept in mind that with menu costs it pays to link product replacements to true changes in prices. Empirical evidence of this phenomenon has been summarised by Moulton/Moses (1997). Then, however, the class mean imputation method will lead to distorted estimates of quality-adjusted price change.

A generalisation of the overlap-method, which has become increasingly feasible with electronic data processing, is the so-called *chaining and re-sampling* method, which may also take into account the changing relative importance of the various price observations in terms of turnover. In a traditional (fixed base) index, only prices for a small number of items are observed for each product category, and no weights are applied at the lowest level of aggregation. The chaining and re-sampling method considers the prices of all product variants of a specific product category and refreshes the sample and the weights each month. Thus, this method avoids the arbitrariness of choosing one particular product variant for price observation and one particular period for refreshing the sample. The product-specific price index is obtained by linking the prices of each specific item in each month with those of the corresponding items from the preceding month. The main weakness of this method is that it may give rise to serious index drift, especially with strong seasonality in the data. The same is true with respect to products with a pronounced shape of prices over the life cycle. With apparel, e.g. only the price rebates of the end-of-season sales would be captured, but never the price increases related to the introduction of a new fashion.

Two less sophisticated indirect methods are the *direct price comparison method*, which presumes that there is no change in quality, and the *"link-to-show-no-price-change" method*, which attributes the entire price change to quality differences. For the European HICP, the latter method is not admissible, unless it can be justified (EC Regulation 1749/96).

This leads to the *explicit methods* of quality adjustment. A traditional method of quality adjustment relies on expert knowledge, or on the valuation of quality changes by the price collector. He/she has to make a decision on the monetary value of the difference in characteristics between the old and the new product variant. Often, either the full change in price is attributed to changes in characteristics, or the prices of the different product variants are compared directly. In these polar cases, direct quality adjustment is identical to the simple implicit quality adjustment methods mentioned above. But the price collectors or the expert may also decide to neutralise only a part of the price difference for inflation measurement. The problem with this widely applied method is that it cannot cope with quality changes accompanied by invariant prices, which may be not untypical in a low inflation environment (Hoffmann, 1999). One explicit method is the so-called option cost adjustment, which consists of estimating the value of a new product feature on the basis of the market value of that feature observed as a separately priced option in earlier periods. This method is frequently applied for cars, and also for personal computers (PCs). For example, the value of a standard inclusion of airbags in cars might be gauged from the price of airbags in the list of separately priced accessories for the same car in the previous period. This requires extensive and detailed data from manufacturers and vendors on the market value of different options in the reference period. The major weakness of this approach is that options made standard are not valued by all customers alike. Hence, the monetary value of the difference in characteristics may be overstated.

An increasingly popular approach for explicit quality adjustment is the *hedonic method*, which can be understood as a more advanced method of the quality adjustment methods based on expert knowledge and option costs. Hedonics consists of regressing the prices of the various product variants on the relevant attributes. For instance, the price of a "car" might be regressed on its size, power, gear-box, safety features (such as airbags or ABS), emission controls and other items used in marketing the product (e.g. audio system, seat heating, electric window control, rain or distance sensors). From these estimates, which may be performed separately for each period or may be pooled across two or more periods, the quality-adjusted price change can be inferred. With pooled data, it can be read directly from a time dummy added to the characteristics. With period-specific regression, either a quality-adjusted price can be imputed either for the reference period or for the observation period, or a price index over characteristics can be computed (Feenstra, 1995). The proper application of the hedonic method requires an extensive set of detailed, quantifiable and market-based information on product qualities, an excellent knowledge of the working of the specific markets as well as econometric expertise.

Many price statisticians have embraced hedonics as a proper method to deal with quality adjustment, in particular because it seems to avoid subjective judgment and is based on actual market data on prices and the quality characteristics of the items priced. However, economic theory, even under perfect competition, does not give a clear interpretation of hedonic coefficients. In practice, it is also uncertain whether the use of hedonic method can eliminate entirely the quality bias, as it might be rather difficult to account for all the attributes that affect a product's price at the time of the purchase. Furthermore, a number of technical problems need to be resolved, such as choosing an appropriate functional form for the hedonic regression (e.g. linear or log-linear) and the stability of the hedonic regressions coefficients.

Still, the increasing popularity of hedonic methods to account for quality changes is seen by many to be justified, in particular because the implicit assumptions of alternative methods can

be even more restrictive than those required by the hedonic approach. The hedonic approach is more objective and transparent than others, at least if it is applied following established and comparable criteria. As highlighted by Kenny and Ahnert (2003), the transparency and credibility of hedonically adjusted CPIs could be further enhanced if the statistical compiler would provide detailed and documented information on the hedonic functions they use when adjusting the prices for particular products for quality adjustment. They also suggest that international or supranational statistical organisations, such as Eurostat, could play a role in the harmonisation of hedonic methods in order to improve their comparability across countries.

Unlike the new products and substitution biases in CPI statistics, which tend to systematically overstate consumer price inflation, the quality adjustment bias might be either positive or negative. Firstly, product quality might either improve or deteriorate. Secondly, there might be an over-adjustment or an under-adjustment to quality changes. Significant upward bias is typically found for durable goods, where technical innovation has been particularly pronounced. Evidence of negative quality bias has been relatively limited, mostly to clothing and rental values.[1] As will be discussed in session 7, most empirical studies on CPI measurement bias have found that quality bias accounts for the large part of the overall upward CPI bias.[2]

Whilst there is a clear recognition of the need for dealing adequately with quality changes for inflation measurement, no consensus has so far emerged concerning the most appropriate methods to account for it. Moreover, it is also unclear for which products there is a need for an explicit adjustment for quality changes. Where explicit quality adjustments are attempted, compilers focus mostly on goods and, in particular, on consumer durables. Nevertheless, quality changes in services might also be substantial and have a sizeable impact on the CPI, as services account for a growing proportion of household expenditures.

A large number of countries use expert judgement to adjust prices for quality change, sometimes for very important items in the CPI (see Table 1). For instance, in Australia the price of processed food, clothing, rent, household appliances and motor vehicles are quality-adjusted by an expert. In the Netherlands, judgement-based adjustments are made for household appliances, telephone and internet services, while in Hong Kong it is used for clothing. Option cost adjustment is used by various national statistical institutes, is in the case of the US (for cars and PCs), Belgium (for cars and PCs) and the Netherlands (cars, audio-visual equipment, photographic and information processing material). In Germany, the Federal Statistical Agency estimates hedonic coefficients, which help price collectors performing explicit quality adjustments.

Different national CPI compilers, such as in Australia, France, Germany, Italy, Japan, Spain and the US, have started to make use of hedonics, in general but not only for high-tech goods subject to rapid innovative progress. National practices and views regarding the choice of product categories to which hedonics are, or should be, applied differ significantly. In the US, for instance, the BLS has moved aggressively to expand the use of hedonic methods for a large range of products, but, in the case of PCs, returned to the option cost method. Many economists have encouraged such enhancements to CPI methodologies. Others, however, have argued that the BLS might have implemented those techniques too extensively in recent years.

In recent years, many countries have opted for chained Laspeyres indices either at the elementary level, (for instance, Brazil, China, South Africa, Canada), or at the higher-levels (for instance, US, Europe, Spain, Mexico, Thailand, Korea, Sweden and Russia).

Issues for discussion

- Which are the most appropriate methods for quality adjustments from a central banking perspective? Should central banks encourage or discourage the use of particular implicit or explicit methods?
- Which product categories in the CPI would benefit from explicit quality adjustments? Should efforts be made by CPI compilers to better adjust the prices of services for quality change?
- Do hedonic regression models improve on traditional explicit quality adjustment based on judgment or on option costs? How reliable, credible and comparable are hedonic adjustments for quality change given the need for large datasets and specific expertise to implement this method? How might transparency and comparability of hedonic quality adjustment be enhanced?

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1 *Moulton (1997) and Crone et al (2000) have found that the component for rental values in the US CPI understates the true quality-adjusted price for this expenditure item.*
2 *See for instance, D. Lebow and J. Rudd (2003) for the US CPI or Rossiter (2005) for Canada.*

- How reliable, credible and comparable are implicit methods for quality adjustment, including the use of chaining? Could some implicit measure leave too much room for discretion to individual price collectors?

Table 1 – International comparison of explicit quality adjustment in CPI measurement

Central banks	Importance of explicit quality adjustment (QA)
Argentina	No explicit QA
Australia	• Hedonic method: Audio, visual & computing equipment • Expert judgment: Processed food, clothing, rent, household appliances, and motor vehicles. These items represent 30.9% in the CPI
Belgium	• Option pricing: PCs and cars These items represent 5.8% in the HICP
Brazil	No explicit QA
Canada	No detailed information is available
China	No explicit QA
France	• Hedonics: cars and books
Germany	• Hedonics is used for used cars, PCs, some electrical household appliances and entertainment electronics • Expert judgment: other items
Hong Kong SAR	• Expert judgment: clothing This item represents 2.5% in the CPI
India	No detailed information is available
Indonesia	No detailed information is available
Italy	• Hedonics for cars and telephone equipment
Japan	• Hedonics for PC and digital camera
Korea	No information available
Malaysia	No information available
Mexico	No explicit QA
Netherlands	• Option pricing: cars, audio-visual, photographic and information processing equipment • Expert judgment: household appliances, telephone and internet services and equipment
Poland	No explicit QA
Portugal	No information available
Russia	No information available
Saudi Arabia	No detailed information is available
Singapore	No explicit QA
South Africa	No explicit QA
Spain	• Hedonic: washing machine and television sets • Option pricing and expert judgment are used for some items but no specific information about the specific products is available
Sweden	No information available
Switzerland	No information available
Thailand	No explicit QA
United States	• Hedonic for clothing, some households' appliances, computers, audio/video equipments and college textbooks • Option pricing for new and used cars These items represent 10.5% in the CPI

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Adjustments for quality change and new goods

Mick Silver (IMF)[1]

A feature of many markets is that new goods and services are being regularly introduced and the quality of existing ones rapidly and substantially changes. If quality is increasing (decreasing), but not removed from the index, price changes will be overstated (understated). National statistical offices measure inflation using the matched-models method. The offices collect details and prices of a representative selection of items in a price reference period and collect their matched prices in successive periods, to compare the prices of like with like. But a potential quality adjustment bias arises when the old, original models in the sample become unavailable, say because the model is replaced by new model of different quality. If the methods used to deal with these unavailable models are inappropriate, we have what is referred to as in-sample quality adjustment bias. There are several approaches to dealing with in-sample bias: implicit methods like imputation, overlap, comparable replacement, carry-forward; and explicit quality adjustments, including expert opinion, quantity adjustment, production and option cost, and hedonic regression estimates. These are all outlined and discussed in Box 1. Methods should be adopted by statistical offices as appropriate on a product-by-product basis, based on an understanding of the circumstances in which each method may best be utilized. There is a need for detailed metadata on the methods adopted. All statistical offices implicitly employ quality adjustment methods, even though they may claim otherwise. For example, as a default policy they may either drop missing models (imputation), link in a new model (overlap), or simply adopt a replacement as comparable irrespective of whether this is justified. In each case, an assumption is being made of the valuation of the quality change, but maybe a bad one by default.

The use of the matched models method also gives rise to out-of-sample bias. The sample of models used to measure price changes becomes unrepresentative when, for example, new models are introduced (but not included in the sample) and old models are retired (and dropped out of the sample). Completely new items may only be included on an irregular basis, usually when the weights of an index are updated and the sample revised. A price index should have regularly updated weights, rotated item samples, and resources devoted to applying the most appropriate quality adjustment method on a product-by-product basis. This in turn may require an increase in the statistical office's resources, something that should benefit central banks when they use inflation measures for macroeconomic planning.

Box 1 –The different approaches for dealing with quality adjustment and their relative merits

The quality adjustment problem becomes apparent to a statistical office when an item of a given quality is no longer available for matched prices to be compared.

Implicit methods

Overall mean/targeted mean imputation

The overall mean imputation is computationally straightforward: it simply excludes the item from the calculation. It is thus based on the assumption that the excluded item, had it continued to exist, would have had price movements similar to the included ones. A targeted form of the method would base the imputation on a product group likely to have similar price movements. Imputations effectively reduce the sample size and representativity of the index.

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[1] *Any opinions expressed in this paper are those of the author and do not necessarily reflect the views of the IMF.*

Comparable replacement

A replacement for the missing item is found and, if judged comparable in quality, its current price is linked to the price of the old (originally used) one. This method relies on the judgment of the price collector and, in turn, on the adequacy of the specifications used to describe the quality of the old item. There is an incentive to assume that replacements are comparable to avoid the need for difficult quality adjustments to prices to maintain comparability.

Overlap method

This requires that price data are available in a common overlap period for the old and replacement items. The price change of the replacement item is simply spliced onto that of the old item at the overlap to continue the series. The implicit assumption for the continued series is that the relative quality difference between the replacement and old item equates to the relative price difference at the time of the overlap. The timing of the splice is thus crucial and the item's price-quality relationship may be affected by its stage in its product life cycle. The overlap method is implicitly employed when samples of products are rotated.

Carry forward method

The old item's price is simply carried forward to the next period. This method induces undue stability into the index, especially for high inflation countries.

Explicit methods

These methods are used when a replacement item of a different quality is found, so an estimate is required of the quality difference to adjust the replacement item's price.

Expert opinion

A subjective estimate from an industry specialists of the price difference due to the quality change is used. The Delphi method is one approach to the making of subjective estimates. Generally, objective methods are preferred.

Quantity adjustment

The replacement may be sold in a different package size. It should not be the case that, for example, because an item is now sold in larger containers measured prices should increase to reflect this. A simple rescaling can be used though in some cases the price-quantity relationship is non-linear.

Differences in production/option costs

An estimate for the quality difference is based on production costs with, for the CPI, a mark-up for the profit margin and indirect taxes. In some products, such as automobiles, the quality improves because an option becomes standard. The relative price of the option can be used as the basis for a price adjustment for quality. However, the cost of producing something as standard may be lower than when it was an option due to scale economies. Further, when it is sold as standard, many of the purchasers will not value it so highly.

Hedonic regressions

A regression equation is estimated with (the log of) price on the left hand side and price determining quality characteristics on the right. The coefficients on the quality characteristics can be used to estimate the effect on price of any quality change. Alternatively, the replacement period's item characteristics can be inserted into a base period hedonic regression to estimate what the replacement price would be in the base period had it existed then, and similarly for a base period item priced in the current period, providing the means for quality-adjusted price comparisons.

Mick Silver (IMF)

The US experience with quality adjustment

Jeremy Rudd (Federal Reserve Board)

Some relevant background

The US consumer price index (CPI) attempts to price the same product over time. In some cases, however, this is not possible: In 1995, for example, replacement items were required for four percent of price quotations per month, on average. This implies an *annual* replacement rate of 30 percent (some items are replaced more than once a year).

When a new good is substituted into the sample, a judgement about quality change is required. About a third of the time – 10 percent of the CPI per year, based on the 1995 data – a quality adjustment is deemed to be necessary by CPI commodity analysts.

Approaches to quality adjustment in US price statistics

The Bureau of Labor Statistics (BLS) have several techniques for making quality adjustments.

- With the *overlap pricing* method, the prices of the original and replacement goods are both observed in the replacement period; the entire difference in price level is attributed to quality. (This is rare.)
- With the *deletion or "link"* method, the outgoing price is used until time t and the new price is used from time t forward; from $t-1$ to t, the average price change in the item stratum is used.
- *Class-mean imputation* is similar to the link method, but the $t-1$ to t price change is based on more comparable items.
- Finally, the *cost-based adjustment* procedure consists in using production cost data to adjust the price.

Hedonic adjustments in the US CPI

In addition to the above approaches, since the late 1990s there has been an increased use of *hedonic techniques* in the CPI. The use of hedonic techniques in US price statistics is not completely new. Since 1991, hedonics have been used for apparel prices in the CPI (this is a highly seasonal good, so replacements are common). Hedonics have also been used since 1988 to make an aging adjustment for CPI housing rents. In addition, the US national accounts made limited use of hedonics to measure computer (investment) prices before the CPI (or PPI) did; nowadays, however, the national accounts mainly use the quality-adjusted BLS price indexes (in particular, individual CPIs are used in the PCE price index).

One other historical note about quality adjustment is worth making, as it illustrates an interesting point. After the perceived productivity speedup in the mid-1990s, the group responsible for the Federal Reserve's industrial production statistics began putting large effort into quality adjustment for certain goods (high-tech equipment and pharmaceuticals). This was based on a "full-universe" matched-model approach, not on hedonics *per se*. With enough data, it was argued, the two approaches would be the same (Aizcorbe, Corrado, and Doms, 2000); recent work by Silver and Heravi (2005) suggests otherwise, however.

Partly in response to the 1996 Boskin Commission report (and other academic recommendations), the BLS began extensive experimentation with hedonics. The first implementation of an hedonic pricing model was for computers (in 1998). Hedonic models were later developed for televisions (1999) and for other types of audio and video equipment, selected household appliances, and college textbooks (all in 2000). In September of 2003, however, the BLS *stopped* making hedonic-based adjustments for computer prices (they now instead use something like a cost-based approach).

The BLS do *not* use "dummy-variable" hedonic regressions to make hedonic adjustments; rather, an estimated hedonic function is used to adjust goods prices during item replacement. For illustration, consider two goods, 1 and 2, with characteristics z_1 and z_2. Good 1's log price at time t equals $p_{1,t}$; at time $t + 1$, it is replaced by good 2 (with log price $p_{2,t+1}$). Assume also that a (log) hedonic function $h_0(z)$ has been estimated in some previous period (time zero). The adjusted log price relative in time $t + 1$ can then be thought of as:

$$p_{2,t+1} - p_{1,t}^{adj.} = p_{2,t+1} - (p_{1,t} + h_0(z_2) - h_0(z_1)).$$

Three features of the BLS procedure are worth highlighting.

- Typically, the hedonic function is re-estimated frequently (albeit with a lag). This is done because estimated characteristic values appear to change relatively rapidly over time.
- The data for estimation often come from outside (that is, non-CPI) sources.
- Hedonic models are often assessed in terms of the plausibility of their coefficient signs (relative to an *a priori* benchmark). This is hard to justify theoretically, however (*c.f.* recent work by Pakes and others).

Early on, it was noted that hedonically adjusted indexes often rose as fast as – or faster than – their unadjusted counterparts (computers were an important exception). This could reflect "piggybacking" of normal price increases with new-model introduction; in this case, the BLS's traditional methods for dealing with quality change could be yielding overly large quality adjustments (indeed, little is known about the properties of these older procedures). The BLS's hedonic adjustment procedures would then mitigate this by recovering the normal price increase. However, this finding could also point to problems with the BLS's hedonic approach. In particular, hedonics are not used for sample rotation (only item replacement). Hence, unless turnover is high (as is the case, for example, with computers), the BLS's hedonic procedures might still miss some portion of quality change. ("Directed" substitution might mitigate this, by forcing more turnover; the BLS have therefore moved toward introducing directed substitution for a few products.)

Two other findings from the BLS's experience with hedonics are worth noting. First, the choice of a particular noncomparable substitution procedure (for example, class-mean *versus* hedonics) can affect both (i) the identification of replacement items as "comparable" or "noncomparable"; and, (ii) the rate of change of *comparable* price quotes. (Possible reasons for this are discussed in the National Research Council's 2002 report on the CPI.) Second, in some cases "vintage" dummies play a large role in the hedonic regressions. Why this occurs is again unclear, though it could reflect specification problems with the hedonic regressions. If so, this phenomenon would suggest that producing a well-specified, useable hedonic model might be very difficult (as we cannot measure enough relevant characteristics in real time).

Some unresolved issues

Pakes (2003, 2005) provides several critiques of the BLS's implementation of hedonic adjustments. Among these, he argues that the BLS's procedure cannot be justified on theoretical grounds (specifically, in terms of cost-of-living-index theory); moreover, he claims that the BLS's focus on coefficient sign or stability (in constructing hedonic regressions) is misplaced. Pakes also suggests several potential areas for improvement. Whether these could actually be implemented by the BLS is an open question; nonetheless, increased academic attention to these issues is highly welcome.

Building on earlier work by Feenstra and others, Hobijn (2003) argues that *both* hedonic and matched-model techniques could yield misleading estimates of price change. The problem is especially acute for goods (such as high-tech goods) for which price per unit quality is an increasing function of quality, as this can lead to overstated rates of price decline for these goods. Intuitively, a matched-model index omits lower-quality varieties in the first period (thereby pushing measured first-period prices up) and omits higher-quality varieties in the second period (thereby pushing second-period prices down). Likewise, a (Laspeyres-like) hedonic imputes prices for lower-end goods that no longer exist in the second period *and* omits the newly introduced higher-end goods (both of these act to push second-period prices down).

Whether the Hobijn result is applicable to the CPI is unknown (as is the prevalence of goods whose price per unit quality is an increasing function of their quality); in addition, we cannot explicitly quantify this effect without specifying consumer preferences. The Hobijn result *does* suggest,

however, that the upper bound on compensating variation provided by an hedonic index might be a poor one. Moreover, both the Pakes and Hobijn results underscore how difficult it is to interpret existing hedonic techniques purely in terms of a utility-theoretic (cost-of-living) framework.

Summary and conclusion

The BLS's introduction of hedonic techniques represents, on balance, an important improvement to the CPI. Nonetheless, one is left uneasy by the degree to which practical application of these techniques appears to have outstripped theory. One is also not fully convinced by some of the hedonic models currently employed in the CPI (very likely, data limitations have an adverse effect on the quality of existing models). In addition, hedonic techniques for quality adjustment are not really applicable for many goods (for example, medical services) – so some other procedure is required. Hence, the BLS should probably proceed slowly – and cautiously – with any further implementation of hedonic techniques in the CPI.

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Jeremy Rudd (Federal Reserve Board)

Summary of discussion

Overall, participants tended to welcome the significant improvement that has been made in terms of quality adjustment in various countries, such as the US, Spain, Italy, Japan, and Germany. Nevertheless, they also recognised that the quality bias is probably the most important in terms of magnitude at the moment and that therefore, further improvement needs to be made.

Delegates supported the use of explicit quality adjustment methods and especially, hedonic methods, because those tend to be more objective and transparent than others, which is particularly important from the perspective of monetary policy. Nonetheless, it was recognized that in general, information on quality adjustment is not available and that users often do not know which methods CPI compilers apply in practice. Therefore, more detailed and documented information (i.e. metadata), could help to increase the transparency of the CPI and thus, its credibility. For instance, more information would be welcome on the types of quality adjustment methods used for the different products and on the hedonic functions applied when adjusting the prices for particular products for quality. In addition, in the European Union, this information would be very useful to enhance comparability across Member States and to accelerate the harmonization process of HICPs, which seems to have slowed down in recent years.

The case-by-case approach was considered an appropriate way to deal with the issue of quality changes. This method has been adopted explicitly in Europe, where new guidelines have been implemented for the HICP, laying down important principles for quality adjustment. In particular, for specific products (e.g. clothes, personal computers, cars) quality adjustment methods are divided into 3 categories: A, B and C. Under category A are classified methods which are highly recommended, under the category B fall second best methods and finally, methods that should not be applied are classified under category C. Improvement in the definition of products and tight descriptions of the items could greatly facilitate the treatment of quality adjustment and enhance the accuracy of the CPI. In addition, specialists of specific industry/services sectors might be useful in the use of hedonics, as they have a good knowledge of the market structure. Therefore, they are able, in general, to identify more easily and in a more accurate way the main drivers of the price evolutions of different products.

Finally, participants recommended more quality adjustment for services, as the latter represent a growing proportion in the CPI. The divergence in the treatment of quality changes for goods and services might well account for some of the differences in their price evolutions (i.e. higher inflation for services than for goods). For this sector, quality might either improve (i.e. health sector) but might also deteriorate (e.g. airlines and supermarkets).

SESSION 5

Other measurement issues of concern to central banks

Chair: Luc Aucremanne (National Bank of Belgium)

                                    Background note and key issues for discussion

Papers: **Price index measurement in Mexico**
                                    Javier Salas (Bank of Mexico)

                                    Administered prices in the French HICP
                                    Valérie Chauvin (Bank of France)

                                    Change in price collection method for the compilation of the South African CPI
                                    Pieter Weidman (South African Reserve Bank)

                                    Summary of discussion

Background note and key issues for discussion

CPI compilation is a rather complicated process. The compilation techniques used in the different countries are not exactly the same, but overall they have much in common. Most methodological issues are described in the CPI Manual, for which a review process is about to be launched.[1] This note presents the different stages involved in the compilation of CPIs and highlights the most important methodological issues that arise for CPI compilers. The note also deals with a number of specific challenges for price measurement, including the treatment of administrative prices, indirect taxation and seasonality.

Reference population, geographic coverage and consumers' basket

The CPI intends to measure the price of a fixed basket of consumption goods and services purchased by the reference population. The reference population refers to the households' group covered by the CPI. The CPI is confined to private households and unlike the GDP deflator, it does not include institutional households.[2] For the purpose of monetary policy, it is generally argued that CPI should include as many private households as possible, and that it should not exclude certain types of consumers, such as extremely wealthy, or consumers, which are engaged in specific activities.[3] In addition, CPI compilers have to decide on the geographical coverage. Usually, a distinction is made between urban and rural households. Most countries tend to cover both areas (in terms of weight), although prices are in nearly every case collected in urban areas only. If price movements are similar in both areas, it does not affect the national CPI. However, if the price evolutions differ, and price collection takes place only in urban areas, then only urban weights should be used. For instance, different countries, such as the US, Australia and Mexico, cover only households in urban areas (weight and prices). In terms of geographical coverage, CPIs might be further defined either as a domestic concept or as a national concept. A CPI based on a domestic concept covers consumption expenditures that take place with the geographical boundaries of the country, whether they are made by residents or non-residents. On the other hand, the national concept refers to consumption expenditures made by residents, whether inside or outside the country. For the purpose of monetary policy, the domestic concept tends to be favoured. Finally, the CPI covers consumption goods and services. A consumption good or service is in general defined as "one that members of households use, directly or indirectly, to satisfy their own personal needs and wants". For the purpose of monetary policy, it has been argued that CPIs should include monetary expenditures, but exclude for instance all payments in kind, purchase of financial assets, illegal activities and gambling.

The collection of prices

In terms of processing, the compilation of CPIs starts with the *collection of individual prices* for the goods and services in the representative consumer basket. Prices might be collected directly in various outlets in different cities or regions across the whole country in order to represent the reference population. This method, referred to as local collection, is used extensively in most countries. However, the number and range of outlets visited as well as the number of prices collected vary significantly across countries. For instance, in Russia and in Poland, around 500,000 price quotes are collected each month in about 30,000 to 50,000 outlets, while in Sweden price collectors each month observe 25,000 individual prices in approximately 1000 outlets. Apart from local collection, individual prices may also be collected centrally from catalogues, trade associations, national or local government agencies, by phone, fax, e-mails or by browsing

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1   *UNECE/ILO/IMF Meeting on Consumer Price Indices in May 2006 in Geneva.*
2   *Such as persons living together in religious institutions or in residential hospitals.*
3   *For instance in Korea, households engaged in agriculture, forestry and fishing and all single persons are excluded from the CPI basket.*

Internet websites. This central collection is usually done for housing, transport, gas, electricity, water, education and health care.

Different measurement errors may arise at this level of the CPI compilation and they have become particularly important in recent years. First, new types of outlets, called discount shops, have recently emerged, allowing consumers to buy some products at a much lower cost than in traditional stores. To avoid the "outlet bias", CPI compilers need to account properly for the change in consumers' purchasing patterns. In addition, CPI compilers need to take into account, in this context, the potential difference in the quality of the products or services offered in these new outlets, which is in general lower than in traditional supermarkets.[4]

Second, CPI compilers need to introduce new products in the CPI basket, in a timely manner, to avoid the "new product bias".[5] Finally, it might also happen that a selected item is no longer available, or that there have been important changes in the quality of this specific item, compared to the previous month. In other words, the items are not perfectly matched anymore. In this case, the price collector will select a new item, similar to the old one, and will record the quality change in the current item.[6] This is particularly important as a CPI intends to measure "pure" price changes. This issue is discussed in details in the session 4 "Dealing with quality adjustment".

CPI calculations

The second step of the CPI compilation is the *CPI calculation*, which refers to the aggregation of individual prices into (1) elementary indices and (2) higher-level indices. For elementary indices, individual price quotes from specific outlets and for specific items of a sub-class (e.g. rice, spaghetti) are averaged and aggregated. These elementary aggregates are groups of relatively homogenous items for which individual expenditure data are in general not available (e.g. particular brands and types of spaghetti, which are considered to be representative of consumers' purchasing patterns for this food item). Depending on the type of products, elementary indices might be computed for the whole country, for separate regions or for separate outlets (for instance, an elementary aggregate might be computed for spaghetti in outlet X in region Y).

According to the CPI Manual, it is important that the number of items, within elementary aggregates for which prices are collected, is large enough to estimate reliable elementary price indices. Furthermore, it also highlights the importance of accounting for substitution at this level of aggregation when, for instance, consumers switch from relatively expensive items to relatively cheaper ones as a result of changes in relative prices. Different formulae can be used to construct elementary price indices with the un-weighted geometric mean of price relatives (GM) seen to be the most appropriate one to handle any potential substitution bias (see p. 2 of the background note for session 7). In recent years a large number of CPI compilers, such as those in the US, Mexico, Italy, Brazil and Spain, have opted for a geometric formula to aggregate individual prices at the elementary level.

Finally, there has been a great interest in recent years for scanner data, as it makes expenditure data available continuously at the level of individual commodities and therefore price statisticians might account for substitution within the items strata. Furthermore, scanner data might also be used in hedonic regressions to adjust for quality changes, as information on items' quality and attributes may be directly available.

These elementary aggregates are averaged to obtain higher-level indices, using elementary expenditure aggregates as weights. At this stage, two different types of elementary aggregate weights might be distinguished: (i) group (e.g. food), class (e.g. bread and cereals) or sub-class weights (e.g. rice), (ii) regional weights and (iii) outlet weight. The weights for the group (or classes and sub-classes) represent their share in the total consumption expenditure of the reference population. This information is usually obtained from the households' budget survey (HBS). Additional information, available at a higher frequency, may also be used such as national accounts data (households' final consumption expenditure), retail sales data, population data and scanner data. Regional weights for a given sub-class are the consumption expenditure in a region (% of the whole country). Outlet weights refer to share of a particular store for a specific product in a specific region.

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4 *For more details, see the issue note on session 7 "Quantifying the measurement bias".*
5 *For more details, see the issue note on session 7 "Quantifying the measurement bias".*
6 *Afterwards, the price collector will send each month this information to the statistical institute, and a commodity specialist will verify the data for accuracy and make corrections or adjustments if necessary. These corrections might simply be an adjustment for a change in the size or quantity of an item, but adjustments that are more complicated might also be needed in certain cases, in particular, those based on statistical analysis (i.e. hedonic method). For more details, see the note on "Dealing with quality adjustment".*

Box 1 – Price Compilation: an overview

CPI

Expenditure weights for products sub-classes (e.g. apples), classes (e.g. fruit) and groups (e.g. food)

CPI calculation

Higher-level indices for each products sub-class for the whole geographic coverage

Regional weights

Higher-level indices for each products sub-class in each region

Outlet weights

Elementary indices for each products sub-class in each region and in each outlet

Price collection

Individual price quotes collected locally for each region

Individual prices collected centrally

The higher-level indices are obtained by applying a Young (or Laspeyres) formula, defined as a weighted average of the elementary indices using weights derived expenditures in some earlier period.[7] While this formula presents the advantage of being relatively simple, it fails to account for substitution ("substitution bias" at the upper level). Indeed, it does not reflect the fact that consumers tend, on the one hand, to reduce their quantity consumed of products, which have become relatively more expensive and, on the other hand, to increase the quantity of items that have been relatively cheaper.

Different solutions have been proposed to reduce this bias. First, the use of chained-Laspeyres index, which updates frequently the base period weights, should reduce significantly this bias, in comparison with a direct Laspeyres formula, since it takes into account the underlying information in terms of changes in quantity.[8] Nevertheless, it is has been argued that this method is not entirely satisfactory, as updated weights still refer to an earlier period and therefore does not allow for complete substitution. Superlative indices (e.g. Walsh, Fisher, Tornqvist – also called ideal indices) use expenditure figures both for the base and current period as weights, are considered to account properly for this type of bias.[9]

Specific challenges related to price measurement

Apart from the measurement issues mentioned above, there might be other aspects of particular importance. In their conduct of monetary policy, policymakers assess regularly inflationary

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7   *If weight expenditure refers to the reference period (i.e. period where the index is set to 100), the index is defined as a Laspeyres index.*

8   *In this context, the European Commission (Eurostat) requires that HICP weights are frequently up-to-date, "Each month Member States shall produce HICPs using weightings which reflect consumers' expenditure patterns in a weighting reference period ending no more than seven years before the preceding December"... Where reliable evidence shows that a weighting change that would affect the change in the HICP by more than 0.1 percentage point on average over one year against the previous year, Member States shall adjust the weightings of the HICP appropriately" (Council Regulation, EC, n 2454/97, 1997). See for more details the issues note on session 7.*

9   *In this context, the BLS has started in 2002 to compute and to publish officially a superlative index, the C-CPI-U, in addition to the traditional US CPI. This index employs a Tornqvist formula and expenditure data in adjacent time period. However, the superlative indices have a drawback in terms of availability of data, which might be serious for the conduct of monetary policy. Weights for the current period are not available on a timely basis; therefore, revisions might be important until the definitive publication of these expenditure data. See for more details the issues note on session 7.*

developments. In this context, they need to determine the factors behind the inflationary pressures. For that reason, it might be relevant to determine the impact of administered/regulated prices, as they usually do not reflect macroeconomic factors. While there is no agreed definition, this term tends to refer to prices that are not determined by market forces (demand versus supply) and that are heavily influence by the government (price or quantity). This might involve direct price-setting, significant subsidisation, regulation related to production of products by the government or some regulatory body. These prices are in general fixed for a relatively long time period, they do not respond to business cycle and tend to show important relative price changes, when a change occurs. The proportion of administered prices varies greatly among countries. For instance, they account for more than 33% in Brazil, while in the US they represent less than 7% of the CPI basket.[10] In recent years, this issue has been intensively discussed in particular in the euro area, as administered prices had an important upward effect on headline inflation and are considered to be an important factor behind the relative price stickiness of the HICP over the last years. However, it has proved to be rather difficult to assess with precision the impact of administered prices on the euro area HICP inflation, as for instance, in some countries the price of a specific product might be market-determined, while in other, it might be strongly influenced by the government. In addition, certain products are considered borderline, and it might be difficult to distinguish whether price changes are related to market forces or to government actions (e.g. food prices subject to the Common Agricultural Policy in the EU). Further work needs to be accomplished on this issue, in order to capture or isolate accurately the impact of administered prices on headline inflation.

The CPI includes all taxes, such as sales taxes, excise duties and value added taxes, as they are part of the price paid by consumers. Another potential issue of concern for central bankers might therefore arise from changes in indirect taxation, which cause a one period change in the price index. These changes tend to be particularly important for beverages, tobacco, and fuels, as these products usually contain a relatively higher level of value added taxes and excise duties. For the purpose of monetary policy, policy makers might be interested to determine the impact of these effects on headline inflation, since it does not reflect a change in the underlying inflation pressures but only to changes in an economic/fiscal tool. In this context, they might be interested by a constant tax index, also called net price index, in which taxes on consumer goods and services are deducted from the purchased prices. In practice, it might be difficult to assess the impact of change in indirect taxation, as it is hard to determine to which extent these changes are passed on to consumers. A typical example concerns a change in taxes on fuel. This will directly affect fuel prices, which might in turn affect the price of transport services (e.g. bus). It might also affect the prices of transported goods and the price paid for these goods by consumers. A given change in indirect taxation might have secondary effects, which might be difficult to distinguish.

The existence of seasonal products pose serious challenges for CPI compilers and also for central bankers in their regular assessment of price stability. Seasonal products refer either to items that are not available during certain seasons of the year or, to items available throughout the entire year but for which quantities fluctuate widely with the different seasons. These aspects are particularly important for food and clothes. It creates important problems for price statisticians as, for instance, the disappearance of a seasonal commodity in a particular month makes it impossible to compute month-on-month price changes. This issue might also be important for central bankers, as it complicates the understanding of the underlying trend in short-term price changes created by some noises in the headline inflation measure. Especially, it is rather difficult, based on non-seasonally adjusted CPI data, to determine whether developments between two months do reflect a normal seasonal pattern or a modification of the economic environment. Central bankers usually cope with this issue by comparing a monthly index in particular month with the monthly index in the corresponding month of the previous year, instead of focusing on month-on-month movement in the price index. However, this might not be entirely satisfactory in case the seasonal patterns change over time.[11] Hence, some central banks prefer to remove completely the different seasonal patterns using specific econometric techniques. Besides providing a better understanding of inflationary developments, seasonally adjusted data might also be relevant in the context of international comparisons, since CPIs in different countries might present different seasonal patterns.[12] Finally, seasonally adjusted CPI data are very useful in economic modelling or for forecasting.

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10 *These figures are based on the information received from a survey (results are available on ebis) and they should be interpreted carefully as the differences might also reflect some differences in the precise definition.*
11 *This might be caused, for instance, by a change in the sample.*
12 *In particular, countries around the world are in different seasons at identical periods of the year.*

However, seasonally adjusted CPI data are not free of controversy. In particular, different techniques exist, and it is unclear which technique performs better, to account for changing seasonality pattern.[13] Additional aspects that need to be resolved include, the best time span to consider, and of the treatment of outliers.

All these different measurement problems are closely related to core inflation measure. Indeed, removing administered prices, taxes and seasonal factors is somehow similar to excluding volatile components (see the background note for session 6).

Issues for discussion

- Is the so-called formula bias, for instance related to the choice of formula to construct elementary price indices or to the choice of index for calculating the weighted aggregate index, significant in national CPI's? Is best practice to address this potential bias evolving in this respect (e.g. the move to geometric means and superlative indices)?
- How often should the CPI basket be revised? Is it useful to set out rules or best practices such as those currently applied for the HICP in the EU (ie products are included as soon as the expenditure for them is higher than 0.1% of the total household spending)? How useful are the so-called chaining indices and which periodicity would be useful when these are applied (e.g. yearly or monthly chaining)?
- How significant are the difficulties related to administered prices, changes in indirect taxation and seasonality from the perspective of central banks? Are there appropriate methods to deal with these issues?
- Are there other measurement issues that CPI compilers should be paying more attention to as they update the CPI Manual?

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13 *Two main approaches might be distinguished: the Census, the X-12 ARIMA seasonal adjustment method, which is commonly used by many institutions. This method is based on moving average filters and it has been developed by the U.S. Bureau. The other commonly used seasonal adjustment method is the TRAMO/SEATS, which is a model-based seasonal adjustment method.*

Price index measurement in Mexico

Javier Salas (Bank of Mexico)

1. Historic evolution of the price indices prepared by Banco de México (1929–2006)

Banco de México has had a long standing tradition constructing and publishing price indices. The first experiences date back to 1929 when a Food Cost Index and a Wholesale Price Index were calculated with information from Mexico City. These indices preceded the Consumer Price Index (CPI) and the Producer Price Index (PPI), which are currently used as inflation indicators (Chart 1).

During the 77 years Banco de México has prepared and published price indices, several improvements have been made as shown in Chart 1, and Tables 1 and 2. The geographical coverage of the CPI has been expanded to 46 cities and to the national level in the case of the PPI. Generic item weights have been set according to the Household Expenditure Survey and to the National Accounts in the case of the CPI and the PPI, respectively. As soon as new information is available, the indices are reviewed to determine if they require rebasing. Currently, the CPI is comprised of 315 generic items (group of products sharing the same characteristics), with 190,000 price quotes raised every month and results are published on a biweekly basis. As for the PPI, 600 generic items are considered with 19,000 price quotes. The quality of the price indicators published by Banco de México is certified by the ISO:9000/2000 methodology implemented since January 2001.

Certain government agencies and private institutions have produced price indicators. Nonetheless, these indicators were short-lived because the government entity that produced them ceased to exist or shifted the use of its resources to other projects. In the case of the private sector, efforts were more oriented to verifying price measurement in times of economic crisis, but since no major deviations were found with respect to the official indicators – in addition to funding problems – most of these parallel price indicators were discontinued. These facts highlight the permanence of Banco de México in producing price indices uninterruptedly.

The institutional arrangement in which the central bank produces the inflation figures is not common. It is often argued that there could be a conflict of interests. Criticism of this arrangement tends to increase in times of high inflation. However, with a higher degree of transparency, the ISO-9000 quality certificate and a low inflation environment, the arguments against this arrangement remain muted. Nonetheless, the recent autonomous status obtained by the statistical agency (Insituto Nacional de Geografía, Estadística e Informática, INEGI) provides an opportunity to improve the institutional framework, and it is very likely that INEGI will produce the price indicators in the future. When the time to transfer the price indices from Banco de México to INEGI comes, the central bank will help to assure that the methodology is implemented correctly and the quality of the indices is maintained.

2. Analysis of the upper and lower substitution bias

2.1 Upper substitution bias

A useful strategy to reduce the upper substitution bias is to have a sample that is always refreshed in terms of the products that make up each generic item as well as the points of purchase. It is not easy to have complete control over sample sizes that are very large, and where price researchers may affect the sample by choosing individual products every time chaining is required. At Banco de México the strategy to tackle this problem has been to produce a Catalogue of Generic Items. The Catalogue gives every participant a complete overview of all the brands and points of purchase that are available for each specific product or service in a generic item.

The Catalogue of Generic Items consists of 315 sets of descriptive statistics on each generic item. Each set has 5 tables with the following contents:

1. Table 3 includes basic statistics on generic items, their weight in the CPI and the number of quotes to be obtained nationwide. The following topics are also covered: description of points of purchase; full explanation of the specific items whose prices are quoted; chaining criteria; and criteria to update the specific goods and services that comprise each generic item.
2. Table 4 presents a summary of brands and points of purchase. In the case of fruits and vegetables, the producing states and the seasonality of such items is detailed. The information is drawn from production accounts and from the Household Income and Expenditure Survey.
3. Table 5 provides a matrix relating the 46 cities included in the CPI with the brands of products or type of services (in the case of fruit and vegetables or meat products, the corresponding varieties) whose prices are being quoted. With this information field work can be carried out with a wide scope that allows for adapting the sample to new outcomes in the market, therefore providing better coverage and permanent update of the generic items.
4. Table 6 accounts for the points of purchase in 46 cities. Points of purchase considered are supermarket, public market, specialized store, informal market, convenience store, department store and price club.
5. Table 7 is similar to Table 6 but presents the points of purchase with the specific name of the outlet.

The information contained in the Catalogue allows the sample to be updated timely and permanently. Price researchers use the Catalogue in their daily activities and consider it a very useful tool to update their samples. Currently, we have not measured how much the upper substitution bias is reduced by constantly improving the representativeness of the sample; however, intuitively it makes sense that systematically refreshing the sample curtails such bias.

2.2 Lower substitution bias

Currently, Banco de México applies the geometric mean to 109 generic items of the Food, Beverages and Tobacco Sub index. The use of the geometric mean helps to reduce the lower substitution bias that is generated by equally weighting the specific items of a generic concept where substitution occurs among its components.

A very good example of perfect substitution within the specifics of a generic item is tomato, where the prices of both plum and round tomato are quoted. In the CPI, domestic production of tomatoes is reflected by sampling 70 per cent of plum tomatoes and 30 per cent of the round variety. Tomatoes carry a large weight in the CPI: 0.9590 in the 1994 base, and 0.4953 in the new base set in the second half of June 2002. Tomato prices are very volatile; 64.7 times larger than the CPI on average for the period June 2003–February 2006 (Graph 1 and Table 8). It is very important to mention that from time to time a significative price differential exists between the two tomato varieties (Graph 2).

The volatility of tomato prices is directly related to weather conditions, plagues and trade with the United States, with all of these conditions affecting supply and prices. As it can be seen in Table 9, in the period August–November 2004 inflation was drastically affected by the hike in tomato prices that occurred as a consequence of hurricanes that hit Florida, destroying the local crops, therefore allowing Mexico to export a substantial amount of tomatoes. In just 5 months inflation went from 4.49 per cent in July to 5.43 per cent in November (Table 9). Tomato prices explained such variation, and the fact that the CPI is calculated with geometric means led to a reduction of 12 basis points with respect to the alternative calculation using arithmetic means in the referred period. As shown in Graph 2, when the price differential between the two varieties narrows, there is bound to be less substitution and vice-versa. Reproducing an example using both arithmetic and geometric means for the period July 2003–February 2006, the result indicates that headline CPI inflation is reduced by eight basis points during the period (Table 10). This result is to be considered a floor in terms of the lower substitution bias correction, because during the simulation period a number of adjustments – such as expanding the sample from 3 to 5 tomato price quotes per price investigator, and balancing the observations to be compatible with the countries production – were made to the generic item.

Applying the geometric mean to the 109 generic items included in the Food, Beverages and Tobacco Sub index certainly renders a more realistic measure of inflation, avoiding the so-called lower substitution bias.

Javier Salas (Bank of Mexico)

Chart 1 – Historic evolution of the price indices prepared by
Banco de México (1929–2006)

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┌─────────────────────────┐          ┌─────────────────────────┐
│   Food cost index       │          │  Wholesale price index  │
│   Mexico city           │          │  Mexico city            │
│   (1929; 16 items)      │          │  (1929; 32 items)       │
└─────────────────────────┘          └─────────────────────────┘
           ↓                                    ↓
┌─────────────────────────┐          ┌─────────────────────────┐
│   Retail price index    │          │  Wholesale price index  │
│   Mexico city           │          │  Mexico city            │
│   (1950; 64 items)      │          │  (1939; 210 items)      │
└─────────────────────────┘          └─────────────────────────┘
           ↓                                    ↓
┌─────────────────────────┐          ┌─────────────────────────┐
│  Consumer price index   │          │  Producer price index   │
│  (several comparison    │          │  (several comparison    │
│   basis)                │          │   basis)                │
└─────────────────────────┘          └─────────────────────────┘
           ↓                                    ↓
┌────┬────┬────┬────┐ ┌──────────────┐ ┌────┬────┐ ┌──────────┐
│1968│1978│1980│1994│ │ 2nd fortnight│ │1980│1994│ │Dec. 2003 │
└────┴────┴────┴────┘ │  June 2002   │ └────┴────┘ └──────────┘
                      └──────────────┘                  ↓
                             ↓                    ┌──────────────┐
                     ┌──────────────┐             │ISO:9000/2000 │
                     │ISO:9000/2000 │             └──────────────┘
                     └──────────────┘
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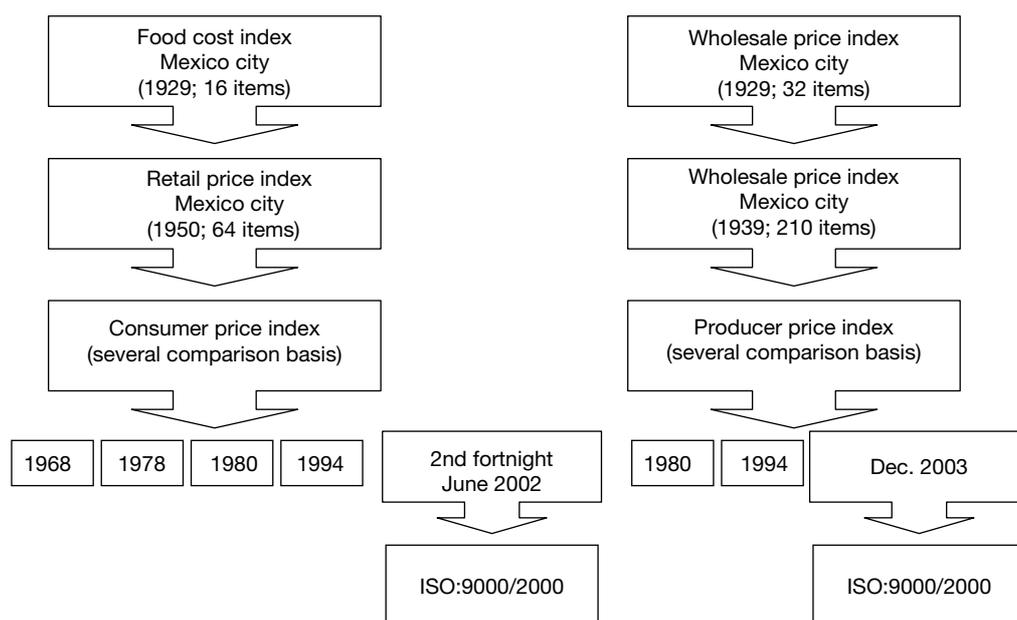
Table 1 – Historic evolution of the price indices prepared by Banco de México (1929–2006)
  CPI evolution in Mexico

Index / Main features	Food cost index	Retail price index in Mexico city	Consumer price index				
Comparison base	1929	1950	1968	1978	1980	1994	JUNE 2F, 2002
Weighting base	1927	1950	1960–1963	1963	1977	1989 updated to 1993	2000 updated to June 2F, 2002
Number of generic products	16	64	172	172	302	313	315
Number of price quotes	64	160	13,000	35,000	90,000	170,0000	190,000
Cities included	Mexico City	Mexico City	7 Cities	16 Cities	35 Cities	46 Cities	46 Cities
Timing	Monthly (1929–1974)	Monthly (1950–1978)	Monthly (1969–1977)	Monthly (1978–1979)	Monthly (1980–1993)	Fort nightly (1988 to June 1F, 2002)	Fortnightly (June 2F, 2002 to present time)

Source: Banco de México Historic Records. Consumer Price Index Methodological Handbook. Banco de México.

Table 2 – Historic evolution of the price indices prepared by Banco de México (1929–2006)
PPI evolution in Mexico

Main features ╲ Index	Mexico City wholesale price index, 32 items	Mexico City wholesale price index, 210 items	Produced price index		
Comparision base	1929	1939	1980	1994	Dec. 2003
Weighting base	1929	1939	1970 updated to 1980	1993	2001 updated to Dec. 2003
Number of generic products	32	210	592	626	600
Number of prices quotes	128	600	6,000	15,000	19,000
Coverage	Mexico City	Mexico City	National	National	National
Timing	Monthly (1930–1979)	Monthly (1939–2000)	Monthly (1981–1986)	Monthly (1996–2003)	Monthly (2004–present time)

Source: Banco de México Historic Records. Banco de México.

Table 3 – Points of purchase information and generic item analysis
Format o de trabajo para la revisión de los genéricos del INPC

Table 4 – Points of purchase information and generic item analysis
Dirección de precios, salarios y productividad
Revisión de genéricos del índice nacional de precios al consumidor (INPC), e índice nacional de precios productor (INPP) hoja técnica de revisión de genéricos de frutas y legumbres

Seasonality of tomato production: supplying States

Tomato varieties quoted: round and plum

Points of Purchase comparison between Expenditure Survey results and commercial sites actually visited

Criteria to update the specific goods and services that comprise the generic item

Table 5 – Points of purchase information and generic item analysis
Índice nacional de precios al consumidor
Resumen de variedad por ciudad

Distribution of tomato price quotes according to variety in the 46 cities that integrate the CPI

Item selection: 315 generic categories of goods and services (strata of items purposively defined) cover the universe of consumption habits of Mexican urban families from the 2000 National Income and Expenditure Household Survey (Encuesta Nacional de Ingreso y Gasto de los Hogares, ENIGH).

Table 6 – Points of purchase information and generic item analysis
Índice nacional de precios al consumidor
Resumen de punto de venta por ciudad

Type of Points of Purchase visited in the 46 cities that are included in the CPI

Genérico: 073 JITOMATE

Ciudades

Punto de Venta	01 AREA METROPOL	02 MÉRIDA, YUC.	03 MORELIA, MICH	04 GUADALAJARA, J	05 MONTERREY, N.L	06 MEXICALI, B.C.N	07 JUÁREZ, CHIH	08 ACAPULCO, GRO	09 CULIACÁN, SIN	10 LEÓN, GTO	11 PUEBLA, PUE.	12 SAN LUIS POTOSÍ	13 TAPACHULA, CHI	14 TOLUCA EDO DE	15 TORREÓN, COAH	16 VERACRUZ, VER	17 VILLAHERMOSA, T	18 TAMPICO, TAM	19 CHIHUAHUA, CHI	20 HERMOSILLO, SO	21 MONCLOVA, COA	22 CÓRDOBA, VER.	23 AGUASCALIENTE	24 TIJUANA, B.C.N.	25 MATAMOROS, TA	26 COLIMA, COL.	27 LA PAZ, B.C.S.	28 CHETUMAL, Q.RO	29 JACONA, MICH	30 FRESNILLO, ZAC	31 IGUALA, GRO	32 HUATABAMPO, S	33 TULANCINGO, HG	34 CORTAZAR, GTO	35 CD. JIMÉNEZ, CHI	36 DURANGO, DGO	37 TEPIC, NAY	38 OAXACA, OAX	39 QUERÉTARO, QR	40 CUERNAVACA, M	41 TLAXCALA, TLAX	42 SAN ANDRÉS TU	43 CAMPECHE, CAM	44 TEPATITLÁN, JAL	45 TEHUANTEPEC, C	46 CD. ACUÑA, COA	TOTAL GENERAL
1 SUPERMERCADO	26	7	6	9	7	5	8	7	5	9	8	8	4	8	6	5	6	4	6	5	2	2	6	5	7	5	5	2	2	2	5	3	4	5	5	8	6	9	2	2	5	2			5		252
2 MERCADO PÚBLICO	20	2	3	3	1		2	3	2	1	3		5	1	1	3	4	2	1	3		3	3	1		2	1	3	2	1		2	1	1	1	4	2	1	3	2	4	3	4				107
3 TIENDA ESPECIALIZADA	1	1	1		6	3			1		1		1	1	3	2					2	3	3			1	3				1	1			2	4	1		2		1						45
4 TIANGUIS O COMERCIO INFORMAL	2			3	5	2			1			2				4					2	1				1	1																	1			25
5 TIENDA DE CONVENIENCIA							1	1		1							4	2	1	1	1					1																					13
6 TIENDA DEPARTAMENTAL				1					2						3				1	1					1																						9
7 CLUB DE PRECIOS	1											1												1																							4
TOTAL GENERAL	50	10	10	15	20	10	10	10	10	10	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	5	5	5	5	5	5	5	5	10	10	10	10	10	5	10	5	5	5	5	455

Data for the CPI are raised from personal visits to retail outlets and households in order to obtain cash prices for selected items. VAT and other indirect taxes are included, and prices of items on temporary sale are recorded. Prices for owner-occupied housing units are imputed using the equivalent rent method.

Table 7 – Points of purchase information and generic item analysis
Índice nacional de precios al consumidor
Resumen de fuente por ciudad

Genérico: 073 JITOMATE

Ciudades

Fuente	01 AREA METROPOL	02 MÉRIDA, YUC.	03 MORELIA, MICH	04 GUADALAJARA, J	05 MONTERREY, N.L	06 MEXICALI, B.C.N	07 JUÁREZ, CHIH	08 ACAPULCO, GRO	09 CULIACÁN, SIN	10 LEÓN, GTO	11 PUEBLA, PUE.	12 SAN LUIS POTOSÍ	13 TAPACHULA, CHI	14 TOLUCA EDO DE	15 TORREÓN, COAH	16 VERACRUZ, VER	17 VILLAHERMOSA, T	18 TAMPICO, TAM	19 CHIHUAHUA, CHI	20 HERMOSILLO, SO	21 MONCLOVA, COA	22 CÓRDOBA, VER.	23 AGUASCALIENTE	24 TIJUANA, B.C.N.	25 MATAMOROS, TA	26 COLIMA, COL.	27 LA PAZ, B.C.S.	28 CHETUMAL, Q.RO	29 JACONA, MICH	30 FRESNILLO, ZAC	31 IGUALA, GRO	32 HUATABAMPO, S	33 TULANCINGO, HG	34 CORTAZAR, GTO	35 CD. JIMÉNEZ, CHI	36 DURANGO, DGO	37 TEPIC, NAY	38 OAXACA, OAX	39 QUERÉTARO, QR	40 CUERNAVACA, M	41 TLAXCALA, TLAX	42 SAN ANDRÉS TU	43 CAMPECHE, CAM	44 TEPATITLÁN, JAL	45 TEHUANTEPEC, C	46 CD. ACUÑA, COA	TOTAL GENERAL
1 MERCADO	2		3	3	1	2	3	2	1	3		5	1	1	3	4	2	1		3	3	1		2	1	3	2	1		2	1	1	4	2	1	3	2	4	3	4		108
2 WAL - MART	12			1		1	2		2	2		2		1	1	1		1		2	1			1	1	4	1	1		37
3 FRUTERÍA Y VERDULERÍA		1			1	1	1	3	2		2	1	3		1	1		2	4	1	2		1		37
4 SORIANA		2			1	1	1		1	1	1		1	2	1	2	2		1	1		2	2	2		1		1	2	34
5 B. AURRERA	3		1	1			1	2	1				1	1		1	2	1	2		2		1	24
6 TIANGUIS O COMERCIO INFORMAL	1		3	5			2			4			2	1		1	1		23
7 COM MEX	2	1		2		1		2			1			1	1		2		2		22
8 GIGANTE			1	1	2	2		2		1		1	1		1		1	1	2	1		1	19
9 CASA LEY							3		1				1			1	2	17
10 TIENDA DE ABARROTES Y MISCELÁNEA	1				1			6	2	1	1	1				1	16
11 CARREFOUR			1	1						1				2	3	15
12 CHEDRAUI	1	1	1			1			1		1		2		1	14
13 M. COM MEX	5		2		1					1	9
14 TIENDA DE CONVENIENCIA			1			2			1			1	1		1	1		9
15 B. GIGANTE	2				2					2	6
16 HEB			1				4
17 SÚPER SAN FRANCISCO DE ASÍS		1				2	4
18 PITICO					3
19 SMART			2		3
20 SUPERAMA			1			2	3
21 MERCO					1	2
22 CALIMAX			1		2
23 SÚPER MAZ			1	2
24 AL SÚPER STORE			2
25 SÚPER AHORROS DEL CENTRO		1	2
26 HIPERMART		2
27 B. COM. MEX.		2
28 V HERMANOS		1	2
29 COMERCAL CALIFORNIANO		2	2
30 SUPERMERCADO GONZÁLEZ		2	2
31 ARAMBURO		2	2
32 SÚPER QUALCAN		2	2
33 MZ		2	2
34 OTRAS	2		1	1	1	2	1	2	1	1	2	1	1	1	20
TOTAL GENERAL	50	10	10	15	20	10	10	10	10	10	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	5	5	5	5	5	5	5	5	10	10	10	10	10	5	10	5	5	5	5	455

Specific outlet or Points of Purchase visited in the 46 cities that are included in the CPI

Sample sizes: Each month 190,000 prices are collected in 15,000 retail outlets and 5,000 households covering the 315 generic items in 46 cities.

Table 8 – Use of the geometric mean to account for product substitutability. The case of tomatoes in Mexico
CPI and tomato volatility
Standard deviation of annual rates of growth (12-month moving average)

		CPI	TOMATO
2003	Jun	0.420	18.276
	Jul	0.505	19.493
	Aug	0.580	21.621
	Sep	0.640	23.104
	Oct	0.695	21.132
	Nov	0.708	19.797
	Dec	0.659	20.343
2004	Jan	0.637	21.274
	Feb	0.548	20.484
	Mar	0.382	22.716
	Apr	0.229	22.239
	May	0.169	22.426
	Jun	0.176	24.321
	Jul	0.199	27.422
	Aug	0.262	25.523
	Sep	0.339	20.837
	Oct	0.433	24.523
	Nov	0.485	33.604
	Dec	0.473	33.677
2005	Jan	0.451	34.303
	Feb	0.467	34.454
	Mar	0.455	33.846
	Apr	0.430	36.317
	May	0.409	40.038
	Jun	0.412	39.662
	Jul	0.414	35.415
	Aug	0.474	34.880
	Sep	0.565	38.802
	Oct	0.647	44.298
	Nov	0.676	45.773
	Dec	0.628	46.561
2006	Jan	0.603	53.727
	Feb	0.597	59.645
	Average	0.478	30.925
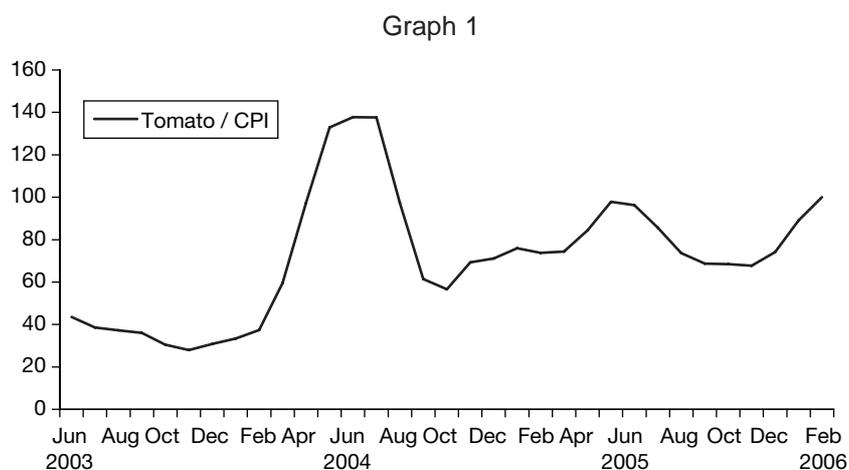
Graph 1

Graph 2 – Use of the geometric mean to account for product substitutability. The case of tomatoes in Mexico

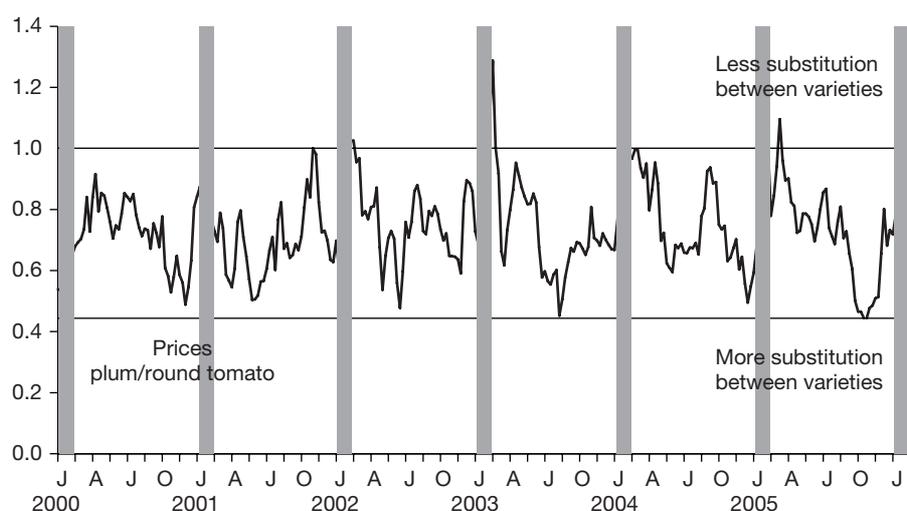*Ratio of consumer prices plum vs. round tomato*

Table 9 – Use of the geometric mean to account for product substitutability. The case of tomatoes in Mexico

Supply of tomato declines, prices skyrocket

	Annual variations				Annual incidences				
	CPI	Core	Non core	Tomato	CPI	Core	Non core	Tomato geometric	Tomato arithmetic
2004 Jun	4.37	3.64	5.99	−17.32	4.37	2.52	1.85	−0.08	−0.07
Jul	4.49	3.67	6.32	−33.33	4.49	2.54	1.95	−0.21	−0.20
Aug	4.82	3.66	7.40	−10.75	4.82	2.53	2.29	−0.06	−0.05
Sep	5.06	3.76	7.93	12.44	5.06	2.59	2.47	0.07	0.11
Oct	5.40	3.84	8.83	61.30	5.40	2.64	2.76	0.36	0.40
Nov	5.43	3.82	8.90	83.21	5.43	2.61	2.82	0.46	0.50
Dec	5.19	3.80	8.20	23.24	5.19	2.59	2.60	0.15	0.18

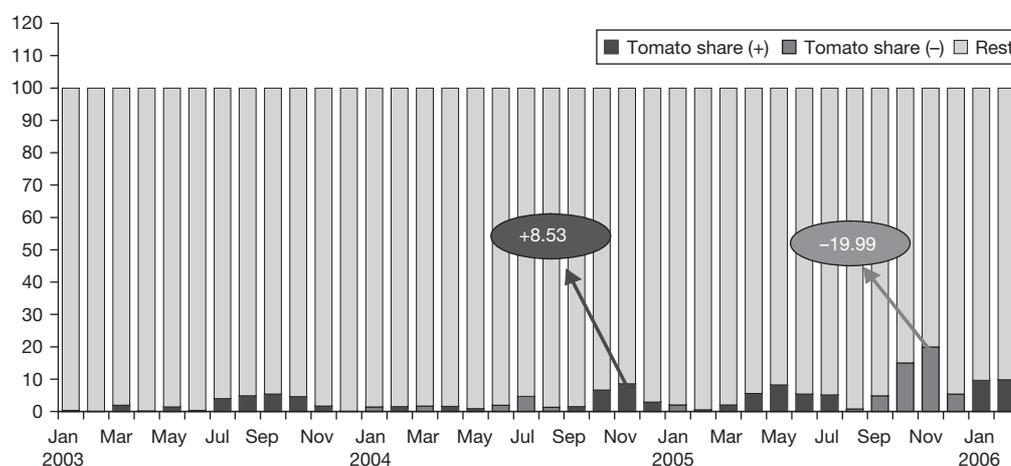Graph 3 – Incidence shares on annual CPI inflation

Table 10 – Use of the geometric mean to account for product substitutabil-
ity. The case of tomatoes in Mexico
CPI (geometric vs. arithmetic mean in tomato prices)
Acumulated variations in percent

		CPI		Accumulated Variation		Differences
		Arithmetic	Geometric	Arithmetic I (A)	Geo-metric (B)	(B − A)
2002	Jun	99.92	99.92			
	Jul	100.210	100.204	0.29	0.29	−0.01
	Aug	100.593	100.585	0.68	0.67	−0.01
	Sep	101.198	101.190	1.28	1.27	−0.01
	Oct	101.646	101.636	1.73	1.72	−0.01
	Nov	102.471	102.458	2.56	2.54	−0.01
	Dec	102.930	102.904	3.02	2.99	−0.03
2003	Jan	103.342	103.320	3.43	3.41	−0.02
	Feb	103.626	103.607	3.71	3.69	−0.02
	Mar	104.277	104.261	4.36	4.35	−0.02
	Apr	104.455	104.439	4.54	4.53	−0.02
	May	104.120	104.102	4.21	4.19	−0.02
	Jun	104.203	104.188	4.29	4.27	−0.01
	Jul	104.355	104.339	4.44	4.43	−0.02
	Aug	104.672	104.652	4.76	4.74	−0.02
	Sep	105.296	105.275	5.38	5.36	−0.02
	Oct	105.679	105.661	5.77	5.75	−0.02
	Nov	106.561	106.538	6.65	6.63	−0.02
	Dec	107.029	106.996	7.12	7.09	−0.03
2004	Jan	107.692	107.661	7.78	7.75	−0.03
	Feb	108.330	108.305	8.42	8.39	−0.03
	Mar	108.697	108.672	8.79	8.76	−0.03
	Apr	108.864	108.836	8.95	8.93	−0.03
	May	108.591	108.563	8.68	8.65	−0.03
	Jun	108.767	108.737	8.86	8.83	−0.03
	Jul	109.048	109.022	9.14	9.11	−0.03
	Aug	109.734	109.695	9.83	9.79	−0.04
	Sep	110.663	110.602	10.75	10.69	−0.06
	Oct	111.428	111.368	11.52	11.46	−0.06
	Nov	112.384	112.318	12.48	12.41	−0.07
	Dec	112.617	112.550	12.71	12.64	−0.07
2005	Jan	112.598	112.554	12.69	12.65	−0.04
	Feb	112.973	112.929	13.07	13.02	−0.04
	Mar	113.491	113.438	13.59	13.53	−0.05
	Apr	113.911	113.842	14.01	13.94	−0.07
	May	113.632	113.556	13.73	13.65	−0.08
	Jun	113.510	113.447	13.60	13.54	−0.06
	Jul	113.952	113.891	14.05	13.99	−0.06
	Aug	114.076	114.027	14.17	14.12	−0.05
	Sep	114.531	114.484	14.63	14.58	−0.05
	Oct	114.813	114.765	14.91	14.86	−0.05
	Nov	115.632	115.591	15.73	15.69	−0.04
	Dec	116.358	116.301	16.45	16.40	−0.06
2006	Jan	117.055	116.983	17.15	17.08	−0.07
	Feb	117.242	117.162	17.34	17.26	−0.08
Total variation during the period			17.34	17.26		−0.08

> Geometric mean in the prices of tomatoes when calculating the corresponding generic item curtails the substitution bias

Administered prices in the French HICP

Valérie Chauvin (Bank of France)

Administered prices can be defined as prices that are either directly set by the government (fully administered prices) or on which the government has a significant influence (mainly administered prices). The latter case can encompass prices that need the approval of the government or of a supervisory authority before any change can be made, or those that are subject to caps, floors or restriction on changes, and in the case of the HICP, those prices that imply changes in out-of-the-pocket expenditures.[1] Such a definition is of course very vague and the coverage of administered prices needs to be defined after a close look at the way practices and the legal framework may hamper price movements.

Borderline cases in France that may or may not be considered as administered prices include items such as rents in the private sector housing as their change is subject to restrictions though independent from government decision, the prices of network industries, telecom and gas, according to the actual influence of government on price setting and, tobacco, as government has a significant influence on the price level, via indirect taxes.

Nevertheless, administered prices exclude prices influenced by regulatory effects such as safety or environmental standards or those subject to government influence on intermediate goods and services (e.g. EU agricultural policy). Although these effects do have an impact on the prices, their influence is difficult to separate and cannot be clearly identified.

It is interesting to analyse administered prices in particular for two reasons. On the one hand, they behave according to specific determinants, such as the public budget balance or the social consequences of both price changes and the timing of this change (e.g. change in gas rents). On the other hand, the sources of information are specific, such as government announcements and budgetary documents.

One way to compute the historical impact of administered prices is to track the announcements made by the government from time to time. This method suffers from two drawbacks. First, it cannot insure that the evaluated impact of administered prices is perfectly coherent with the impact measured by the price index. Since the impact is evaluated on the basis of announcements, it is an *ex ante* evaluation. The actual impact, *ex post*, can be different and cannot be assessed in this way. Second, as past measures are difficult to track, some may be forgotten. Thus, it is most useful to construct a separate index of administrative prices that can also be used to analyse the contribution of these prices to price index.

There are many benefits in computing an index of administrative prices. In the first place such an index can be used to compute a price index excluding administered prices, which can be modelled by the usual determinants for inflation. Moreover, in the euro zone, such an index excluding administered prices has a more stable composition than the overall HICP as many administered prices were added since 1996. Another reason for analysing the administrative prices through an index would be to estimate their second-order effects on a range of other prices. For example in France, the reference for wages is the CPI excluding tobacco. Similarly, changes in health care costs will have an impact on the HICP but not on the CPI.

Graph 1 presents the different inflation measures in the case of France. An interesting point to note is that changes in administered prices have tended to occur contra-cyclically. From 1997 to 2001, when the French economy grew rather strongly, administered prices and indirect taxes contributed only moderately to overall inflation. On the contrary, in 2002–04, due to budgetary restrictions, government measures were increased significantly in a period of low growth.

Over the recent past, the impact of administrative prices has been typically contra-cyclical and this must be taken into account in assessing the current evolution of prices and forecasting their dynamics. By using an index of administrative prices, the quality of the forecasts can be improved.

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1 *HICP in Europe takes into account only out-of-the-pocket expenditures, so that a change in reimbursement rates, where they appear, implies a change in the HICP.*

Graph 1 – Inflation measures and the contribution of administered
prices and indirect taxes

Year-on-year, in %
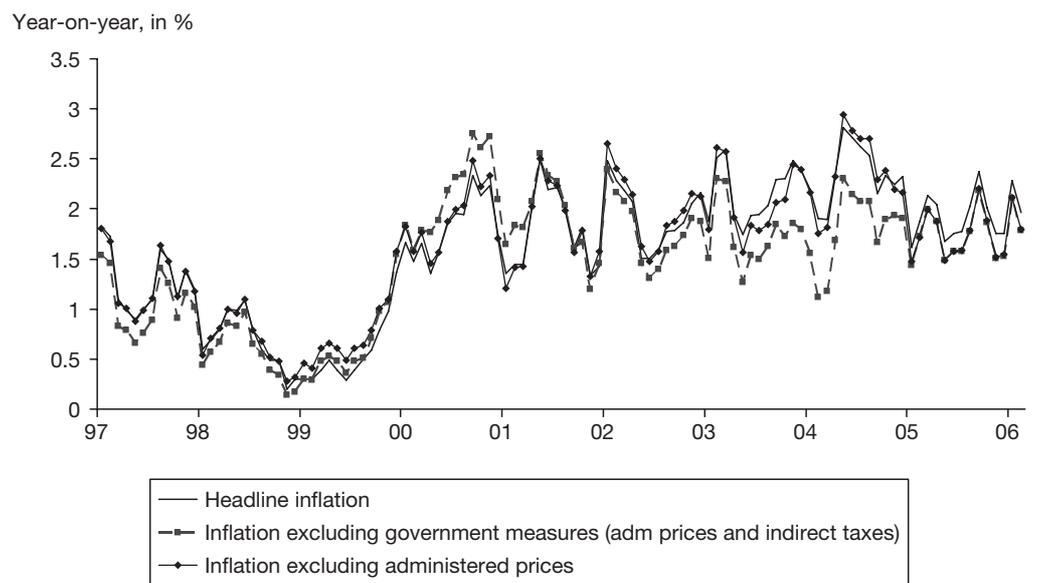
Sources: Eurostat, INSEE, Banque de France.

Valérie Chauvin (Bank of France)

Change in price collection method for the compilation of the South African CPI

Pieter Weideman (South African Reserve Bank)

Statistics South Africa (Stats SA) has introduced changes in the methods used for compilation of the South African CPI in the past few years. There were several reasons which prompted this change. In the first place, outdated rental data in 2003 led to unrealistically high increases in the house rent component of the CPI. This was later revised with use of more appropriate rental data by Stats SA and resulted in a downward revision of the already published CPI by 1.9 percentage points in 2003. However, the revision was done by extrapolation, based on the increases in house rent estimates. This revision led to serious concerns being expressed on the appropriateness of the methods followed by Stats SA for the compilation of the South African CPI. Reviews were conducted by both the African Development Bank and Statistics Canada on the compilation methodology used in calculating the South African CPI.

South Africa has used a postal method of data collection since the inception of CPI compilation in 1910. However, the system suffered from several short comings which were also confirmed by the reviews conducted in 2003. The main objection to this method was that there was no proper control over the quality of price information supplied by the respondents. Moreover, it was very uncertain as to how respondents handled the issues relating to the unavailability of products or substitution by other products as well as the introduction of new products. There were no independent ways to verify or validate the accuracy of the information received. For these reasons, the review recommended that the postal price collection method should be replaced by a more direct price collection method. In 2004, Stats SA made the strategic choice to introduce a more direct price data collection method.

A pilot of this new direct price collection method, where price collectors directly collect the price data from the retail outlets (stores) was started in July 2004. Stats SA was assisted by the Australian Bureau of Statistics in this process. Following the success of this pilot, direct price collection method was rolled out to all metropolitan areas during 2005.

It needs to be emphasised, however, that this change in the process of price data collection was not accompanied by any change in the CPI calculation methodology. The anticipated benefits of the new price data collection method were mainly seen in the improved ability for quality control at all stages of the CPI compilation process. Since the completion of the pilot, prices for around 60 per cent of the CPI basket are now directly collected from retail outlets. The remaining 40 per cent, mainly administered prices, are still collected by means of a postal survey or using third party data. The first publication of the CPI compiled using direct price collection methods was in February 2006 for the January 2006 release.

However, it was interesting to note that despite the changeover, the results from both methods were very similar. The new method did result in a marked increase in the cost of data collection. Nevertheless, the new method is likely to prove beneficial over time as this will lead to more rigorous verification and better quality data. Further, it allows for a fuller capture of price changes unlike the earlier response rate of 90 per cent possible with the postal survey method. The collectors of price data are also better able to assess the increasing variety in products and outlets to enable the price collection authority to make the appropriate changes and possible incorporation of new products and outlets into the CPI basket. The direct collection method is also in line with international best practises which will enable South African participation in international programmes such as the International Comparison Programme (ICP).

Notwithstanding the institution of a new price-collection method for the compilation of the South African CPI by Stats SA, certain biases still remain, namely:

- substitution bias which results from the shift in demand, and therefore purchasing volumes, from one product to another due to relative price changes;

- outlet bias whereby buying power shifts from one outlet to another outlet which offers lower prices or better quality;
- new product bias whereby new products are not included in the CPI basket in a timely fashion; and,
- no explicit account, such as the use of hedonic techniques, is yet taken of quality changes.

The following improvements being implemented by Stats SA will, however, address some of these issues:

- the periodicity of the Household Income and Expenditure Survey, whereby weights for the components of the index are calculated, will be increased from five years to three years;
- preliminary results from a direct rental survey will be made available in April 2006;
- an improved method of collecting domestic worker wages will be instituted in the near future; and,
- the possible future use of scanner data will be investigated.

Pieter Weideman (South African Reserve Bank)

Summary of discussion

Compilation of the CPI involves a number of measurement issues which are discussed in greater detail in the background issues note and the individual contributions. In particular, the main issues and challenges in the computation of the CPI were seen in four broad areas: the coverage of the CPI, data collection methods, the aggregation of micro prices into the composite index and, the treatment of specific types of prices such as administered prices.

In terms of coverage, typically, the products included in the basket of goods, the reference population, and the retail outlets used in the sample are key aspects of the methodology of CPI compilation. The second issue is about the way in which data are collected. One possible focal point related to the use of scanner data for the compilation of the CPI and whether these data had the potential to solve some of the measurement issues. The third issue relates to the aggregation of micro prices into the overall CPI and, in particular, the question of the appropriate aggregation method. Finally, the issue of treatment of administered prices poses a significant challenge to many countries. The discussion dealt with the treatment of certain types of administered price changes which may need to be excluded from the CPI formula precisely because they are so specific and therefore not very informative for analytical purposes. These types of price changes include changes in indirect taxes, changes in administrative prices and price changes of seasonal goods. More generally, administered prices are not a collection issue, but an interpretation issue for users of CPI data.

The coverage of the CPI sample poses several issues. First, there is the question of bias-outlet bias illustrates this issue well; the appearance of new outlets has to be taken into account in the data collection. Indeed, if those new outlets are cheaper, a substitution effect will occur. In the US, Jerry Hausman, had argued that the BLS was not appropriately taking into account the appearance of Wal-Mart. This could result in a measurement bias, if the new establishments are not included in the data collection procedure.

Using multiple sources of data collection can help to better understand the price differentials of products in different markets. For instance, INSEE conducted an analysis of price movements of products that were bought by consumers in supermarkets and discount shops and noticed different price evolutions in different kinds of outlets. Similarly, changes in the sources of data (reference population or geographical coverage) can have marked effects on the CPI. For instance, the Indonesian statistical office had collected prices only in traditional markets before 2001. The subsequent inclusion of supermarkets resulted in a downwards pressure on inflation. Furthermore, the increase in geographical coverage (new cities added to the survey) could bring changes to the CPI level. In cities with infrastructural problems there is a persistently higher level of CPI as compared to national CPI. It is also it is important to remember that usually samples are collected in big cities which tend to have a higher price level compared to the newly added smaller cities (located near rural areas). When such changes occur, it would be necessary to link back the series with the old sample at hand so year-on-year changes can be computed on a consistent basis.

The process of collection of prices data at the micro level has its share of complications. Most countries resort to a sample coverage based on direct collection of price data from retail outlets. Methods like postal survey as in South Africa are being replaced by more direct ways of collecting the information as the former is considered less satisfactory in terms of the quality of the information obtained. More recently, some countries have adopted newer modes of collection such as collecting the prices from the Internet. This could become a standard in the future as it can be cost-effective, timely and accurate. Moreover, it would allow monitoring the appearance of new outlets. Price collection from the Internet should be included in the CPI calculation as soon as the presentation of prices on the Internet has become standard.

Aggregation of the micro prices into sub-groups and into a composite index has both practical and methodological implications. For a start, the sample should be large enough to provide reliable estimates of elementary aggregates. Moreover, it is necessary to account for substitution when, for instance, consumers switch from relatively expensive items to relatively cheaper ones as a result of changes in relative prices. The use of the geometric mean was seen as an important aggregation tool at the micro level which could more appropriately handle substitution bias.

It was widely accepted that one had to discriminate between administered prices and other prices in order to have a proper assessment of price development. The concept could be more or less defined but the implementation was considered to be extremely difficult (at least among

EU-countries) as countries apply concepts in different ways. This was becoming a real issue due to the high share of administered prices in the HICP in some countries. On the treatment of rent (which are usually classified as administered prices), it was suggested that only social housing and housing offered by governments at low rents could be considered as administered prices. Rents on the private housing markets should be treated with care: what is sometimes regulated is the increase in rent, but not the level. Tenants can enter into contracts with landlords at any (unregulated) level.

It was also noted that, as central banks are mostly interested in monitoring inflation, it was important to avoid having different sets price indicators to measure the level of inflation. This is important in the context of administered prices. Two things should be distinguished: there is some government influence on price setting (examples include rents, electricity, theatre tickets) and there are other items where the out-of-pocket expenditures of households are much smaller than the "true" price of these goods. The share of out-of-pocket expenditures, however, may vary over time. For instance, due to the changes to the health care reform in Germany, consumers have to pay a higher price for health services, but the producer price of health services has not changed and thus the impact on the GDP deflator was close to zero. In such cases, conflicting signals are received by the consumers: consumer price inflation accelerated, whereas a hypothetical PPI for health service would not have increased. As a tool for measuring price stability the CPI would then not be the most informative indicator. As alternative measures for inflation, the GDP deflator or the PPI would be more appropriate in such specific cases.

If the share of administered prices in the CPI is high, these prices tend to increase much faster than the market prices in periods of high inflation (two times), as in Brazil or Argentina. It was an open question whether the inflation rate would have been lower without administered prices.

In conclusion, there was a general agreement that while it is difficult to reach a consensus on which part of the administered prices should be excluded from the CPI, there was need for more discussion on this issue.

Measures of core or underlying inflation

Chair: Roberto Sabbatini (Bank of Italy)

                             Background note and key issues for discussion

Papers: **Core Inflation: Definitions and measures**
Roberto Sabbatini (Bank of Italy)

                             The Canadian experience with core inflation
Thérèse Laflèche (Bank of Canada)

                             Core inflation measures: The case of Poland
Jarosław T. Jakubik (National Bank of Poland)

                             Core inflation measurement at the Riksbank
Jesper Johansson (Sveriges Riksbank)

                             Summary of discussion

Background note and key issues for discussion[1]

Much effort has been made, and continues to be made, to improve the methodology and process for calculation of official CPI statistics. As it is based on observed prices across a very wide range of goods and services, the headline CPI is inevitably subject to short term movements as a result of variations in the prices of seasonal goods (e.g. fresh food), changes in indirect taxes, and various idiosyncratic shocks affecting specific markets (e.g. oil). This is generally accepted by many users of the CPI statistics. In addition, however, economic analysts, and monetary policy experts and policy makers in particular, would like to be able to distinguish between the common, persistent, durable trend or underlying price movements and the temporary, transitory, or noisy movements. As a result, measures have been developed over the last two decades of so called core inflation measures.

Though the term and concept of core inflation is now regularly used, there is so far no agreement on a particular definition and on a specific method to measure it. Eckstein (1981) defined core inflation as "the trend rate of increase of the price of aggregate supply". According to Bryan and Cecchetti (1993) "in general, when people use the term they seem to have in mind the long-run, or persistent component of the measured price index", which they then relate to the growth rate of the money supply. Quah and Vahey (1995) define core inflation as "the component of measured inflation that has no medium to long run impact on real output". Blinder (1997) identified core inflation as the durable part of inflation.

Two broad categories of core inflation measures can be distinguished: (1) statistical measures and (2) model-based measures. The first exploit the properties of the CPI data by removing and/or reweighing the components of headline inflation in an attempt to differentiate between transitory and more durable components of overall inflation. Exclusion-based measures, trimmed means, variability-adjusted measures and dynamic factor indices fall into this category. 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.

The traditional *statistical measure* of core inflation is headline inflation minus one or more particularly volatile consumption items such as fresh food and energy. The obvious advantage of such a measure is that it is available on a timely basis, transparent, simple to compute, internationally comparable and easy to explain to the public. In principle, it may be relatively straightforward to argue that particular CPI components should be excluded from a core inflation measure on the ground that their prices are too volatile. For instance, food prices, in particular for fresh or unprocessed food, tend to exhibit rather erratic patterns, as they are greatly affected by weather conditions and other supply conditions. As the demand for this type of good is in general inelastic, a small change in supply might cause large price changes. Energy prices, particularly oil prices, are also quickly affected by supply conditions (or even expectations of changes in supply conditions). However, the example of oil prices also shows that it may be difficult to always distinguish between specific supply shocks and underlying demand conditions as strong global demand has also had a significant impact on energy prices in recent years.

An important drawback of this traditional core inflation measure is that some items are seen to be removed on an arbitrary basis. Moreover, if central banks are concerned about potential second round effects, for instance through a wage-price spiral or indexation mechanisms, it is not clear why headline CPI measures should be statistically adjusted. In addition, changes in relative prices associated with globalisation might make measures of core inflation that leave out energy prices less appropriate. Integration of major countries such as China and India into the world economy might have put upward pressure on energy prices but also downward pressure on prices of many consumer goods, which remain in the CPI.

Another statistical approach is the use of *trimmed means*, also called limited influence estimators. These are calculated by excluding a certain percentage of the largest and smallest price changes among the components of overall inflation. The underlying rationale is that large

relative price changes do not contain relevant information about underling inflationary developments, as these price changes are expected to be quickly reversed. In this case, particular goods or services are excluded depending on the size of their relative price change, and not on an arbitrary basis. This measure may have some appeal in terms of timeliness and ease of computation. At the same time, there is some concern that the tails of the price distribution might contain some useful information about future inflation trends that should not be discarded. In addition, it is not clear how much of the distribution should be trimmed.

A third statistical approach consists of re-weighting the elementary price indices by the inverse of their standard deviation (variance weighted price index) or by their persistence[2] (Cutler measure). As a result, relatively volatile or relatively more persistent prices receive a higher weight in the CPI basket. Although these measures do not discard any prices from the overall inflation measure, their computation raises some practical problems. Over which horizon, for instance, should persistence or standard deviation be computed? As mentioned by Mankikar and Pailsey (2002), these core inflation measures and, especially the Cutler measure, might be vulnerable to the Lucas critique, as estimates of persistence may depend significantly on the monetary policy regime.[3] If past monetary policy were significantly different from the current regime (ie credibility, transparency and accountability), the value of the autoregressive coefficient might significantly affected, and if future policy were to take into account such weights, the measure would become misleading.

In contrast to the various statistical measures of core inflation, model-based approaches rely more closely, in principle, on economic theory. Quah and Vahey (1995) develop a structural bivariate VAR, in which they define core inflation as the inflation measure that has no impact on output in the medium to long run. Siviero and Veroneses (2006) have recently developed a model in which the main objective of policymakers is to minimise a welfare loss whose arguments are headline inflation, output gap and a measure of the monetary policy instrument volatility. Based on their model, they define core inflation as the inflation measure that optimizes this welfare function.

Although the recent model based approaches may be appealing in different ways, they are not without controversy. One general weakness is that they are sensitive to model specification and they are not easy to compute and to communicate to the public.

In general, central banks rely on different core inflation measures in their regular assessment of price stability. The most traditional core inflation measure is headline inflation excluding the most volatile components and especially food and energy (see Table 1). A number of countries also exclude administered prices and changes in indirect taxation in their measure of core inflation. These core inflation measures are generally officially published either by the CPI compiler or by the central bank, as policy makers tend to use these measures also in their external communication. A large number of central banks compute trimmed mean estimators, and they tend to use these measures in their external communication. Finally, few countries[4] do rely on more complicated core inflation measures, such as VAR based measure or DFI. In particular, Italy uses these measures for forecasting headline inflation.

It is not easy to evaluate the competing measures of core inflation. One way would be to compare them with a benchmark for trend inflation such as a moving average of headline inflation (Bryan and Cecchetti, 1993, Bryan, Cecchetti and Wiggings, 1997, Baskshi and Yates, 1999). An alternative is to assess the individual measures in terms of the characteristics that such indicators should exhibit, similar to what can be done for the headline CPI (see background note for session 2). The work on core inflation measures is gradually resulting in an agreement on such a set of characteristics from the perspective of monetary policy (Roger, 1997, Wynne, 1999). They include:

- *low variability*: as the indicators all aim to remove erratic and idiosyncratic price changes, they should have a lower variability than headline inflation;
- *limited bias*: the core inflation measure should not deviate systematically from headline inflation since over time idiosyncratic price changes should not always be in the same direction and since headline inflation is generally expected to revert back to its underlying trend;
- *few revisions*: just like headline CPI the core inflation statistics should not be revised or at least not too often;

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2   *Persistence is measured as the coefficient of a first order autoregressive model.*
3   *See for more details some work done by the Inflation Persistence Network (IPN) in Europe.*
4   *According to the answers to the survey, we conducted, only Italy and Switzerland use these two core inflation measures.*

Table 1 – Core inflation measures and their use by central banks

Central banks	Core inflation measures	Purpose of these measures
Argentina	*Officially Published:* • "other components of CPI" : headline CPI excluding highly volatile or with a seasonal pattern (fresh fruits, fresh vegetables, outerwear, holidays transportation, recreational trips and accommodation) and goods/services largely affected by indirect taxations or for administered prices (housing fuels, utilities, public transportation, mail, phone service, motor fuel and cigarette) *Not Officially Published:* • CPI excluding food and energy • IPCP – consumer price index weighted by the persistence (Cutler measure)	• The central bank does not explicitly used a core inflation measure for policy purpose, but internally "other components of CPI" is used in order to assess underlying inflationary pressures • The two other measures not officially published are used for internal discussion
Australia	*Unofficial measures:* • Trimmed mean (30%) • Weighted median • Exclusion measures, such as CPI excluding volatile items	• The statistical measures of underlying inflation produced by the Reserve Bank of Australia are monitored internally, and discussed in the quarterly Statement on Monetary Policy, which provides a qualitative assessment of likely prospects for both underlying and headline inflation over the medium term • These measures perform well in capturing trends in headline inflation
Belgium	*Officially Published:* • Health index (national CPI excluding tobacco, alcoholic beverages, petrol and diesel) • Headline inflation HICP excluding energy and unprocessed food *Not Officially Published:* • Headline inflation HICP excluding energy, unprocessed food and administered prices • Trimmed mean based on HICP using JB-Monthly estimator	• Analysis of current the inflationary underlying pressures and of the inflation differentials between Belgium and the euro area • The health index is used for the indexation of wage, rents, …
Brazil	*Officially Published:* • Core IPCA trimmed means non smoothed (exclude the percent changes in price for which the cumulative weight is either less than 20% or higher than 80%) • Core IPCA – excluding administered prices and food at home *Not Officially Published:* • Core IPCA trimmed means with smoothed price increases of some utilities • Core IPCA trimmed means (exclude the percent age changes in price for which the cumulative weight is either less than 14.4% or higher than 90.4%) • Other core inflation measures are also published by the Brazilian national institute of statistics (IPEA)	• It is not the target of the CB but it is always used as an "auxiliary tool" in the decision of the interest rate • All these measures are used for internal but also external communication of the monetary policy

Table 1 – (continued)

Central banks	Core inflation measures	Purpose of these measures
Canada	• CPIX CPI excluding the 8 most volatile components (fruit, vegetables, gasoline, fuel, oil, natural gas, mortgage interest rates, inter-city transportation and tobacco) and adjusts the remaining components for changes in indirect taxes • CPIFET : CPI excluding food, energy and the effects of indirect taxes • CPIW (weighted variance)	• Analyzed internally on a regular basis but also published in the monetary policy report. The predictive power of core inflation for future headline inflation is limited
China	n.a	n.a
European Union – ECB	*Officially Published:* • HICP excluding energy and unprocessed food • HICP excluding energy • … *Not Officially Published:* • Trimmed means	• ECB looks at various measures in the context of its regular analysis. In its external communication, the ECB uses HICP excluding energy and unprocessed food; it is considered as a first step of the analysis of sectoral inflation developments. This measure is not considered as a leading indicator for future headline inflation
France	*Officially Published by INSEE:* • Seasonally adjusted inflation indicator "excluding public tariffs, products with volatile prices and impact of fiscal measures" • HICP excluding unprocessed food and energy	• The measure HICP excluding energy and unprocessed food is monitored by forecasting team at the Banque de France. But recent work has shown that core inflation has a weak forecasting performance for future inflation
Germany	*Officially Published:* • Headline inflation HICP excluding energy and unprocessed food *Not Officially Published:* • Headline inflation CPI excluding energy and unprocessed food • CPI weighted mean • CPI 5%-trimmed mean • CPI volatility adjusted-weights	These measures are analysed and monitored occasionally, and are used for internal or external communication
Hong Kong SAR	–	–
India	–	–
Indonesia	*Officially Published:* • CPI excluding administered prices and volatile food	External communication
Italy	*Officially Published:* • HICP excluding unprocessed food and energy prices • National CPI excluding food, energy and regulated prices *Not Officially Published:* • Core based on the method developed Cristadora, Forni, Reichlin and Veronese (DFI) • Core based on the method Siviero and Veronese (theoretical model) but still preliminary	• Cross-section based measures are used in the assessment of the inflationary outlook, but not for forecasting • The measures, not officially published, are used as forecasting indicators
Japan	*Officially Published by Japan's Statistics Bureau:* • CPI excluding volatile food (fresh food)	• Used in the external communication of the bank (Monthly report)

Table 1 – (continued)

Central banks	Core inflation measures	Purpose of these measures
Korea	*Officially Published by Korea National Statistics Office and the Bank of Korea:* • CPI excluding petroleum products and agricultural products, apart from grains	• Target of the Bank of Korea • Useful to forecast headline CPI
Malaysia	*Officially Published by the Central Bank of Malaysia:* • CPI excluding price-volatile and price-administered items	• Core inflation is used in the external and internal communication of the central bank. It is used to facilitate economic analysis and monetary policy decisions. Core inflation is an important indicator, which the central bank uses in forecasting headline inflation
Mexico	*Officially Published by Central Bank:* • CPI excluding the most volatile items (30.44 removed)	• Core inflation is used to assess the general trend in inflation and to decide on a change in the monetary policy stance • Core is an useful indicator for forecasting inflation
Netherlands	*Officially Published by Statistics Netherlands:* • CPI excluding energy and fuels, fresh fruits and vegetables, expenditures abroad • Constant tax rates index (afgeleide reeks) • Constant tax rate index excluding government services and expenditures abroad • Constant tax rate index excluding rents, energy and fuels, government services and expenditures abroad • Constant tax rate index excluding rents, energy and fuels, fresh fruits and vegetables, government services and expenditures abroad • Constant tax rate index excluding energy and fuels, fresh fruits and vegetables, government services and expenditures abroad • HICP core inflation (Eurostat) HICP excluding unprocessed food and energy	n.a.
Poland	*Officially Published:* • CPI excluding administratively controlled prices • CPI excluding most volatile prices • CPI excluding most volatile prices and fuel prices • CPI excluding food and fuels prices (net inflation) • Trimmed mean (15%)	Core inflation measures are used to support decisions of the MPC, in case the MPC considers core inflation measures in their particular decisions, it appears in the after-meeting statements
Portugal	*Officially Published:*	• HICP excluding unprocessed food and energy prices
Russia	*Officially Published by Rosstat:* • CPI excluding volatile and administered items (e.g. vegetables, fuel, some transport, communication, public utilities services)	The purpose is to eliminate the impact of short-term market-shocks, seasonal and administrative factors. Used as a benchmark for the monetary policy
Saudi Arabia		
Singapore	*Officially Published:* • MAS underlying inflation: Headline CPI excluding private road transport costs and accommodation costs	• MAS underlying inflation is used for both internal and external communication purposes. It is useful for assessing the persistent part sources of cost and price pressures in the economy, and it contributes to the decision process on the appropriate monetary policy response

Table 1 – (continued)

Central banks	Core inflation measures	Purpose of these measures
South Africa	*Officially Published :* • CPIX (excluding interest rate on mortgage bond) • CPI excluding fresh and frozen meat, fish, vegetables, fruit, interest rates on mortgage bonds and overdraft/personal loans, changes in VAT and assessment rates (taxes predominantly determined by local government)	• Only CPIX (excluding interest rate on mortgage bond) is used in the formulation of monetary policy
Spain	*Officially Published by Central Bank:* • HICP excluding unprocessed food and energy	• Not used
Sweden	*Published by Central Bank:* • UND1X: headline CPI excluding mortgage interest payment, changes in indirect taxes, and subsidies *Not Officially Published:* • Trimmed means • Weighted medians • Other exclusion based measures.	• UND1X is a well-known indicator among central bank watchers. Forecasts and analysis of UND1X are used both for internal and external communication purposes.
Switzerland	*Officially Published by SFSO:* • Core inflation 1 : headline CPI excluding food, beverage, tobacco, seasonal products, energy and fuels • Core inflation 2: headline CPI excluding food, beverage, tobacco, seasonal products, energy, fuels and administrative prices *Not Officially Published and computed by the SNB:* • 15% trimmed means • weighted median • core measure based on a generalized Dynamic Factor Model (Forni, Hallin. Lippi and Reichlin, 2000, 2002). Use for internal purposes	• The SNB monitors all the measures of core inflation at hand in context of its regular analysis in order to distinguish short-term price fluctuations from medium-to-long term inflation movements. The two indicators published by SFSO and the trimmed mean are used in external communication and they are discussed in • The quarterly Monetary Policy Report.
Thailand	*Officially Published by Central Bank:* • CPI, excluding raw food and energy.	• This core inflation measure is the central banks' target measure of core inflation and its forecasts is used by the MPC to form their policy recommendations and is available in the quarterly inflation reports
United States	*Officially Published:* • CPI excluding food and energy prices • PCE excluding food, alcoholic beverages and energy • Trimmed mean for the CPI and PCE • (weighted) median for CPI and PCE	• Monitoring and forecasts in general non-energy, non food indices are combined with separate forecast for food and energy to yield a forecast of topline CPI

- *good transparency*: if core inflation is meant to be used in the communication of monetary policy the concept should be relatively easy to explain to the general public;
- *timeliness*: core inflation measures should be available with the same frequency and timeliness as headline inflation;
- *forecasting performance*: a crucial objective of all core inflation measure should be to facilitate the prediction of future developments in headline inflation;
- *cross-country comparability*: in principle it should be possible to compute similar core inflation measures in all countries.

Based on these criteria it is probably fair to say that none of the existing core inflation measures fully meets these characteristics and that none of the measures perform better than the others. Thus trade-offs may need to be made and empirical work to be carried out in order to rank the different measures. Perhaps too many things are being required from core inflation measures. For the time being monetary experts and policy makers would do best to look at different indicators of core inflation as suggested by Hogan et al (2001) and Rich and Steindel (2005). Until more work, in particular cross-border analysis, is carried out views will probably continue to differ on the usefulness of measures of core inflation.

Issues for discussion

- How should core inflation be defined? What is the objective of developing measures of core inflation?
- Do model based approaches for measuring core inflation have an advantage over statistical approaches?
- Is there agreement on the desirable properties of core inflation measures?
- How useful are currently available measures of core inflation for the conduct of monetary policy? Should central banks focus on one particular measure or on a wide range of measures? How should central banks communicate about core inflation?

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Core inflation:
Definitions and measures

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1. Definitions and measures

From the viewpoint of the monetary authority, the interest in core inflation stems from the need to isolate the common (or persistent) component underlying price movements from the temporary one, often identified with idiosyncratic shocks affecting only specific markets. Blinder (1997) casts the issue as follows: "What part of each monthly observation on inflation is durable and what part is fleeting? (. . .) To me, the durable part of the information in each monthly inflation report was the part that was useful in medium – and near-term inflation forecasting" (p. 157). Similarly, Bryan, Cecchetti and Wiggins (1999) argue: "How should we interpret month-to-month changes in the measured Consumer Price Changes? Over the years, this question has led to the construction of several measures of what has come to be called 'core-inflation'" (p. 1). The various indicators proposed in the literature differ in the technique used to identify and remove transient noise.

1.1 Definitions

Though the concept of core inflation is intuitively appealing, definitions are often based on synonymous concepts such as "underlying" or "trend" inflation. Among the formal definitions having some theoretical justification, Bryan and Cecchetti (1993) state that "in general, when people use the term they seem to have in mind the long-run, or persistent component of the measured price index", which they relate to the rate of growth of money.

Quah and Vahey (1995) develop a structural bivariate VAR to estimate core inflation, which is defined as that component of measured inflation that has no impact in the medium to long-run on output. Their approach is appealing since the identification conditions to distinguish the core and the non-core part of actual inflation are formulated with reference to the economic theory.[1] Subsequent contributions based on the same approach differ mainly with respect to the long run identification conditions to the VAR (see for instance Blix, 1995, Folkertsma and Hubrich, 2000, Bagliano et al., 2002).

A recent contribution by Siviero and Veronese (2006), still unpublished, is based on the idea that the main justification for building a core inflation measure rests on the latter's ability to effectively support policy decisions. To put this idea in practice, the authors develop a model (for the euro area) in which the policy maker aims at optimising a standard welfare function whose arguments are overall inflation, the output gap and a measure of instrument volatility. More importantly, they develop a multi-sectoral model in which the monetary policy instrument is allowed to react differently to the main inflation sub-indices. The definition of core inflation adopted in this paper is quite original and relies on economic criteria. Specifically, core inflation is that measure such that the policymaker by basing his/her decisions on it maximizes policy effectiveness (i.e. minimises a standard welfare loss). In practice, within this framework core inflation is built as a linear combination of the various inflation components, the weights being a function of the optimised values of the parameters in the policymaker's reaction function.

An alternative, and more practical, approach to evaluate competing measures is based on the comparison with a "benchmark" for trend inflation, for instance a moving average of headline

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1   *The practical implementation of this approach presents a few difficulties. First, a complex phenomenon such as inflation is approximated by a model with only few variables (two or three in most cases). Faust and Leeper (1997), among others, note that a VAR with few variables can approximate badly models with a much larger number of variables. Second, the authors themselves remark that finite sample may contain insufficient information on the long run effects, leading to core inflation estimates that can be very imprecise. Third, from an empirical viewpoint: (a) the identification conditions cannot be tested; (b) for those variables which are affected by seasonality the use of dummy variables might not be enough to "clean" the series and the presence of residual seasonality in small samples can bias the estimate of the coefficients. Finally, this measures might only be available with a delay with respect to headline inflation, since the model typically includes variables (e.g. output) published with a lag.*

inflation (Bryan and Cecchetti, 1993, Bryan, Cecchetti and Wiggins, 1997, Bakhshi and Yates, 1999).[2] A further rather pragmatic approach, typically followed in this literature to define core inflation, is based on the identification of a set of characteristics that such indicators must exhibit, which are summarised below (Roger, 1997, Wynne, 1999):

- *bias*: core inflation should not differ systematically from headline inflation, for various reasons: (i) over a long term horizon erratic changes are likely not to be always in the same direction; (ii) headline inflation is the measure considered by the public opinion and by the business community in forming their expectations;
- *variability*: a lower variability than headline inflation is an obvious pre-requisite of any indicator aimed at removing the contribution of erratic changes;
- *revisions*: if core inflation is part of the communication strategy of the monetary authority it should not be revised (at least not too often), in order not to have to change the evaluation of the inflationary outlook after few months;
- *transparency and communication*: if core inflation is used in the conduct of monetary policy it should be transparent for the public opinion;
- *timeliness*: the measure of core inflation should be computed with the same frequency as headline inflation;
- *forecasting performance*: core inflation should be able to cast light on future developments of headline inflation;
- *cross-country comparability*: in order to monitor inflationary tendencies across different economic areas (o different countries as in the euro area) it should be possible to compute easily core inflation in all countries.

1.2 Measures

None of the measures proposed in the literature (for a survey see ECB, 2001) satisfies all the above properties.

The traditional indicator of core inflation, based on the *a priori* exclusion of the most volatile prices from the overall CPI (typically energy and food prices), is easy to compute (the breakdown of the CPI which is needed is quite limited and the time series do not need to be very long since no estimation procedure is involved) with obvious advantages for cross-country comparisons; it is never revised; it is transparent and accountable. On the other hand, the exclusion in each month of the same items can be arbitrary, since in principle each good or service can determine erratic fluctuations in the overall index; moreover, if the percentage of items removed from the basket is too high, the resulting measure of core inflation might not be credible for the agents (in particular households), who would then form their inflation expectations with reference to a totally different indicator (headline inflation).

The so called limited influence estimators (LIE) do not require to choose *a priori* which items have to be removed from the overall index.[3] These measures are also never revised and can be computed on the basis of short time series. Their main disadvantage is that in the operation of removing the items from the tails of the distribution, the information on their "name" is lost. Indeed, erratic changes of different items which have a similar impact on the overall index can lead to completely different evaluations of the inflationary outlook. An interesting example is that of the prices of electronic equipment (computers, camera, etc.), which over the last years tended to display a more or less pronounced downward trend. A trimmed mean would systematically remove such items (located at the extreme of the left tail of the price change distribution); however, this is quite inappropriate since such changes are due to long-lasting phenomenon, which then should be captured by a measure of core inflation. From an operational point of view a difficulty is that highly disaggregated series are needed and results can differ according to a different level of disaggregation of data; the use of excessively aggregated figures can also imply an *a priori* reduction of the noise.[4]

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2   *As argued by Marques, Neves and Sarmento (2000), this approach can be misleading in particular because the definition of the benchmark is often based on ad hoc considerations; if the benchmark is not the optimal measure of the "true" underlying inflation, the best indicator of core inflation is not necessarily selected.*

3   *Among the limited influence estimators, an important difference between the median and the trimmed mean is that in the latter case one has to fix a* priori *the percentage of items to remove from each tail (5%, 10%, etc.). In order to avoid removing "too much" or "too little" from each tail, several methods have been suggested to fix the percentage of the tails to be cut in an "optimal" way (the so-called "optimal trimming"): Bryan, Cecchetti and Wiggins (1997), Roger (1998), Chatelain, Odonnat and Sicsic (1996), Kearns (1998) and Meyler (1999), Aucremanne (2000), Johnson (1999).*

4   *An open issue is the time horizon with respect to which the percentage changes have to be computed (1-month, 3-month, etc.), since the set of items to be removed each month can change according to different time horizons. For instance, if the 12-months rates are considered, the trimmed mean will tend to remove the same items for twelve*

Another approach is based on the variability of the price of each elementary item included in the overall basket (Variance Weighted Price Index). Under this approach, each series receives a weight which is negatively correlated with its volatility, measured by the root mean squared error, σ (Wynne, 1998; Dow, 1994). This measure responds primarily to the requirement of having an indicator with low variability. From an operational point of view a critical aspect is related to the choice of the time horizon over which the standard deviation has to be computed: with a period too short the risk is that too much emphasis is given to outliers; instead, if the period is too long then the weight of each elementary item is revised only very slowly.

Core inflation can also be estimated on the basis of univariate statistical methods. The estimate of the cycle-trend series represents, in principle, the solution to the problem of removing the irregular components from the overall series. However, in the implementation of a statistical filter two main problems are faced. First, the revisions in the trend-cycle series can be large in particular for the last observations, with the risk of a different evaluation of the inflationary outlook after few months due to a statistical artefact. Second, this approach is not transparent for the general public and various statistical tools can be implemented (X11-Arima, Tramo-Seats). From a more practical point of view, the application of these methods requires relatively long time series and the estimates are typically not robust to alternative specifications of the statistical model (for instance with respect to the detection of outliers, the time span, and so on; see below).

Multivariate statistical methods have also been exploited. The so-called dynamic factor index (DFI), first used by Bryan and Cecchetti (1993), is a direct implementation of the model with unobserved component introduced by Stock and Watson to analyze the US business cycle (1991). Bryan and Cecchetti (1993) assume that the co-movements at all leads and lags of the observed price indices only depend on the fluctuations of a latent variable, which is defined as core inflation. The variability of each price index depends on two components: the first is associated to the common component; the second derives from an idiosyncratic one. The identification assumption adopted in this context is, then, that the unobserved component, named core inflation, is not correlated at all leads and lags with the idiosyncratic factors. A more recent extension of this idea is in Cristadoro et al. (2005), who construct a core inflation indicator for the euro area. Like Bryan and Cecchetti (1993), they use a large panel of euro area time series containing national/sectoral price variables as well as monetary and real variables. Their core inflation measure is then computed by projecting the medium and long-run component of monthly inflation on a set of common factors, which induce the covariance between the elements in their panel. By construction, one may expect the forecasting performance of this indicator to outperform that of the alternative measures. Its main disadvantages, again, lie in the revisions when new data are released and, in particular, in the lack of transparency of this measure.

The bottom line of the discussion above is that it is impossible to identify an indicator of core inflation which satisfies all the desirable properties. Moreover, there might be trade-offs between these properties, which have to be evaluated in the context of any empirical analysis. This suggests that probably in this literature too many things have been required from a core inflation measure, which at the same time should be

i)   a good indicator of current inflation (here an important requirements is that this measure exhibits a low variability),
ii) a good indicator of future headline inflation,
iii) a viable target for monetary policy (hence, the comparison between alternative measures involves issues such as accountability, transparency, communication, minimization of revisions).

The analyses by the Bank of Canada and the Bank of Poland state that quite clearly. For instance, Hogan et al. (2001) state that "Different measures do well along different dimensions. Each measure can provide some particular insight into how inflation is evolving. Therefore rather than selecting one measure as the best to perform the role of core inflation as an indicator of the trend in inflation, it might be more useful to have a limited number of measures of underlying inflation and use the varied information in each of them to create a more accurate picture of the dynamics in inflation" (p. 26).

Further considerations are useful for evaluating the various measures. First, the importance attached to the forecasting performance of headline inflation should not be over-emphasised. The forecasting performance of core inflation measures is complicated by the fact that the impact of

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consecutive months. On the other hand, if the 1-month or 3-month percentage changes are computed, the issue of how seasonal fluctuations are captured becomes relevant. In fact, changes due to the presence of seasonality tend to lie on the tails of the distribution changes, but it is not obvious that the trimmed mean is the most efficient technique to capture both the seasonal and the erratic changes. Alternatively one could refer to the distribution of seasonal adjusted percentage changes, though in this case the estimation of the seasonal component must be performed on a very large number of elementary series.

shocks on the medium-term inflationary outlook, due to so-called second round effects acting through the intersect oral linkages and wage setting mechanisms, can be very different according to the nature of the shock itself. Broadly speaking we can distinguish between three situations:

(a) erratic changes with a clearly temporary and reversible impact on prices, such as a sharp increase in the price of fresh vegetables due to bad weather conditions.
(b) Shocks to important production inputs, typically oil, which are likely to induce second round effects. In these circumstances just removing the impact of such shocks can lead to underestimate an important source of potential future inflationary pressures.
(c) An intermediate case is that in which the price change of a certain item takes place once a year and it is concentrated in a given month, different from year to year. This is often the case for regulated prices. In these circumstances the assessment of inflation is biased in that month, since the monthly change of the overall index which is observed is likely to be quite large but at the same time it would be wrong to interpret it as an erratic change.

The point which is worth stressing here is that forecasting can be performed best on the basis of a broader macro-assessment of all source of inflationary pressures (input prices, labour costs, exchange rate, output gap), captured through a structural macro-model. Hence, the issue is whether the forecasting performance must be assessed only comparing results across various core inflation measures, or enlarging this perspective and comparing also the forecasting performance of alternative approaches based on forecasting techniques of headline inflation.

Second, concerning the use of core inflation as a viable target for monetary policy, if the Central Bank is to be held accountable for maintaining inflation within a target, it is better to target a measure which excludes shocks considered out of the Bank's control, in order to enhance its credibility (Hogan et al., 2001). Equally important are other requirements such as that the preferred measure should not be subject to frequent or strong revisions since that would question its ability to be used in the current monitoring of inflation and could create credibility problems, or that core inflation to be "credible" should not exclude too much from headline inflation.

1.3 Is the traditional measure of core inflation out-of-date?

On the basis of the above discussion, it could be argued that the traditional index based on the a priori removal of food and energy products (CPI-XFE) may not that out-of-date as it is often claimed in the recent literature. This could also contribute to explain why most Central banks still refer to it (or to slightly different versions) as their central measure of core inflation.

The traditional measure may represent, in fact, a "fair compromise" between the various desirable properties, in particular in terms of transparency, communication, accountability, absence of revisions and cross-country comparability (the last requirement is particular important for the euro area). From the point of view of the policy maker a further advantage is claimed by Blinder (1997): "as a central banker, I always preferred to view the inflation rate with its food and energy components removed as our basic goal. But not because these components are extremely volatile (…). The real reason was that the prices of food (…) and energy are, for the most part, beyond the control of the central bank". On this basis he proposes to exclude from the computation of a core inflation measure regulated prices and, eventually, the impact on consumer prices of changes in indirect taxation. The importance of these considerations is also stressed in Hogan et al. (2001).

On the empirical ground, recent evidence based on micro consumer price data for the euro area (Dhyne et al., 2005) confirms that indeed prices of energy and (unprocessed) food products are the most volatile in the CPI basket. The same analysis also suggests that these prices tend to move up and down quite symmetrically; these characteristics would lead to a measure of core inflation based on the a priori removal of these items which is not systematically biased with respect to headline inflation. On a more theoretical ground, this empirical evidence goes hand in hand with the results of recent theoretical models which argue that the higher the degree of nominal inertia which affects a given sector of the economy, the higher should be the incentive for the monetary authority to stabilise the corresponding price. More specifically, the overall economic welfare is enhanced if the Central Bank assigns a larger weight to sectors where price developments are more persistent (Benigno, 2004) which, as mentioned above, on the basis of the available empirical analysis turn out to be those producing and selling food and energy goods.[5]

On the contrary, the main argument to support the view that CPI-XFE index is not an optimal measure of core inflation is based on its poor forecasting performance of headline inflation

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5 *The basic argument is summarised in ECB (2005). In an economy with two sectors (the same applies if two regions are considered, as in Benigno, 2004) of equal size (hence each receives a weight equal to 1/2), one more rigid and*

which is outperformed by more sophisticated approaches, confirmed by various empirical analyses. This is indeed an important limitation of the CPI-XFE index; however, one may also argue that within a Central Bank, in the context of the a broad assessment of the inflationary outlook to support monetary policy decisions, forecasting is typically carried out on the basis of specific tools (structural macro models) which are better suited to capture the second round effects of shocks to the main determinants of inflation. Hence, the comparison should not be among the forecasting performance of only core inflation measures, but also between the latter and those obtained through these alternative techniques.

A further disadvantage of the traditional measure, which should be carefully examined, is the risk that too much expenditure is excluded a priori from the overall basket. For instance, in the case of Canada the portion excluded amounts to around 25 per cent; for Poland this share is even higher (around 30 per cent).

2. Should monetary policy target core inflation or headline inflation?

An important issue in this literature is whether monetary policy should refer to headline inflation or to core inflation, however it is defined. In dealing with that it might be useful to go back to first principles and remind ourselves why a Central Bank is concerned about inflation. The main reason is that inflation, in the presence of nominal rigidities, induces sub-optimal choices by price and wage setters, which in turn distort relative prices and reduce the welfare of the society. The sub-optimality of these choices would be reduced, if not eliminated altogether, if price and wage setters were to expect stable prices for the future (i.e. zero or very low and stable inflation). Therefore, it is to ensure that current choices (with persistent consequences) of these agents are made under the expectation of zero or low inflation that monetary policy is committed to deliver such a result. Then, it seems natural to argue that monetary policy should take as a reference (a) future inflation (forward-lookingness principle), and (b) a measure of inflation that is comprehensive enough to be relevant for the price and wage setters (comprehensiveness principle). From the point of view of the monetary authority a target set in terms of core inflation can be easier to achieve, since it should be less affected by supply shocks beyond the control of monetary policy; however, this could conflict with the need to take as a reference the inflation people refer to in forming their expectation.

Focussing on the euro area, the Eurosystem approach is well in line with the above basic principles: price stability is defined with reference to the future (the medium term) and to the harmonized index of consumer prices (HICP), that more accurately and reliably measures losses in the purchasing power of money with which price and wage setters are mostly concerned, and that therefore is more likely to be the object of their inflation expectations. As a matter of fact, in Europe most wage bargaining is explicitly made taking into account expectations of HICP inflation; the appropriateness of such a choice is further strengthened by the high persistence of wages which characterises labour markets in the euro area.

In this framework, how should the policy maker regard core inflation in particular when its developments are in conflict with headline inflation? While the second principle (comprehensiveness) would suggest that headline inflation should be heeded, the first (forward-lookingness) suggests that it is important to extract from the dynamics of current variables all the information about future price trends. In this respect, those prices which exhibit higher persistence are likely to contain more information on future inflationary trends, while the most volatile ones should be more heavily discounted. In other terms, this points in the direction of paying attention to measures of core inflation, without dismissing headline inflation.

3. Conclusions

On the basis of the above discussion it is quite clear that core inflation is indeed an elusive concept; none of the available indicators can be fully trusted, in the sense that none gives an answer

> the other more flexible, a monetary policy upon the occurrence of an aggregate shock the rigid sector bears a higher cost than the flexible one in the adjustment to that macroeconomic shock, since the stickier prices create more distortions in this sector. This imbalance leads to a welfare loss that could be reduced by weighting more the sector with stickier prices to take into account more than just its overall size. This argument is also in line with the general equilibrium approach to core inflation introduced by Aoki (2001), who defines core inflation as the inflation rate that monetary policy should stabilize in order to maximize the welfare; in practice, the optimal policy turns out to be that which aims at a complete stabilization of the inflation rate in the sticky-price sector. In this framework, the CPI-XFE index can be regarded as a measure which assigns zero weight to the fully flexible sectors. The main problem with this approach is that the main implication of the model depends critically on its actual specification.

to all we would like to know from a core inflation measure. We can indeed share the view that "different measures do well along different dimensions. Each measure can provide some particular insight into how inflation is evolving".

This general conclusion supports the Eurosystem approach to the analysis of the inflationary outlook, based on the regular analysis of a number of indicators of inflationary pressures, none of which, however, is sufficient by itself to completely understand inflation developments. Instead, the best assessment is that based on a broad cross-checking of all indicators with a view to identify the nature of the shocks impacting inflation and their likely persistence. This analysis must necessarily be carried out also by relying on structural macro-models better suited to envisage future trends.

Having in mind all this, the traditional measure of core inflation based on excluding *a priori* the most volatile items from the overall index (CPI-XFE or slightly different version of it) is appealing in the sense that it may represent a fair compromise between various needs. In particular, due to its simplicity, it can be a relatively easy and transparent way to communicate to the public about the inflationary outlook. Furthermore, it presents the same general trend as headline inflation but it is much less volatile, and it is never revised, at least not too often. Besides all that, it is also likely that the monetary authority has some capacity to realize a (operational) target defined in terms of an index excluding food and energy products (better if regulated prices are excluded as well), whose price movements are dominated by supply shocks which are beyond the influence of monetary policy. A further important advantage of this measure (in particular for euro area countries) is that it can be easily computed for all countries. All in all, in terms of communication, transparency and accountability this traditional indicator presents important advantages over more sophisticated approaches. On the theoretical ground, recent theoretical contributions taking on board welfare considerations seem to support a measure which assigns zero weight to the most volatile components.

In terms of forecasting future trends of headline inflation, its relatively poor performance compared to more sophisticated measures should not receive too much emphasis since typically within a Central Bank the process of forecasting inflation is based on different tools (structural macro models, etc.).

All this does not imply that more sophisticated measures cannot be used by the monetary authority in the context of an approach based on cross-checking various pieces of information. However, their high degree of sophistication might be hardly understood by the public opinion and by price setters: hence, their use could be restricted to internal purposes, in the context of a broad assessment of inflationary pressures.

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Appendix: Seasonality *versus* core inflation

A practical issue which can be analysed in evaluating alternative versions of a core inflation measure based on the a priori exclusion of specific items from the overall basket concerns the treatment of seasonality.

Seasonal movements may be regarded as a "particular" source of noise, in the sense that they affect monthly development of the index but its pattern is quite regular over the years. As known, turning points cannot be readily identified either by changes over the previous period calculated on the raw data (which are affected by seasonal factors) or by changes over the corresponding period of the previous year (which reveal turning points long after they have occurred, since they are affected by developments over the whole year). Hence, an issue is if the core measure should be seasonally adjusted, with figures presented in terms of month-on-month changes, or not. In the first case, turning points would be detected more promptly but at the price of lower transparency and revisions in the figures. Besides that, various methodological aspects are involved in the seasonal adjustment process; these concern: (i) the method to use; (ii) the best time span to consider; (iii) the treatment of outliers and of other fixed effects; (iv) the use of a direct or of an indirect approach.

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The Canadian experience with core inflation

Thérèse Laflèche (Bank of Canada)

Since the adoption of an inflation-control target in 1991, the Bank of Canada has specified the target range in terms of the 12-month change in total CPI. It has also used a measure of core inflation as a short-term operational guide in its formulation of monetary policy.

The first core inflation measure used was CPIXFET, which is the 12-month rate of increase in the CPI excluding food, energy and the effects of changes in indirect taxes. When the inflation targets were renewed for the third time, in May 2001, the Bank adopted CPIX as its new operational guide for policy. CPIX excludes eight of the most volatile components of the CPI (fruits, vegetables, natural gas, fuel oil, gasoline, inter-city transportation, tobacco and mortgage interest costs) and adjusts the remaining components to remove the effect of changes in indirect taxes.

Core inflation has proven to be useful in different ways in conducting monetary policy. First, core inflation is a better indicator of current underlying inflationary pressures than total CPI, which can be misleading since certain of its components are very volatile. Responding to temporary fluctuations is neither desirable nor feasible given the lags of the monetary policy effect. In fact, attempting to do so would increase economic volatility. Second, given that core inflation is considered to represent the underlying trend to which total inflation will return, it provides a reliable operational guide for the conduct of the monetary policy. As long as core and total inflation share a long-term trend, focusing on core inflation is consistent with targeting total inflation. Finally, core inflation is also useful for communicating monetary policy to the public. Analyzing and comparing the evolution of core and total inflation in the *Monetary Policy Report* help the general public to understand and to assess the monetary policy decisions of the Bank.

There is no unique definition of core inflation and there is no way to measure it directly. CPIX was chosen among many other core inflation measures on the basis of different criteria. However the Bank closely monitors, in addition to CPIX, a set of core inflation measures that have generally proved useful. Among them is CPIW, which is a "double weighted" measure. Instead of excluding the volatile components from the total price index, as CPIX does, CPIW reduces their influence. To do so, it assigns to each of the components of the total index a weight inversely proportional to its variability. This weight is multiplied by its original weight in the CPI basket, which represents the importance of the component in consumer spending.

Two other measures of core inflation are closely monitored by the Bank: MEANSTD and WMEDIAN. They are "order measures" calculated using the ordered cross-sectional distribution of year-over-year price changes of the CPI components. On a month-to-month basis, MEANSTD excludes price components whose rate of change is over or under 1.5 standard deviations from the average. WMEDIAN is the weighted median, that is the 50th percentile of the weighted cross-sectional distribution of price changes in any given month.

There is no unique concept of core inflation. However, all the core inflation measures described above are based on the concept that total inflation can be separated into two components: the core part, representing the underlying trend of inflation as shaped by the pressure of aggregate demand, and the non-core part which reflects price movements caused by temporary shocks or relative price changes. Based on this concept, CPIX has been found to have stronger theoretical foundations than CPIXFET. The components excluded from CPIX are those most likely to be significantly affected by temporary supply shocks. Fruits and vegetables, for instance, are affected by weather-related disturbances to crops. This is not the case for all food components. For instance, food from restaurants, which is excluded from CPIXFET but not from CPIX, is less affected by supply shocks because other costs, such as labour and rent, are important inputs into restaurant meals.

All eight components excluded from CPIX were found to be more volatile than the components excluded from CPIXFET but not from CPIX (meat, fish, dairy products, bakery products, other food products, food purchased from restaurant and electricity). Moreover, the three components that were excluded from CPIX but not from CPIXFET (mortgage interest costs,

intercity transportation and tobacco) were all more volatile than the seven components excluded only from CPIXFET. The statistical criteria used to choose the excluded components were the standard deviation and the frequency of exclusion from the MEANSTD measure.

It is supposed that for core inflation to be a good estimator of the underlying trend of inflation, it must have some ability to predict the evolution of total inflation. It must at least contain more information on future inflation than total inflation itself. Using a Cogley's equation, one can test the hypothesis that deviation between core and total inflation will be reversed in the future, with total inflation returning to core inflation. In 2001, empirical estimation of this equation with different core inflation measures showed that CPIX had the best performance. The same test conducted with an updated sample showed that CPIW now outperforms CPIX.

Practical criteria must been taken into account by the central bank in the choice of a core measure. Ideally, a core measure should be timely, free from revision and easy to communicate. These criteria are more supportive of an exclusion-based measure like CPIX, than of a more complicated one like CPIW.

No core measure is perfect. No measure is immune from persistent transitory shocks similar to those that hurt Canadian electricity prices and auto insurance premiums some years ago. All of the core measures are also time-dependant. In the context of the inflation-target renewal in 2006, all of the Canadian core measures were recently updated and re-evaluated in the light of the theoretical, statistical and practical criteria.

The main conclusions were that CPIX still satisfies the essential criteria and no other core measure outperforms it significantly. The alternative core inflation measures contain useful information and will therefore continue to be closely monitored by the Bank. All core inflation measures have limitations: they are not immune from transitory shocks and have limited predictive power.

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Core inflation measures:
The case of Poland

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The Central Statistical Office (CSO) in Poland publishes a CPI that measures the headline inflation rate. The CSO does not publish any core inflation measures. Instead these measures are calculated by the National Bank of Poland (NBP). Measures of core inflation are used by the National Bank of Poland to capture longer term price trends, to project underlying inflationary trends and to support policy analysis. Core inflation better illustrates long-term trend in price growth and takes a smoother course as compared to the CPI index. As core inflation shows influence of monetary policy on inflation, it can better support decisions of the Monetary Policy Council. The National Bank of Poland has published 5 measures of core inflation since 1997, which are used for research and analysis purposes, although their predictive power is rather weak.

The NBP uses different methods to calculate core inflation measures. Four of these measures can be broadly described as mechanical measures. The first measure is to calculate core inflation excluding all administratively controlled prices i.e. prices that are not determined by market mechanisms, but are subject to various forms of administrative regulation (e.g. subject to excise duty, set by local authorities, determined by the government or the authorised offices). The commodities and services which are subject to administrative controls include: alcoholic beverages and tobacco products, postal and telecommunications services, municipal transport, electricity, gas, central heating, hot water, fuels and various forms of insurance. In 2005, the excluded groups accounted for ca. 26.6% of the total CPI. Graph 1 compares the CPI index measuring the headline inflation with the core inflation measure excluding administrative controlled prices.

Graph 1 – CPI and core inflation after excluding controlled prices
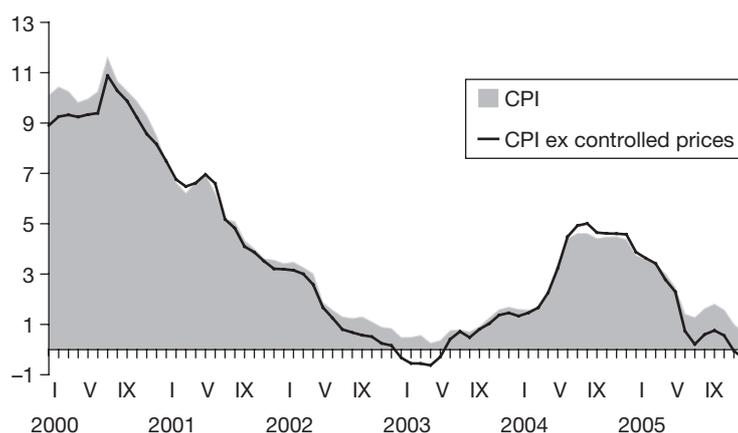
The second measure estimates core inflation excluding most volatile prices. These commodity groups include items that are subject to seasonal fluctuations and those components that are susceptible to shocks or cyclical changes: postal and telecommunications services, housing occupancy charges, fruit and vegetables, electricity, hot water and fuels (optionally). The third measure used by the NBP excludes most volatile prices as well as the fuel prices. In 2005 these excluded groups accounted for ca. 17.8% of the total CPI and 21.6% when fuel prices were also excluded. These effects and their comparison with the CPI are shown in Graph 2.

Graph 2 – CPI and core inflation after excluding the most volatile prices
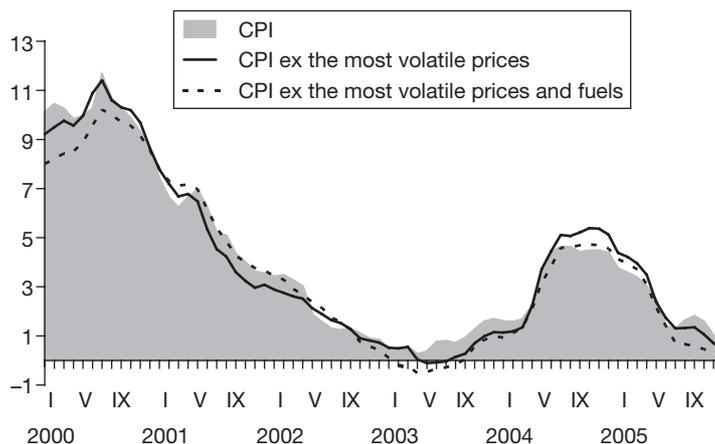

NBP also uses a 'net' inflation concept where food and fuel prices are excluded. In 2005 food and fuel prices excluded from the CPI index accounted for ca. 30.8% of the total CPI. This measure is the most commonly recognized method of measuring core inflation and is often equated with "core inflation".

Another measure used to estimate core inflation is the "15% trimmed mean index". This is obtained by symmetrically trimming 15% of prices subject to the greatest and smallest change relative to the previous period, on both sides of the distribution and by excluding most extreme price changes above and below the mean. Graphs 3 and 4 show the effect of "net inflation" and "15% trimmed mean index" on the CPI.

Graph 3 – CPI and "net" inflation after excluding food and fuel prices
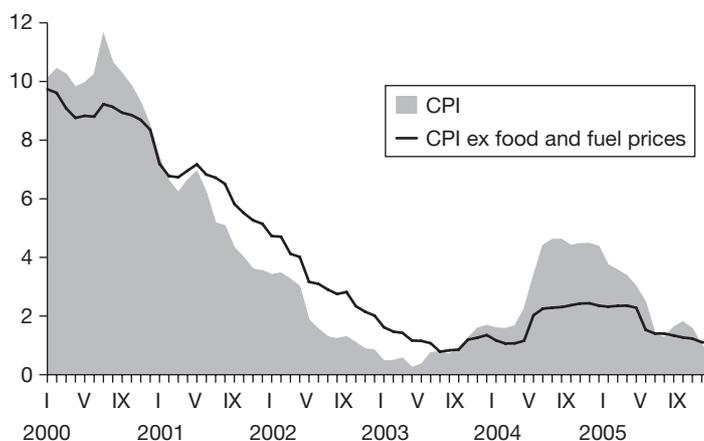
Graph 4 – CPI and 15% trimmed mean index
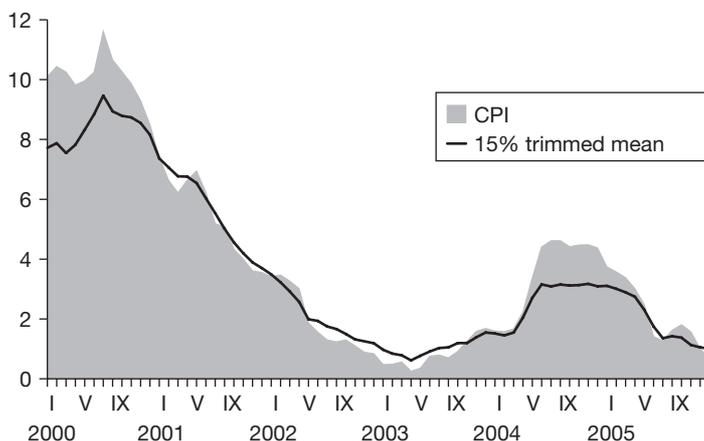
Besides these, the NBP has developed other new measures to estimate core inflation namely: variance weighted average, and two measures based on rank criterion and the most volatility criterion. These estimates are not published but are used internally in the discussions of the Monetary Policy Council.

Variance weighted average

This method is based on averaging with weights inversely proportional to the volatility of each components of the CPI index. The weights are calculated as the ratio of the inverse of each element's variance, σ_i^2, to the sum of the inverse of all elements' variance. This index attaches more importance to the relatively stable groups and less importance to the groups that are relatively more volatile.

$$w_i^* = \frac{1/\sigma_i^2}{\sum_{i=1}^{N} 1/\sigma_i^2}$$

Measure of core inflation calculated on the basis of rank and the most volatility criterion (1)

This measure is a linear combination of weights of two measures a measure that is calculated on the basis of rank and the measure that takes into account durability of increase of the CPI components.

All indices are sorted and then each of them receives a rank that represents position of given index occurrence at the CPI. The following formula is applied:

$$w_{it}^{**} = \max\left[\exp\left(-a \frac{(R_{it} - \overline{R}_i)^2}{\sum_{i=1}^{100} (R_{it} - \overline{R}_i)^2} \right) - x;\ 0 \right] w_{it}$$

where:
x new weight of index i in time t,
y old weight of index i in time t,
z position of occurrence of index i at the CPI in time t,
a average position of occurrence of indices calculated on the 48 latest months,
a, x – parameters (set by minimizing the root mean square error of the CPI index and its Hodrick-Prescott trend).

Measure of core inflation calculated on the basis of ranking and the most volatility criterion (2)

In this measure with weights constructed on the basis of the most volatility criterion. In this case variance of the latest 24 months is calculated and then 19% of the most volatile indices are eliminated. The level of exclusion is set by minimizing the root mean square error of the CPI index and its Hodrick-Prescott trend.

Graph 5 shows the performance of these measures against the CPI.

Graph 5 – CPI and other core inflation measures
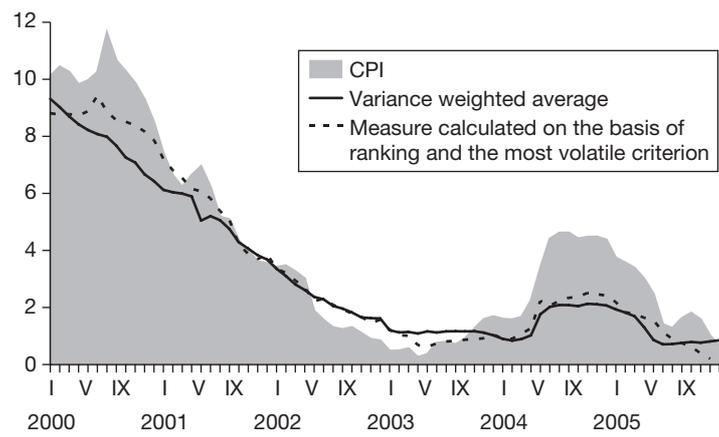
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Core inflation measurement at the Riksbank

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The inflation target in Sweden is expressed in terms of the annual rate of change in the Swedish Consumer Price Index (CPI). The inflation target was laid out by the General Council of the Riksbank in 1993 stating that "…the change in the consumer price index as from 1995 shall be limited to 2 per cent, with a tolerance interval for deviations of 1 percentage point." However, in a later clarification by the executive board of the Riksbank, it was stated that monetary policy should normally not react to changes in interest rates and changes in indirect taxation. This led the Riksbank to focus also on a core inflation measure called UND1X in its monetary policy decisions. UND1X strips out effects from interest rates and changes in indirect taxation from the CPI.

   UND1X is calculated and published by Statistics Sweden every month on behalf of the Riksbank, and is well known among different central bank watchers. UND1X and CPI share the same trend but can at times deviate quite substantially from each other (see Graph 1).

Graph 1 – CPI vs UND1X
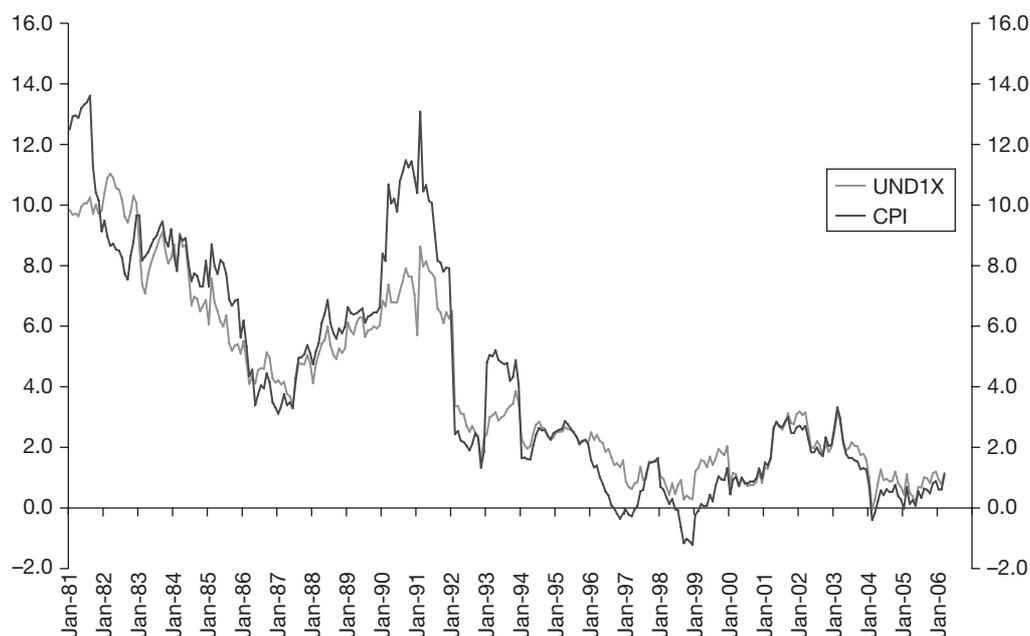
   The Riksbank publishes forecast of UND1X-inflation in its quarterly Inflation Reports and comments on these forecasts in its monetary policy decisions (Graph 2)

Graph 2 – UND1X-forecasts in the Riksbank's inflation report
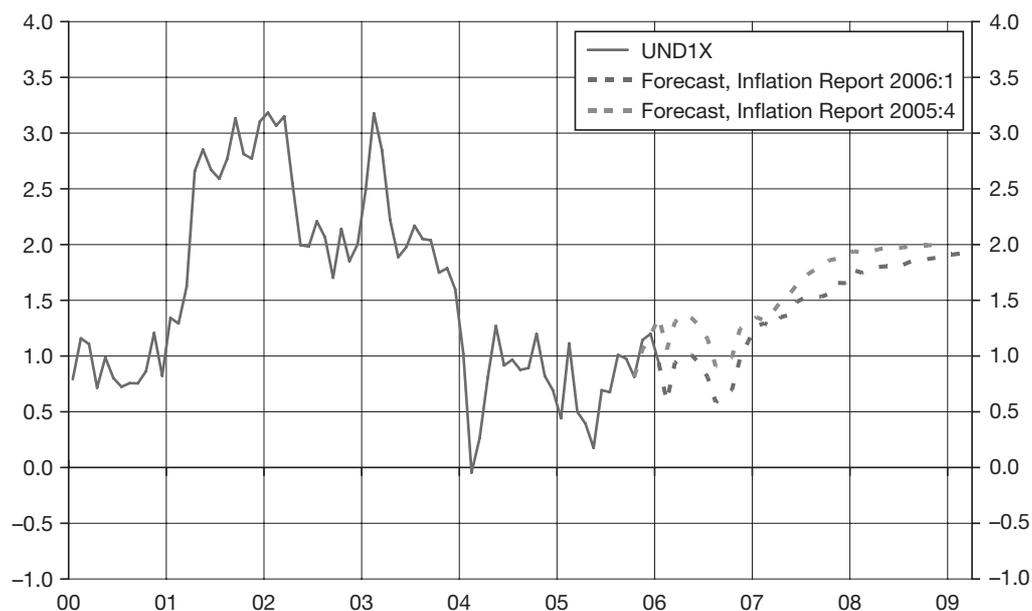
In its Inflation Reports the Riksbank also regularly publishes a number of alternative measures of core inflation (see Graph 3). These include trimmed means, UND1X excluding energy, CPI with item weights inversely related to its historical standard deviations etc. These are however only used as indicators of the current underlying inflationary pressure in the economy. Normally, no forecasts of these measures are published.

Graph 3 – Measures of core inflation published in the inflation report
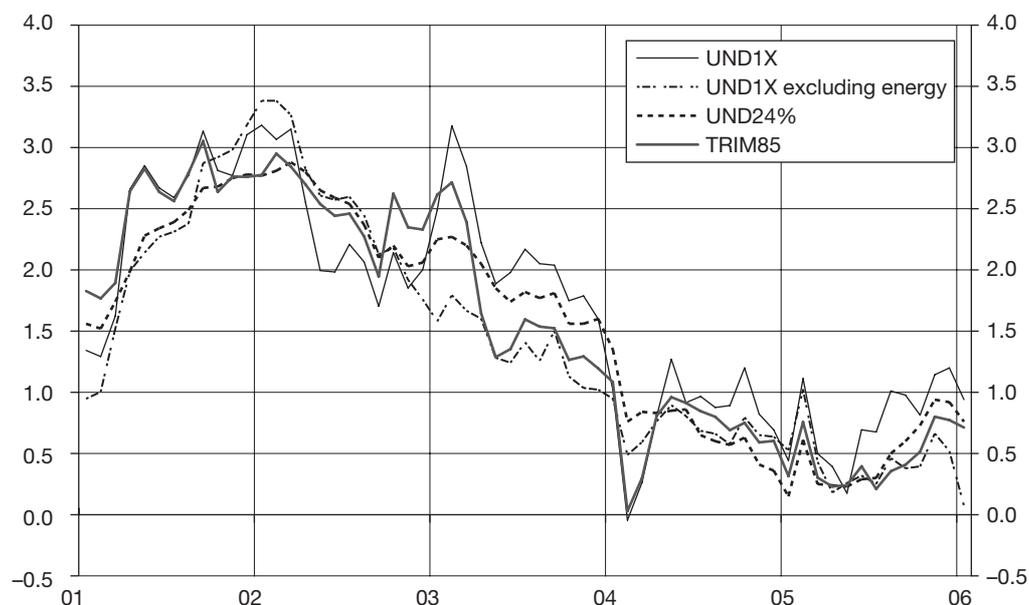
Jesper Johansson (Sveriges Riksbank)

Summary of discussion

Core inflation measures can be used in different ways: as a forecasting tool, a trend indicator or for a purely descriptive and backward-looking analysis.

The forecasting performance of core indices is often considered in the literature as the most important criterion to select the best core index. However the response to the IFC survey shows that central banks do not often use core inflation measures for forecasting purposes. Indeed, several empirical works have shown that core inflation is not a good predictor of future headline inflation for at least two reasons. Firstly, it is often computed as a univariate indicator which is over performed by better forecasting tools using model-based approaches; these models rely on various measures like output gaps, resource utilisation, and unit labour costs to project inflation. Secondly, headline inflation itself could be affected by core inflation, depending on the monetary policy stances which could change over time. Therefore a correct evaluation of the core inflation's ability to predict headline inflation would necessarily need to take into account the policy actions of the monetary authorities. Indeed, some authors regard the weak forecasting performance as an important drawback for the use of core inflation measures. One measure, developed by Cristadoro, Fornari, Wright and Veronese, seems to provide a satisfactory forecasting performance. However, its lack of transparency limits its usefulness as a tool for central bank's external communication.

A second way to use core inflation measures is to separate the persistent, underlying inflation from its transitory movements. In this framework, the headline CPI is expected to converge on the core inflation in the medium or long term. Several central banks use core inflation measures to determine the longer term inflationary trends. The literature on this aspect is abundant. Mark Wynne assessed the properties of the underlying inflation measures, their information content as well as some measures of trends like moving averages of inflation rate. Carlos Roballo Marques did a co-integration analysis, showing the statistical conditions, a core inflation measure needs to meet in order to be an attractor for headline inflation. However, as the graphs provided by the IFC Secretariat show, the headline CPI of several countries have consistently deviated from their core inflation measure in the last three years. Central banks have been faced with increasing difficulties to explain this trend. Large part of these discrepancies can be attributed to oil prices, which have been recently driven more by demand than supply. The question was raised during the discussions whether their exclusion from core measures is still relevant; the increase in oil prices are becoming more persistent as well as having second round effects. In particular, the ability of core inflation measures to provide an indication of what inflation could have been without an increase in the energy prices is questionable. A model-based approach would perhaps be a more valid alternative.

Apart from its use as a forecasting tool or as a measure of inflation persistence, core inflation measure is often used at a purely descriptive level. For instance, the ECB Monthly Bulletin uses core inflation as a means to decompose the sectoral shocks. The sectoral analysis of current inflation developments in the euro area always starts with a descriptive and a backward looking analysis of the core measure.

A clear definition of the core measure would help to improve comparability between national definitions. Unfortunately the literature does not offer a coherent conceptual framework for the discussion, like it does for the measurement of headline CPI with the COLI and COGI concepts.

The foregoing discussion suggests that it is necessary to clearly determine the uses of the core indices. Having clearly established its use and purpose, it would be further useful to consider what its desirable properties should be. More generally, it could be said that core inflation measures should possess attributes of low variability, low volatility and should be credible to the public.

In order to have low variability, the core measure needs to exclude the more volatile components in the basket. Measures such as trimmed means, which exclude larger price movements, would satisfy this criterion. However as the experience in Argentina and Canada shows, this approach tends to exclude the same components as are omitted in the more conventional exclusion measures which use volatility as a criteria for exclusion. In that sense it does not over perform measures that pre-determine the components that are to be excluded. Further, it could be argued that rather than high variance, the persistence of fluctuations over time might be better criteria for removing components from the core measure. For instance, the prices of electronic goods have shown a persistent downward trend in recent years. Using the trimmed means

approach would result in perhaps excluding these components from the core measure, due to high variability, which may not necessarily yield a better measure. Moreover, this would carry a risk that potentially useful information on the underlying inflation may be lost.

The seasonal adjustment of the core measures is another aspect to be considered. Few countries seasonally adjust their CPI or core inflation. Typically only annual percentage changes are available. The seasonal adjustments which allow for prompt identification of turn points are performed in Germany and at the ECB for the headline CPI and its components, with the exception of the energy prices, where the seasonal pattern has been blurred by energy shocks.

Further in this context, a key issue to be considered is the periodic revision of the core measure. In some measures, re-weighting of inflation components by the inverse of their standard deviation is directly dependent on the time period over which the deviation is calculated. Consequently they are revised more frequently. While this might result in a better estimator of the measure, it should be recognized that this could make the measure more difficult to be understood and accepted by the public.

This leads us to the question of credibility of core inflation measures. This is an important issue for the central banks. There is an issue of "perception of inflation by the public". Core inflation is well understood by the academic community and is meaningful in the context of monetary policy, but is more challenging in terms of communication to the public. In Canada, the core inflation appears to have been better understood by the general public perhaps due to the adoption of a more pragmatic approach in the choice of the measure.

Despite their many constraints and performance issues, central banks continue to use core inflation measures for their research and policy analysis. In some cases, they have developed more elaborate and sophisticated indices which address the problems discussed in this session. But surprisingly, as survey conducted by the IFC secretariat shows, despite several years of lively theoretical debates and the development of sophisticated indices, most of the central banks continue to rely on "old-fashioned" core inflation measures, i.e. based on an index that excludes unprocessed food and energy. As recent literature indicates, central banks should perhaps attach higher weights to stickier sectors. Unprocessed food and energy belong to this category, which is also confirmed by the analysis of the European Inflation Persistent Network.

Indeed, the use of these measures is mainly on account of the trade-off that central banks seek to achieve between different attributes: communication, transparency, accountability, absence of revision, timeliness, cross-country comparability. Moreover, given that the core inflation index is typically developed by a central bank, it is important for this measure to be as transparent and easily understood as possible. It could be argued that the transparency objective would be better served if the index were computed by an independent agency as in Canada or Sweden. However the lack of consensus on the definition of a core measure prevents an easy transfer of the compiling responsibility to the statistical agency. Moreover, some central banks fear that this transfer could reduce their flexibility in using other core inflation measures. On the other hand, this flexibility might conflict with the need to have a transparent and easily understood measure that can be accepted by the public. Under these circumstances, central banks should aim to have as transparent measure as possible to avoid any adverse impression. It is also argued that as long as detailed data are publicly available, the issue of who compiles this index becomes less important than its verifiability.

Finally, there is the issue of comparability of the measures across countries. It is recognized that this is not always easy. For instance both Canada and Poland extract volatile elements out of the CPI. On the other hand, administered prices are excluded in Poland but not in Canada. Sweden focuses on taxes and interest rate costs for consumers which may not be the case in several other countries. Harmonisation by itself is not as important as countries would have to deal with different structural factors which might be specific to their economies. It is more important for the central banks to select the best core measure to suit the monetary policy requirements of the country.

In conclusion, it was felt that there was a need for a clear distinction between the measures used internally within the central bank and those that are externally published. For analytical purpose, central banks may use a number of measures that are not constrained by the trade-offs required in a publicly announced measure. However, for external purposes, central banks need to be more careful. Traditional measures which exclude food and energy are often preferable as these represent a fair compromise between all the required properties. Actually different measures perform well along different directions, which explains why each central bank uses its own preferred methods.

SESSION 7

Quantifying in the measurement bias in CPIs

Chair: Mark Wynne (Federal Reserve Bank of Dallas)

                                Background note and key issues for discussion

Papers: **Measurement error in the US CPI**
                                Jeremy Rudd (Federal Reserve Board)

                                The accuracy of the HICP: a comment on recent contributions
                                Diego Rodriguez-Palenzuela (European Central Bank)

                                **The "Index of perceived inflation (IPI)" for Germany:
                                Conceptual principles and shortcomings**
                                Hans-Albert Leifer (Deutsche Bundesbank)

                                Summary of discussion

Background note and key issues
for discussion

In competitive market economies, new goods and services are introduced on an ongoing basis, while others disappear from the market. New sales outlets are established, and older ones are closed. Relative prices tend to change frequently in response to changes in technology, consumer preferences and income. Technological innovation leads to improvements in the quality of many goods and services available to consumers. These, and other technical reasons, make it difficult to accurately calculate a consumer price index (CPI).

In recent years, monetary policymakers have paid increasing attention to methodologies used to calculate inflation measures and to indicators of potential mismeasurement in official CPI statistics. The fact that many economies are approaching or experiencing price stability means that measurement errors in the CPI are relatively more important than they were in the past when inflation was running at a double-digit rate. That central banks have adopted explicit targets, objectives, indicators, benchmarks or reference rates of inflation also puts a premium on the accuracy of estimates of the respective inflation measure. Moreover, the CPI is regularly used as a reference for indexing contracts, including for financial instruments such as index-linked bonds. Finally, it should not be forgotten that inaccurate CPI statistics may have implications for the measurement of other economic variables, such as real output and productivity. If measured inflation overstates actual inflation, then real economic growth will be simultaneously understated. If this happens at low levels of inflation and economic growth, an economy may be much closer to deflation than expected.

Sources of measurement bias[1]

Session 4 has discussed the way in which CPI measurement might be affected by changes in the quality of the products contained in the basket of consumer goods on the basis of which the index is calculated. It concluded that there is a potential *quality adjustment bias* in official CPIs and that there are various implicit and explicit methods to address this issue.

Substitution bias may be introduced when insufficient account is taken of the fact that consumers may switch from relatively expensive goods to cheaper goods, as a result of changes in relative prices. Substitution might also occur in response to changes 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 (e.g. meat vs fish). The typical index formula used to compute CPI – in general a Lowe or Laspeyres index – using a set of fixed quantity weights from an earlier period for each product category. This type of formula fails to properly take account of changes in consumer behaviour resulting from changes in relative prices. There is an overstatement of consumer price inflation, as the weights of products that have become relatively more (less) expensive, and from which consumers move away (to which consumers switch over) are too high (low).[2]

Different solutions have been proposed to deal with the issue. A chained Laspeyres index, which frequently updates the base period weights, could significantly reduce the higher-level substitution bias. However, as long as updated weights refer to an earlier period the CPI index will not allow for complete substitution. Superlative indices (e.g. Walsh, Fisher, Tornqvist – also called ideal indices) which use expenditure figures both for the base and current period as weights, are considered to account properly better for the substitution bias. Since 2003, the US Bureau of Labor Statistics (BLS) has published a superlative index, the C-CPI-U, in addition to

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1 *Compared to a cost of living index (for more details, see the issue note 2 "Inflation measures from a perspective of monetary policy").*
2 *Eurostat requires that HICP weights are frequently updated: "Where reliable evidence shows that a weighting change that would affect the change in the HICP by more than 0,1 percentage point on average over one year against the previous year, Member States shall adjust the weightings of the HICP appropriately" (Council Regulation, EC, n 2454/97, 1997).*

the more closely tracked Consumer Price Index for Urban Consumers, or CPI-U. This new index employs a Tornqvist formula and expenditure data in the most recent previous period. The drawback of the superlative indices is that they are less timely than traditional Laspeyres-type indexes as it is almost impossible to calculate expenditure weights for the current period. Revisions are therefore likely when the index is recalculated with the current expenditure data when these become available.

At the *lower level*, the substitution occurs when consumers switch between items within the same product category (e.g. between different types of spaghetti). At this lower or elementary level, expenditures are not weighted but the choice of the formula to aggregate individual prices may result in more or less bias when substitution occurs. The three most widely used formulae are the arithmetic mean of price relatives (AR), the ratio of arithmetic mean prices (RA) and the geometric mean of price relatives (GM). The Consumer Price Index Manual mentions that the use of AR creates a substantial bias in the CPI and should therefore not be used. The GM[3] formula assumes that the elasticity of substitution between products is 1, while the RA[4] formula assumes that it is 0. Hence, it has been argued that the use of geometric mean will in general provide superior results, as it allows for a certain degree of substitution.[5] In fact, a large number of national statistics institutes have opted in recent years for the use of the geometric formula to aggregate individual prices at the elementary level.

The *new products bias* results from product innovation. As mentioned by C. Obst (1999), three issues may arise in this context. First, the introduction of new products on a timely basis in the CPI basket might be difficult as expenditure weights may not be available quickly. Second, as prices for the new products are not available before they are introduced, it is not possible to compute price changes immediately. One shortcut in this case may be to apply the Hicks' reservation price concept, which is defined as the price just before the introduction of the product that ensured that there was no demand for the purchase of this product. Finally, new goods increase the welfare of consumers, as there is an increase in the range of brands or types of a particular product and completely new goods are introduced. Ultimately, 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.[6]

Outlet bias in the CPI can be significant when the structure of sales outlets undergoes important changes, as in the case of the introduction of supermarkets, mass retail outlets (e.g. WalMart and Carrefour), Internet shopping or discount stores. 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. In this context, two issues can be identified. First, the switch to low-cost outlets might affect the consumption of some specific products (such as food and clothes, for instance). A close and frequent monitoring and updating of the outlet structure could help to address this issue. Second, if consumers opt for discount shops, the quality of the products or services offered in the new outlets might be different. If quality changes are significant, CPI compilers should consider this effect (see the discussion on quality change in the background note for session 4).[7]

Quantifying the measurement bias

Potential measurement bias in official CPI statistics became an important policy issue, not only in the US, with the publication of the Boskin Report in 1996. Commissioned by the US Congress, the Report indicated that the US CPI might have an upward bias of about 1.1% a year (with plausible estimates ranging from 0.8 to 1.6 %). The Report also quantified the sources of

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3 *The GM formula represents Cobb-Douglas type preferences, in which expenditure shares are assumed to stay constant over time.*
4 *The RA formula represents Leontief type preferences, in which quantity are assumed to stay constant over time.*
5 *In case of small price changes it is however suggested to use the RA formula.*
6 *The European Commission has laid down minimum requirements in this respect: "Each month Member States shall produce HICPs using weightings which reflect consumers' expenditure patterns in a weighting reference period ending no more than seven years before the preceding December". New products should be incorporated in the HICP as soon they achieve a significant proportion of the households' expenditure, defined as 0.1% of the total consumers' expenditure.*
7 *It as been argued that the quality tends to be lower in discount shops compared to traditional supermarkets. This concerns not only the quality of a specific product but also the service provided in the discount shops.*

measurement bias: substitution bias (0.2–0.4% a year), outlet bias (0.1–0.3%), quality changes (0.2–0.6%), new products (0.2–0.7%) and formula bias (0.3–0.4%). Other studies on the US CPI have confirmed these numbers. By estimating the stability of quality Engel curves for various durable goods, Bils and Klenow (2001) have suggested that the Boskin figures might even be too low. In addition, although important improvements have been made to the US CPI methodology by the BLS since the Boskin Report, recent estimates of the US CPI bias remain relatively similar to those mentioned in the Report. Indeed, Lebow and Rudd (2003) find that the US CPI still overstates the rate of increase in the true cost of living by about 0.9% a year, with a confidence interval ranging from 0.3 to 1.4. As reflected by the range of plausible values found in the various studies of measurement bias, there is a large amount of uncertainty surrounding these estimates and therefore these figures should be interpreted with care.

Since the publication of the Boskin Report, research on measurement bias in CPI has also emerged in other countries. In Europe, different studies have been undertaken at the national as well as at the regional level. Evidence based on the national CPIs is less clear than for the US, but researchers tend to find on average that the CPI overestimates the true cost of living by an amount, which is probably lower than the one pointed out in the Boskin Report. For instance, Hoffmann (1999) calculates that the German CPI displays an upward bias of about 0.5% a year. Lequiller (1997) estimates that the substitution and outlet biases probably result in an overstatement of the cost of living by about 0.35% a year in the French CPI. Wynne and Palenzuela (2002), basing their analysis on the HICP, conclude that it is not possible to give a precise estimate of the measurement bias, as HICPs are improving on an ongoing basis and as detailed information on how national CPI compilers calculate HICPs is not available.

Studies have also been carried out in Canada, Japan[8] and New Zealand[9] and they all tend to find that their national CPI overstates consumer price inflation. For instance, a recent study in Canada (Rossiter, 2005) has shown that the bias in the Canadian CPI is about 0.6% a year, which is lower than the estimate for the US CPI and for the HICP. The author finds that the substitution bias accounts for 0.15, the outlet bias for 0.08, the quality bias for 0.15 and the new products bias for 0.20%.

Inflation perceptions

An indirect way to assess the potential bias in official CPI statistics is to compare these with measures of inflation perceptions, as has been done by Wynne (2005) for the euro area (on the basis of this he concludes that there is a potential upward bias in EU HICP of between 1–1.5%). In Europe, data on inflation perceptions are available from the Harmonised Consumer Survey conducted by the European Commission (EC). Each month, 26,000 consumers in the euro area are asked about their perception of inflation. The particular question is: "How do you think that consumer prices have developed over the last 12 months?". There are six possible answers to the question (1) risen a lot, (2) risen moderately, (3) risen slightly, (4) stayed about the same, (5) fallen, (6) do not know. The results of these surveys are summarized as a balance statistic, which is calculated as the difference between the weighted proportion of respondents stating that consumer prices have risen and the weighted proportion of consumers stating that consumer prices have fallen or stayed about the same. The statistics are published not only for the euro zone as a whole but also for each country in the area.

Until the euro cash changeover, the measure of inflation perceptions has generally been in line with official inflation statistics in most European countries. However, after the introduction of the euro perceived inflation started to diverge and has remained persistently above official inflation statistics in every euro area member country[10]. Several explanations have been put forward for this perception gap. Brachtinger (2005) has shown that consumers perceive price changes more strongly for frequently bought goods as well as for price increases. At the time of the euro changeover, the European economy was hit by a large number of shocks, which resulted in relatively large price changes, particularly for products, which are frequently bought by consumers (e.g. petrol, vegetables, meat, and alcohol). Therefore, consumers might have perceived higher inflation, although this was not related to the cash changeover per se.

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8 *See Shiratsuka (1999).*
9 *See for instance, Diewert and Lawrence (1999).*
10 *While in EU countries outside the euro area (UK, Denmark and Sweden) no such perception gap has been observed.*

It has also been stressed that factors directly or indirectly related to the euro changeover might have caused this perception gap. For instance, Traut-Mattausch et al. (2004) have found, based on a survey, that consumers tend to overestimate continuous price increases for euro-denominated prices (compared to prices in national currency) and to perceive price increases for euro-denominated prices even when prices remain, in reality, unchanged. In addition, Mastrobuoni (2004) finds that the perception gap was closely related to the difficulty encountered by consumers to adapt to the euro. In many cases national currencies have remained the benchmark and consumers continue to mentally compare current prices in euro with those they remember in their respective previous national currency. As prices since January 2002 have obviously changed, this might explain the persistence of the gap observed since the changeover. Finally, Hermann (2005) finds evidence that the complexity of the conversion rate might explain the difference in the perception gap across countries.

Outside Europe there are few official measures of inflation perceptions available. In Indonesia and Japan such indicators are computed regularly on the basis of surveys of the household sector. Unlike Europe, inflation perceptions seem to have remained broadly in line with official CPI statistics in these two economies.

Issues for discussion

- How useful is it to have an empirical estimate of the bias in official CPI statistics? Can this potentially impact the reliability of these statistics from the perspective of monetary policy? Should this influence the way in which monetary policy is formulated and communicated?
- How confident can we be about the estimates of the bias in official statistics and its different components? Are there potential sources for measurement bias other than substitution effects, quality changes, new products and changes to the outlet structure? Is the formula bias potentially important? How confident are we in existing estimates of bias? Is there a need for ongoing work?
- Can measures of perceived inflation help to shed light on the potential bias in CPI statistics? How useful are inflation perception measures based on consumer surveys from the perspective of central banks and should their use be promoted? Can we improve upon existing measures of inflation perceptions?
- How should estimates of bias factor into quantitative definitions of price stability or inflation targets? How should uncertainty about these estimated factor in to these definitions?

Table 1 – Ranking and estimates of the measurement bias in CPI statistics

Central banks	Ranking of bias	Estimates (sources)
Argentina	1. Substitution bias; 2. Quality bias; 3. Outlet bias; 4. New product bias	n.a.
Australia	1. Substitution bias; 2. Quality bias; 3. New product bias; 4. Outlet bias	n.a.
Belgium	1. Quality bias; 2. New product bias; 3. Outlet bias; 4. Product substitution bias	n.a.
Brazil	n.a.	n.a.
China	n.a.	n.a.
Canada	1. Quality bias (0.15); 2. Substitution bias (0.15); 3. New product bias (0.10); 4. Outlet bias; (0.10)	0.58 with a upper bound of 0.75 (Rossiter, 2005)
Euro Area- ECB	1 Quality and new products bias; 2. Substitution	1–1.5 (Wynne, 2005)
France	–	0.35 (Lequiller, 1997)
Germany	1. New product bias; 2. Quality bias; 3. Outlet bias and product substitution bias (small)	0.75 (Hoffmann, 1998) 0.5 (Hoffmann, 1999) less than 0.5 (Bundesbank, 2002)

Table 1 – (Continued)

Central banks	Ranking of bias	Estimates (sources)
Hong Kong SAR	1. Substitution bias; 2. Quality bias; 3. Outlet bias; 4. New product bias	Around 1.0% (results obtained before the use of the geometric formula)
India		
Indonesia	1. Quality bias; 2. Substitution bias; 3. Outlet bias; 4. New product bias	n.a.
Italy	1. Quality bias; 2. Substitution bias and New product bias; (less important)	0.9 (Shiratsuka, 1999)
Japan	1. Quality bias; 2. New product bias;	Not yet available
Korea	1. substitution effects; 2. Quality adjustments; 3. New outlets of products	n.a.
Malaysia	1. Substitution bias	n.a.
Mexico	1. Substitution bias; 2. Quality bias; 3. New product bias	Not published
Netherlands	–	n.a.
Poland	1. Quality bias; 2. New product bias; 3. Outlet bias; 4. Substitution bias	n.a.
Portugal	All biases are important	n.a.
Russia	1. Quality adjustments; 2. substitution effects; 3. New products	n.a.
Saudi Arabia		
Singapore	–	n.a.
South Africa	1. New product and Outlet bias; 2. substitution bias; 3.Quality bias	n.a.
Spain	1. Quality bias; 2. Outlet bias; 3. New product bias; and substitution bias (small)	0.6 (Ruiz-Catillo et al. (1999)). In meantime, some changes have been introduced to reduce the bias; (GM, weights and products are update every year, use of hedonic methods)
Sweden	Substitution bias	n.a.
Switzerland	1. Substitution bias; 2. Quality bias; 3. Outlet	0.5–0.6 (Brachinger et al., 2000) In meantime, some changes have been introduced to reduce the bias; (GM, Chain Laspeyres index)
Thailand	1. Substitution bias; 2. New product and Outlet bias; 3. Quality bias	n.a.
United States	1. Quality bias (0.4); 2. Upper level of substitution bias (0.3); 3. Measure errors in expenditure weights (0.1); 4. Lower level of substitution bias (0.05); 5. New outlet bias; (0.05) The figures in brackets are reported by Lebow and Rudd (2003)	0.4–1.5 (Lebow, Roberts and Stockton, 1994) 1.0 (Shapiro and Wilcox, 1996) 1.1 (Boskin Report, 1996) 0.8 (GAO update of Boskin Report, 1999) 0.9 (Lebow and Rudd, 2003)

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Measurement error in the US CPI

Jeremy Rudd (Federal Reserve Board)

Introduction

This paper summarizes some work that Federal Reserve staff have done on quantifying the measurement error in the US Consumer Price Index (or "CPI bias"). (See Lebow and Rudd, 2003, for a comprehensive treatment of many of these topics.)

Ideally, we would like both a point value and "confidence range" for our estimates of CPI bias; both, of course, are relevant for policymakers. Before we begin, however, we need to specify:

- an "ideal" that we want the index to approach; and
- a methodology for assessing measurement error.

Defining the goal of the CPI

We cannot assess the measurement error in the CPI unless we have a view about what the index is *supposed* to be measuring. For the CPI, the Bureau of Labor Statistics (BLS) state:

> "Although the CPI cannot be said to equal a cost-of-living index, the concept of the COLI provides the CPI's measurement objective and the standard by which we define any bias in the CPI." (*BLS Handbook of Methods*, chapter 17)

The benchmark we used for our own work, therefore, was that of a "conditional COLI," that is, a COLI defined holding constant nonmarket goods or environmental factors (such as government-provided goods or crime). In computing CPI bias, we also took as given:

- the CPI's scope (out-of-pocket expenditures by consumers); and
- the CPI's use of "plutocratic" (as opposed to "democratic") weights.

Methodologies for assessing CPI bias

Broadly speaking, we want to compare the CPI to an (unobserved) conditional COLI.
There are other ways to proceed, however (to obtain either a total bias measure or a value for a component of overall bias). For example, we could:

- estimate the COLI from a fully specified demand system;
- use survey data on living standards (Nordhaus, 1998; Krueger and Siskind, 1998); or
- use other indirect evidence on living standards based on observed expenditure patterns (Hamilton, 2001; Bils and Klenow, 2001).

The particular method employed by the Federal Reserve staff involves identifying various ways in which the actual CPI might fall short of a conditional COLI, and quantifying the likely differences. A similar approach was taken by the Advisory ("Boskin") Commission, as well as by Shapiro and Wilcox (1996) and earlier Federal Reserve work; naturally, a large amount of judgement informs these sorts of bias estimates. That said, given that we need to take a stand on the accuracy of the CPI, it is preferable to base our assessment on a systematic review of the available evidence. (This can also highlight just where the existing evidence is weakest.)

Sources of bias in the US CPI

Our study identified four broad sources of bias in the CPI. Three of these are very familiar.

1. *Substitution*: As a fixed-weight Laspeyres index, the CPI tends to overstate increases in the cost of living by ignoring changes in consumer demand in response to relative price changes.

For the US CPI, substitution bias comes in two forms: *upper-level substitution bias* (which refers to substitution *across* the CPI's roughly 8000 item-area strata); and *lower-level substitution bias* (which refers to substitution *within* these strata).

2. *Quality change/new goods:* The CPI might not properly measure quality improvements in existing goods, or benefits to consumers from the introduction of new goods.

3. *Outlet changes:* When new retail outlets are rotated into the CPI, the BLS assume that price differentials between old and new outlets reflect quality differences. Some or all of these differences could reflect true (quality-adjusted) price change, however.

In addition, we identified a fourth, less-familiar source of bias:

4. *Weighting:* The CPI's expenditure weights come from survey data, which could be inaccurate.

Let us now consider in turn how each source of bias can be quantified.

Upper-level substitution bias

The standard way of measuring upper-level substitution bias (ULSB) involves comparing the existing (Laspeyres) CPI to a "superlative" version of the index. There are, however, some complications with this approach.

- Typically, a "chained" superlative is used. However, each link of the "chain" will involve a different reference indifference curve.
- Sampling error in the underlying price data can bias superlative indexes down in practice (*c.f.* Greenlees, 2001); a correction is therefore needed.
- Bradley (2001) has argued that ULSB does not really exist (little scope for substitution across item–area strata) – instead, finite–sample bias in Laspeyres is corrected by a superlative.

Lower-level substitution bias

Expenditure data are not available (even with a lag) to measure within-stratum substitution bias (also known as lower-level substitution bias, or LLSB). The usual way LLSB is measured involves comparing the existing index with an index whose within-stratum prices are aggregated using a geometric mean. In 1999, the US CPI moved to geometric-means aggregation for about three-fifths of the index. Geo-means aggregation implies a (near) unit elasticity of within-stratum substitution; however, if – as seems plausible – *actual* elasticities of substitution are larger than unity, then some LLSB could remain in the US CPI. (There is not much evidence on this.)

New-outlet bias

Changes in consumer buying patterns suggest that not all of the price differential between old and new-outlets reflects quality. There is very little evidence on the magnitude of this effect.

- Reinsdorf (1993) found a 0.25 pp per year price differential at incoming outlets for certain foods and gasoline. Some, all, or none of this could reflect true price change.
- More recently, Hausman and Leibtag (2004) find an estimate for food at home of 0.32–0.42 pp per year (but this also includes some correction for substitution bias).
- Lebow *et al.* (1994) judged that new-outlet bias is probably relevant for about 40 percent of the overall CPI.

Weighting bias

The weights in the CPI are derived from the BLS's Consumer Expenditure Survey (CEX). Surveys can be affected by reporting bias (*e.g.*, underreporting of alcohol or tobacco purchases), recall bias, or lack of knowledge about total household expenditures. If items with weights that are too large tend to display above-average price increases, then the CPI will be biased upward.

- We assess this by comparing the CEX weights with consistently defined PCE data from the national accounts.
- Many of the differences between the CEX and PCE weights are in line with *a priori* expectations.

- We therefore estimate "weighting bias" as the average difference in the growth rates of the published and PCE-weighted CPIs.

Quality-change and new-items bias

A COLI must try to capture quality changes and any benefits from the introduction of new goods. The BLS devote considerable effort to quality adjustment; nevertheless, many analysts believe that unmeasured quality improvement is a source of significant upward bias in the CPI. This is probably the most controversial single issue surrounding the topic of CPI bias, both because quality-change bias estimates tend to be large, and because a large degree of judgement is needed in order to quantify them. There are also some important unresolved issues regarding conventional methods for dealing with quality change (*c.f.* Hobijn, 2003). Even less can be said about the magnitude of new-goods bias.

Our study reviewed the evidence on quality-adjustment bias for each category of expenditure. In some cases, useable studies (e.g. hedonic analyses) exist to inform these estimates. In most cases, however, the evidence is extremely thin. We categorized the degree of evidence as follows.

1. *Estimates based on at least a moderate degree of evidence*: These prices account for 7 percent of the CPI and 5 percent of our total quality-change/new-goods bias estimate.
2. *Estimates based on a small or inadequate degree of evidence*: Accounts for 39 percent of the CPI and 68 percent of our bias estimate.
3. *Estimates almost totally subjective*: These represent 54 percent of the CPI and 27 percent of our bias estimate.

In addition, several other interesting points arise from a consideration of this source of bias.

- First, it is important to avoid double-counting (e.g. a log-linear hedonic estimate should be compared to a CPI series with geo-means aggregation).
- Second, most relevant studies (e.g. hedonic estimates) cover short periods of time that might not be representative.
- Finally, it is important to choose studies whose baseline price-change estimates are computed in a manner that is comparable to the existing CPI (many are not).

Aggregating each source of bias

We can combine each individual source of bias to obtain an aggregate bias estimate. When doing this, it is again important to avoid "double counting."

- For example, for a "prospective" estimate of bias, the estimates of quality-change bias for each good should be aggregated using very recent expenditure weights.
- Similarly, if "weighting bias" is an issue, the individual quality-change bias estimates should be aggregated using the preferred weights.

When we combine our individual estimates, we obtained an overall (prospective) bias figure of 0.9 percentage point per year. Most of this reflects quality-change/new-goods bias (0.4 percentage point per year) and upper-level substitution bias (0.3 percentage point per year).

Construction of a confidence interval

Following Shapiro and Wilcox (1996), we can also compute a confidence interval for our bias estimate. This requires us to specify distributions for each bias component; if there is a range of estimates for a particular component, then this can be used to inform its assumed distribution. We might also have priors about the distribution's "shape." (In most cases, however, the assumed distributions will be purely subjective.) The distributions can then be combined – with assumptions about how the sources of bias are correlated with each other – to yield an aggregate distribution.

Under our assumptions, we obtained a 90 percent confidence interval around our overall bias estimate that ranged from 0.3 to 1.4 percentage points per year.

A note about PCE bias

The PCE chain price index is an important alternative US price statistic. What can we say about this measure's bias?

- First, since individual CPIs are used in the PCE index, quality-change/new-good bias is still present (its magnitude can be different inasmuch as PCE and CPI weights differ).
- Weighting bias is absent, however (by construction), as is upper-level substitution bias (the PCE index uses a superlative formula).
- Finally, other sources of bias (outlets, lower-level substitution) are also present.
- In addition, we also need to take a stand on the broader scope of the PCE price measure. One assumption we might make is that the PCE's scope is appropriate for that index, and that no quality-change bias is present in nonmedical, nonmarket PCE prices.

Concluding thoughts

This methodology provides a useful benchmark estimate of CPI bias (in particular, it provides a helpful guide to areas where future work is needed). However, this approach is uncomfortably subjective. (Under the circumstances, that might be the best we can do.) Related to this is a concern that quantification of a bias estimate (and its confidence interval) might imply a degree of certainty that we simply do not have. Finally, this method tells us little or nothing about the nature of *time variation* in overall CPI bias, which might be of particular interest to a monetary policymaker.

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Jeremy Rudd (Federal Reserve Board)

The accuracy of the HICP: a comment on recent contributions[1]

Diego Rodriguez-Palenzuela (European Central Bank)

1. The years around the start of Stage Three of EMU witnessed considerable interest by researchers on the magnitude of a possible measurement bias in the HICP. That research had been surveyed in a number of overview papers and conferences, such as Hoffmann (1998), the ECB's Price Measurement Conference held in 200I[2], Wynne and Rodriguez-Palenzuela (2003) and Cecchetti and Wynne (2004). In particular, Wynne and Rodriguez-Palenzuela (2003) concluded that it was difficult to assess the size of the bias, as there was insufficient information available for assessing the size of a potential bias.

2. Since the ECB Conference in 2001 there has indeed been some further improvement in the methodology underlying Eurostat's HICP. Notably, there has been an improvement and harmonisation of quality adjustment and sampling methods (e.g. standards for clothing, books and CDs have been recently adopted) but clearly more of such improvement remains necessary. Furthermore, there has been increasing co-operation at the European level at the level of consumer price indices production (e.g. the CENEX project for hedonics). Meanwhile, some important decisions are pending, such as the issues around the inclusion of owner-occupied housing in the HICP.

3. At the same time, our knowledge about the magnitude of a possible measurement bias in the HICP does not seem to have increased in any significant manner over the last three years, in which relatively limited additional evidence on these matters has emerged. One of the few new attempts in recent years to gauge the magnitude of a bias is provided by Wynne (2005). This paper builds on the so-called indirect approaches to estimating a bias in the consumer price index. Wynne (2005) exploits the qualitative information pertaining to reported perceptions of changes in prices in the EC's Harmonised Consumer Survey (HCS).

4. The study in Wynne (2005) underlines the importance of cross-checking the results from various methodologies for arriving to a broad based conclusion relating issues which remain complex and surrounded by high uncertainty such as the accuracy of the HICP. Relating specifically to the methodology proposed, Wynne (2005) would seem to merit further attention and extensions in the direction of increasing the accuracy and robustness of results, with a view to complement other results obtained with different methodologies, such as other indirect approaches and the direct, Boskin-report type of approach. The remainder of this note briefly summarises the approach implemented in Wynne (2005) and then outline possible avenues for extending and making more robust such an approach to assess the accuracy of the HICP.

5. Starting with the summary of the indirect approach to assessing the size of the measurement bias in the HICP proposed in Wynne (2005), a key issue in this respect is how to connect the information on inflation perceptions in the HCS to the conventional measure of inflation in the HICP.[3] Such connection between the two sources of information is far from trivial: The HCS survey has only recently started to provide a data series for *quantitative* perceptions of contemporaneous price developments while it has provided a *qualitative* index for such perceptions from the outset. Therefore, an obvious challenge confronted in Wynne (2005) in using qualitative survey-based data such as the HCS to assess the record of accuracy of the HICP relates to the difficulty of convincingly mapping at least a range of the qualitative index to a quantitative index. This is however possible at least for one of the qualitative responses in the HCS, which relates to the survey question on whether households perceive

the price level as *unchanged* (and which obviously should correspond to the case of *zero* inflation). Wynne (2005) takes advantage of this unambiguous relation between the qualitative responses and the quantitative HICP index to gauge the size of the bias: the instances when the qualitative responses to the HCS in a given country and year state perceptions of unchanged prices (thus a perception of absence of inflation), one can compare this outcome with the annual change in the HICP in the same country and year. If perceptions of changes in the HCS are a correct summary measure of price developments, one could then attribute the extent to which the HICP is above zero to the measurement bias in the HICP. This comparison is at the core of the results in Wynne (2005).

6. In implementing this approach to gauging the HICP bias, Wynne (2005) takes two intermediate steps: he first constructs an index number which summarises the state of perceptions of inflation by households by means of a *balance of responses* in the HCS in a given country and year. This provides the survey-based data points measuring perceptions of inflation in countries and time. Each of these data points are linked one to one to the corresponding outturn for HICP inflation in that country and year, leading to a cluster of data points showing the observed relation between HICP outturns and HCS based measures of expectations. In a second step, Wynne (2005) fits a non-parametric kernel regression (with HICP as the fitted variable and the HCS index as the regressor) to such cluster of data points, and then checks the value fitted for HICP when the index takes the value of zero (i.e. the value of the index corresponding to "perception of unchanged price level or equivalently zero inflation"). As a result of these steps, the approach obtains that the measurement bias calculated according this criterion would be between 1% and 1.5% annually. This range appears to be considerably above the available rough estimates of the HICP measurement bias.[4]

7. Overall, implementing a higher number of methodologies to assess the size of a potential measurement bias in the HICP permits the cross-checking of the various results and thus to enhance the robustness of the assessments. At the same time, relating the specific range estimate for the bias mentioned above, much caution needs to be exerted, as it is also the case for all attempts thus far to gauge the size of the HICP bias. In what follows, we aim at pointing at possible caveats that would seem applicable to the approach in Wynne (2005) described above and which underline the need for caution. We also briefly discuss possible avenues that in our view may serve to address some of the caveats and might thus be useful to researchers in future extensions of this complementary approach to assessing the precision of the HICP.

7.1. First, it needs to be noted that the HCS and the HICP were in principle not designed to measure the same phenomenon or answer the same question. Therefore, even if both indices were fully accurate, still disparities could arise as they are not fully aligned in their ultimate purpose: While the HCS means to respond to the question of how households perceive changes in the *cost of living*, the HICP, which is not designed as a Cost-of-Living CPI, aims to measure the changes in prices in monetary transactions, excluding items directly affected by monetary policy decisions such as interest rates.[5] Such difference in scope could therefore mean that certain disparities are possible even under perfect measurement in both the HCS and the HICP: for instance, interest rate changes or changes in residential property prices could affect more directly an HCS-based index of price level changes than the HICP.

7.2. Second, an additional challenge that needs to be recognised and addressed in measuring perceptions of inflation by households relates to the wide disparity in responses across households, even for households which are regionally close – and thus face comparable conditions as regards price developments. In practice, such disparity in perceptions is addressed by computing a weighted average of responses, i.e. the so-called *balance of responses*, which gives a certain weight to the various responses and adds them up. Such emphasis on the aggregation of responses should not mask that households do provide considerably different responses to the same question and such variety of responses advises for exerting caution when interpreting the results.

7.3. Third, and foremost, one needs to recognise limitations and potential measurement imperfections also in survey based indicators of inflation perceptions. Indeed, a measure

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4 *See in particular Cecchetti and Wynne (2004), cited above.*
5 *The HICP is defined by Eurostat as "…a Laspeyres-type price index that is* based on the prices of goods and services available for the purchase in the economic territory of the Member State for the purpose of directly satisfying consumer needs*" (emphasis in original; See "Compendium" of HICP reference documents (2/2001/B/5), December 2001, Eurostat). In the HCS Survey consumers are asked the following question: "Compared with what it was 1 months ago, do you think that the* cost of living *[underlining added] is now: very much higher? / quite a bit higher? / a little higher? / about the same? / lower? …".*

of price level changes based on indices constructed on the basis of HCS data might also be affected by a measurement "bias". Two possible sources of such possible bias are often quoted: first, households may weigh more heavily the more frequently purchased items. If, in a certain period, items, which are purchased with higher frequency (such as gasoline, tobacco or restaurant services) experience relatively higher price increases compared to items usually purchased less frequently (such as durable goods), a perception bias may arise. Second, the changeover to euro coins and banknotes, which took place in the first months of 2002, may plausibly also have had a direct bearing on the formation of household *perceptions* about changes in consumer prices, over and above any direct true impact of the changeover on prices.[6]

8. The previous considerations however do not necessarily suggest abandoning the approach of using survey based data on perceptions for the purpose of assessing the accuracy of the HICP. Rather, they point to the possibility of addressing some of these concerns in further efforts to expand the number of methodologies in this area. While the purpose of this note is not to advance new methods to address the above mentioned concerns, some possibly relevant elements in that discussion on methods are provided.

8.1. Relating the point in paragraph 7.2 above and relating purely to descriptive aspects of the data in the HCS, it would seem possible and desirable to explore in further detail – compared to the usually reported *balance of responses* in the form of a weighted average of responses – the best way to represent by means of summary statistics the information in the HCS survey regarding perceptions of inflation. In particular, it would seem natural and useful that, in characterising the mean response to the question on inflation perceptions at a given point in time, the information on *dispersion* of responses is taken into account.

8.2. Relating the point in paragraph 7.3 above, it would seem also important to allow in the analysis of the information in the HCS in connection to inflation perceptions for the possibility of potential "cognitive biases", by which households would, at least episodically, perceive inflation in a not fully accurate manner. Along the lines mentioned above, it would seem possible to elaborate on the analysis of the factors which may underpin such potential cognitive bias in inflation perceptions, such as i) the specific weights which household attach to items in connection with the frequency of purchases, ii) possibly also the (country-specific) algebraic complexity involved in the conversion from legacy currencies to the euro, or, iii) the possibility of instances of monetary illusion (or *disillusion*) if some households could tend to report as *perceived higher inflation* what in reality corresponds to more general losses in real disposable income also related to lower growth in nominal wages.

9. In conclusion, it would seem that the "knowledge gap" about the potential measurement bias the euro area's HICP has not closed over the last few years. In this respect, it would seem desirable that the vitality which this area of research experienced in the period 1998–2003 could be regained, taking into account the importance of the underlying issues both from an economic welfare and policy perspectives. In this respect, new contributions to the literature seem to provide possible further avenues to estimate the HICP bias, by adapting for the euro area work by the Fed in this field (see Lebow and Rudd (2003)) and possibly also by refining the approach proposed by M. Wynne (2005) using survey data. Relating the latter, the general point made in Wynne (2005) – using and cross checking information from various sources should serve well the enhanced assessment of the HICP accuracy – seems important and potentially very fruitful in particular if the potential biases and shortcomings specific to measures of inflation of perceptions based on information in the HCS are taken into account in such an assessment. Indeed, to the extent that the traditionally discussed potential "biases" in the HICP (i.e. substitution, outlet, aggregating formula biases, etc.) are of different nature that the potential "cognitive biases" in the HCS-based measures of inflation perception, it would seem plausible to augment or enrich the analysis in Wynne (2005) to deliver such an enhanced assessment of accuracy in the HICP. Such approach would indeed seem to merit much further attention.

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6   *For an analysis of how stated perceptions of inflation may be subject to cognitive biases see Ehrmann (2006).*

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The "Index of perceived inflation (IPI)" for Germany: conceptual principles and shortcomings

Hans-Albert Leifer (Deutsche Bundesbank)[1]

Last September saw the publication of the results of a project on constructing and calculating the IPI which had been undertaken jointly by Professor Hans Wolfgang Brachinger (University of Freiburg/Switzerland) and the Federal Statistical Office in Germany. Two statements, in particular, attracted attention.

- "It is apparent that the IPI actually does capture inflation as perceived by the general public."
- "The analyses also show that inflation perception, even in 2005, (that means in the first eight months) is persisting at a monthly average level of 7.4% and thus roughly at the level of the time when the euro was introduced." (The official rate was 1.8%)

The data used for calculating the IPI are data of the consumer price statistics, that is, the collected monthly prices and the expenditures for goods in the base period (the year 2000), estimations by the Federal Statistical Office and four major assumptions. The assumptions are

- Consumers perceive price changes as absolute differences between the observed price and an individual reference price, and rate higher prices as losses and lower prices as gains.
- Consumers perceive price increases more strongly than they do price reductions or unchanged prices. To quantify this behaviour it is assumed that consumers evaluate price increases twice as strongly as price reductions.
- The more often a product is bought, the stronger is the perception of the price changes.

With the aid of assumptions 1–3, the traditional Laspeyres formula of the CPI

$$\text{CPI} = \Sigma \frac{p_t}{p_0} \times \frac{p_0 q_0}{\Sigma\, p_0 q_0}$$

(where p = prices, q = quantities, 0 = base period and t = reporting period)

can be transformed into the formula of the IPI

$$\text{IPI} = \Sigma \left[c \frac{p_t}{p_v} - (c-1) \right] \times \frac{h_0}{\Sigma h_0} + \Sigma \frac{p_t}{p_v} \times \frac{h_0}{\Sigma h_0}$$

$$\underbrace{\hphantom{\Sigma \left[c \frac{p_t}{p_v} - (c-1) \right] \times \frac{h_0}{\Sigma h_0}}}_{\text{price increases}} \quad \underbrace{\hphantom{\Sigma \frac{p_t}{p_v} \times \frac{h_0}{\Sigma h_0}}}_{\text{price reductions}}$$

(where c = loss-aversion parameter, p_v = reference price, h_0 = purchasing frequency in the base period).

Concerning the fourth assumption, this means the determination of the reference prices (p_v), Brachinger discusses three variants:

- Variant 1: The average of the prices in the two preceding years is used as the reference price.
- Variant 2: It is assumed that the consumers use only the old D-Mark prices as a reference (the average of the last two years of the D-Mark).

Figure 1 – Official inflation rate and perceived inflation rate given alternative assumptions about the applied reference prices – Reporting month August 2005
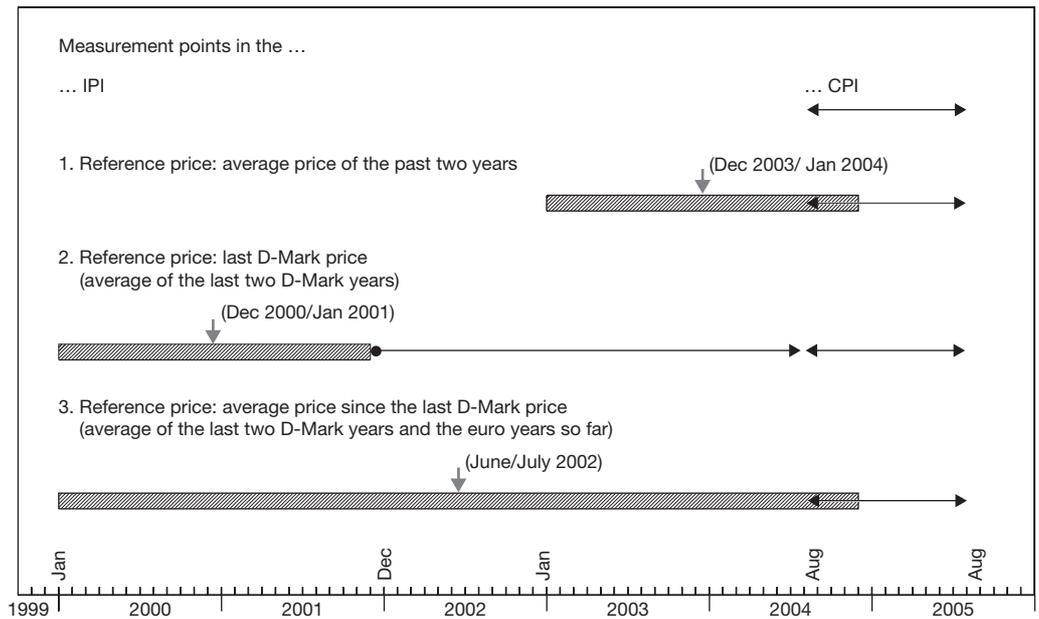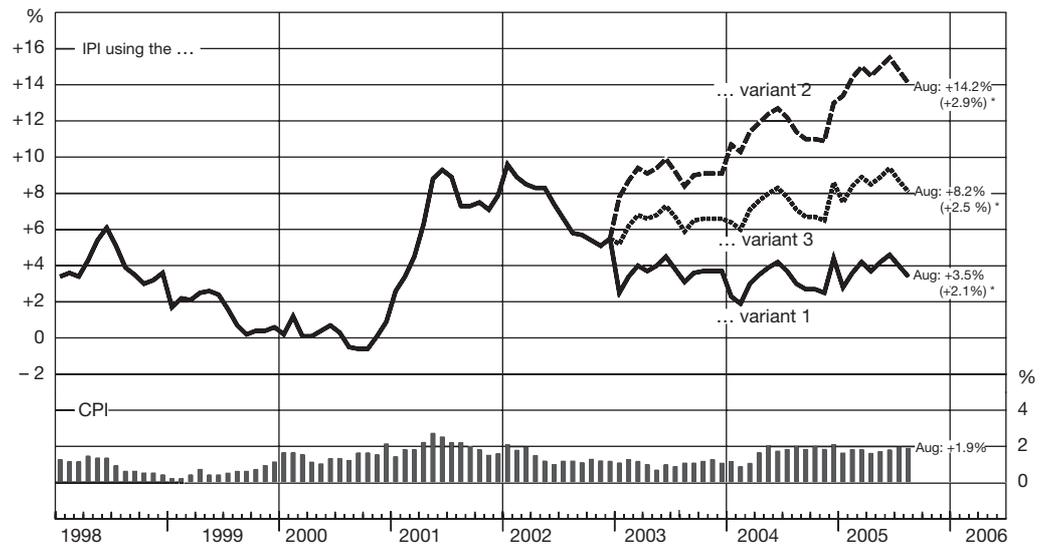

Figure 2 – Official inflation rate and perceived inflation rate given the three variants about the applied reference prices (monthly)


*In brackets: rate per year.

Source: Professor Brachinger's calculations; own calculations based on Federal Statistical Office data.

- Variant 3: It is assumed that consumers use an average price as a reference price calculated since the last D-Mark price. This is the variant that Brachinger feels is very suitable for explaining the widespread perception of constantly high inflation in Germany since the introduction of euro cash.

  Figure 1 shows the three variants, in which the rate of August 2005 is calculated. The shaded areas are those time spans for which the average prices are compiled in the variants. In Figure 2 the three mentioned variants are compared over time and the results for August 2005 are shown.

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2 *By the way, quite recently he informed the public that the rate for December 2005 was 9.6% (official rate: 2.1%).*

Figure 3 – Balance of EU consumer survey, and inflation rate according to the CPI and the IPI: a comparision (monthly)
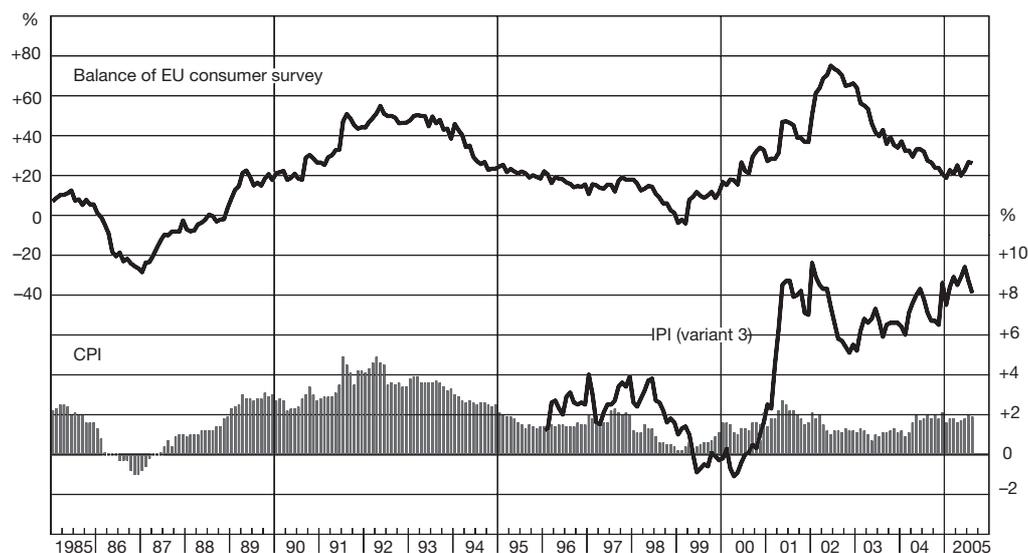
Source: Professor Branchinger's calculations; European Commission, own calculations based on Federal Statistical Office data.

Figure 4 – Inflation perception according to response category and the IPI
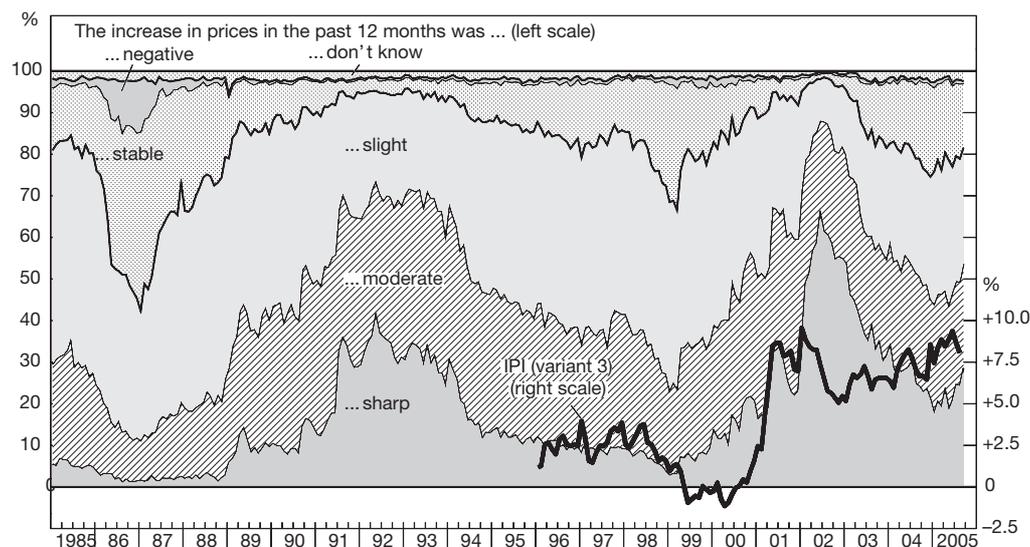
Source: European Commission, Professor Brachinger's calculation

In Brachinger's preferred variant 3, the perceived inflation rate was 8.2% in August 2005 (official rate: 1.9%).[2]

The following interim conclusion is possible.

- The IPI does not measure perceived inflation directly. It is, rather, a model calculation on a series of more or less plausible or partly questionable ad hoc assumptions and/or a transfer of findings made in other contexts.
- The actual individual price changes measured for the CPI are weighted differently, and the strict year-on-year relationship of the official inflation rate is abandoned.
- The numerous variants introduce a certain degree of "free choice" into the calculation of the IPI.[3]

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3 *For example, in discussing the IPI, the German Council of Economic Advisors refers to a variant which gives an estimate of perceived inflation of about 3% for 2005 and which is in stark contrast to Brachinger's 8%. This is done without giving any reasons for deviating from Brachinger's preferred variant.*

As mentioned before, the IPI is not a measure of perceived inflation. It may be that the IPI could be used "at least" to understand deviations between perceived and measured inflation. As kind of "benchmark" for the perceived inflation, the responses to the monthly consumer surveys of the European Commission are chosen. In principle, these figures do not supply information on the level, but rather on the development of perceived inflation over time. If the IPI shows the same development over time as the survey, in general, and the calculated balance of this survey, in particular, the IPI could then be used as an explanation of the difference between measured and perceived inflation. In Figure 3 these indicators are compared. It is obvious that the balance of the survey shows a development that differs from the IPI. If the balance is interpreted as an indicator of perceived inflation, it is at variance with the IPI. A similar result can be achieved if one looks at the individual response categories in isolation (see Figure 4). If any conclusion at all can be drawn from the survey, it is surely that there is no empirical evidence that the inflation perception of the German general public is as high now as it was at the time euro cash was introduced.

The variability of the IPI depends essentially, through the weighting of the purchasing frequencies, on relative price developments – loss aversion and the generalised anchoring effect lead only to a level effect. This therefore raises the question of the empirical justification for Brachinger's opinion that inflation perception is determined by the purchasing frequencies. Evidently, it is the case that consumers attach less importance to purchasing frequencies when assessing the general price trend or, put in a different way, purchasing frequencies have less of an impact on price perception than does the budget impact.

In the end, the one and only conclusion should be that not only is the IPI is not an indicator for measuring the perceived inflation, it cannot even be used to understand deviations between perceived and measured inflation.

Hans-Albert Leifer (Deutsche Bundesbank)

Summary of discussion

The 10th anniversary of the appearance of the Boskin commission's estimates of biases in the CPI, was seen as an appropriate opportunity to revisit some of the issues that had stimulated much interest in central banks and the academic community about the effect of measurement bias on the CPI. Around the same time, William Nordhaus had presented a paper in which he described the perceived income growth and measured median income growth in the US. The paper showed that the discrepancy between household perceptions of price rise and the official statistics reflected the potential existence of bias in the price statistics. Since then, academics and central bankers have attempted to quantify the measurement bias in different ways. The three papers presented in this session address the issue of measurement bias, the ways to quantify this bias as well as to consider the issue of measured versus perceived inflation.

In the discussion that followed, the chairman recalled his earlier work in this area and said that the absence of hard numbers was very discouraging. It would be interesting to know how much the state of knowledge had advanced over the last decade. There was also a concern that most literature on the subject were based on estimates of bias obtained from the US data and estimates. This would be too narrow a base to extrapolate for other countries.

While discussing the US paper, there were some questions on the assumptions used in measuring the bias. For instance, the assumption that non-market based components would not have a bias may not necessarily hold and it was possible that such components of the CPI might in fact show some bias in their estimation. Another issue related to the type of data that was collected by the survey conducted in the US on inflation perception. If adequate micro data were available, it would be interesting to look at the various individual factors about the respondents and perhaps obtain useful insights on the way inflation is perceived at the household level. On the need for a quantitative definition of price stability, it was felt that a numerical definition by itself may not suffice. It is equally important to have an inter-temporal time series comparison. Although, thanks to the effort of CPI compilers we have now a much better CPI compared to 10 years ago, the numerical definition of CPI or inflation targets had not changed much over time. It is also obviously important to measure the CPI bias, especially if this comes from quality changes or from new products biases. In this case prices might be underestimated and the actual growth rates may be higher.

The household surveys conducted in the Euro Area had many consequences: in Germany discussion started with the release of the survey, in France there were concerns about the reliability of their CPI and HICP data. In fact, the Ministry of Finance decided to compile its own price index – with a much smaller amount of prices collected. Further evaluation of the surveys showed that household surveys were not as reliable as surveys in industry – there is only a loose link between the variables and the balance of opinion. They have tried to estimate the link between the balance of opinion and the inflation with a view to identify a change in behaviour in wage settlements, price development and consumption behaviour. The result is that the gap between the survey and the inflation rate can not explain any recent wage, price and consumption development. However, this gap had no consequences for the behaviour of households.

Not much has been done on measurement bias after the ECB study was published in 2002. To the extent that measurement bias is driven by quality adjustment issues, and will no further work done on quality adjustment, it would only be possible to confirm the sources of the bias. But the bias itself cannot be further quantified.

In Mexico, there has been some identification of weight bias in areas such as owner-occupied housing, the purchase of durable consumer goods on credit or cash, and the introduction of alcohol and tobacco into the index. Consumers often tend to underreport their consumption.

In the Euro area, as long as consumers perceive inflation as much higher than what is measured by central bank estimates, there could be a credibility problem for the central bank. There is, however, some evidence that in terms of financial markets ie bond markets, the inflations expectations have always been in line and below the current development in inflation. From the financial markets perspective the credibility of inflation measured by the central banks is very high for the Euro Area, but households might have another idea.

In the case of Indonesia, inflation perception by consumers lags behind the actual inflation rate. Consumers generally refer to the previously published rate and regard that as current in terms of inflation development.

SESSION 8

Central bank input into national and international discussions on CPI methodology

Chair: Gabriel Quirós (ECB)

                   Background note and key issues for discussion

Papers: **The Bundesbank's contribution to the inflation measurement debate in Germany**
                   Johannes Hoffmann (Deutsche Bundesbank)

                   Summary of discussion

Background note and key issues for discussion

The CPI is a key statistic for central banks in their conduct of monetary policy. Indeed, it serves as a target, objective, indicator, benchmark or reference in their policy framework and is an important variable in their communication of interest rate decisions. No doubt, the effort to improve the methodology for calculation official CPI statistics has contributed to make them more reliable, timely, transparent and accurate. New statistics, for instance on core inflation and inflation perception, are being developed. There is always room for improvement, however, as the research on estimating the remaining bias in official CPI statistics illustrates.

With one or two exceptions, central banks are not the official compilers of CPI statistics. However, as key stakeholders in good CPI data, they have developed ongoing cooperation with the statistical agency compiling the data, typically the national statistical institute. The cooperation can be formalised, whereby the central bank is officially consulted when major changes are made to the CPI methodology. In Europe, for instance Eurostat, in close collaboration with the ECB and the national institutes of statistics, has developed the HICP Working Group, a platform to enhance the accuracy and the harmonisation of HICPs. Cooperation can also be less formal, for instance, through independent research carried out by central banks on CPI issues or through informal contacts between experts at central banks and national statistical institutes.

At the international level, central banks have not been directly involved in the development of the CPI Manual nor in the Ottawa Group, a so called city group set up by the United Nations in 1994, to provide a forum for specialists to share their experiences and discuss research on crucial issues related price measurement. On 10–12 May 2006, a meeting will be organised in Geneva by the UN Economic Commission for Europe and ILO[1] (the latter is the official owner of the CPI Manual) to serve as a forum for discussion of both conceptual and practical aspects of the compilation of CPI statistics. The measurement of core inflation will be one of the main topics on the agenda of the meeting. The CPI Manual and related future work will also be discussed. The meeting will be followed by a meeting on 14–16 May in London of the Ottawa Group.[2]

The issues raised at the workshop could be brought to the attention of these international meetings on a bilateral basis through the respective national statistical institutes represented at the meeting. Since the BIS has an observer status in the UN meetings and has started to cooperate more actively with various international statistical groups, including the UN, a short summary of the workshop could be presented at the UN and Ottawa Group meetings. The meeting of the IFC Council, which is scheduled to take place on the occasion of the Third IFC Conference at the end of August, could discuss whether specific issues related to price statistics, for instance core inflation, could be revisited by the IFC at a future date.

Issues for discussion

- How do central banks provide input on CPI methodological questions at the national level (including the EU level for the ECB and the ESCB)? In some countries, central banks have been involved in basic research on price statistics (US, DE, ES to mention a few) and in some countries central banks are members of statistical advisory bodies and committees that advise, have a strong influence or may even decide on main methodological issues in CPI compilation. What has been the experience of these national central banks? Has there been a positive impact on the development of improved CPI statistics? Can more actions be taken to improve the reliability, timeliness, transparency and accuracy of national CPI's?
- Should central banks become more actively involved in CPI methodological issues at the international level? Should they follow the discussions in the UN/ILO and/or Ottawa Groups

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1 *For additional information on this meeting, see http://www.unece.org/stats/documents/2006.05.cpi.htm*
2 *For more information, see http://www.statistics.gov.uk/events/ottawa_group/*

on the CPI Manual more actively? Given the main objective of central bankers – price stability – are there limits to this involvement?

- How can the IFC assist central banks to monitor conceptual and practical developments with respect to the CPI, and price statistics more generally?

The Bundesbank's contribution to the inflation measurement debate in Germany*

Johannes Hoffmann (Deutsche Bundesbank)

The past

The Deutsche Bundesbank's involvement in the debate on inflation measurement has a long tradition. As early as in 1965, in its report prepared at the request of the Federal Finance Court, the Bundesbank concluded that the Consumer Price Index of that time was not free of distortions and therefore did not reflect the true rate of inflation with total accuracy. It testified that "In general, it should not be considered a reduction in the value of money if the cost-of-living index . . . rises by, say, 1% per annum; and an annual increase of between 1% and 2% in the index can be regarded as indicating a deterioration in the value of money only with certain reservations." These findings were fed later into the "price assumption" underlying the Bundesbank's medium-term-oriented monetary policy strategy.

Committees and informal cooperation

Most of the Bundesbank's involvement in the measurement debate is much less spectacular than such statements on the bias in the CPI inflation rate. Most of the work comprises contributions to the work of statistical committees – at the national and at the international level – and informal cooperation with the German Federal Statistical Office. The Bundesbank, represented by the Head of the General Economic, Capital Markets and Financial Statements Statistics Division, contributes to the work of the Technical Committee on Price Statistics at the German Federal Statistical Office. This committee brings together producers (practising statisticians from the Federal Statistical Office and from Länder statistical agencies) and users of price statistics, mainly officials from the federal and the Länder governments, but also from other public agencies such as the Bundesbank. Its importance arises from the fact that the consumer price statistics in Germany are decentralised: price data are collected and processed by the *Bundesländer*, the CPI for Germany is an aggregate derived from *Länder* CPIs (see Deutsche Bundesbank, 1998). Hence, the federal and the *Länder* statistical agencies have to reach a consensus on how to collect and to process price data.

At a more informal level, the Bundesbank also plays an active part in an annual workshop on inflation measurement ("Messen der Teuerung"), which brings together German (and Polish) academic and practising statisticians and users of price statistics. We see this conference as an ideal opportunity to communicate our needs to the practising price statisticians, especially from the Länder statistical agencies. Furthermore, we very much appreciate the often lively discussions with the practitioners and academic experts on price statistics.

Even more informally, we are routinely in close contact with the Federal Statistical Office. At the Bundesbank, we receive the price index data at a highly disaggregate level (ten-digit COICOP level). This gives us the opportunity to check the data thoroughly and to run the seasonal adjustment procedures. If we find strange behaviour in (sub)indices, we ask the Federal Statistical Office for an explanation, which is always provided quickly and reliably. For the future, it is envisaged that the seasonal adjustment will be performed in close cooperation with the Federal Statistical Agency, as is already the case with other short-term economic indicators.

At the European level, the Bundesbank – once again represented by the Head of the General Economic, Capital Markets and Financial Statements Statistics Division – contributes to the work of the Working Group "Harmonisation of Consumer Price Indices" at Eurostat. Major topics

* This paper represents the author's personal opinions and does not necessarily reflect the views of the Deutsche Bundesbank.

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on the agenda of this committee include sampling, quality adjustment, owner-occupied housing and social protection.

Within the Bundesbank, responsibility for statistical methodologies lies with the Statistics Department. However, the Bundesbank management will also listen to the views of the Economics Department, and the Statistics Department sees its primary task as safeguarding a reliable statistical foundation for the analyses prepared by the Economics Department. Hence, there is quite close cooperation between the Statistics Department and the Economics Department in the field of statistical methodology and practical statistical problems.

Problems of inflation measurement in Germany, 1998

The Bundesbank's commitment to inflation measurement acquired a new qualitative dimension, when, in 1996, Professor Otmar Issing, then Chief Economist at the Bundesbank, inspired by the Interim Report of the Boskin Commission, initiated a research project in the methods and practice of consumer price inflation measurement in Germany.

From the beginning, the CPI research project received full support from the CPI staff of the German Federal Statistical Office. The Bundesbank obtained access to confidential data and to internal documents, and major parts of the study were discussed in depth with the CPI experts at the Federal Statistical Office. Looking back, I think the main quality of the paper is that it took seriously the procedures of the German price statistics for dealing with changing product quality and new products and outlets and that it analysed these procedures meticulously. This earned the study the respect of the Germany price statisticians, and later, at the international level, the respect of price statisticians from other countries. But this would not have been possible if the German CPI statisticians had kept the doors closed.

In the course of the research project, I compared the results of the German price statistics at a highly disaggregated level with alternative data. There was evidence of linking errors and of inconsistent quality adjustment. Even while the study was under way, the Federal Statistical Office started revising their methods for quality adjustment and improved the training of the price collectors. The linking errors were removed. Furthermore, the CPI statisticians started checking the long-term plausibility of measured price developments.

As a by-product, the 1998 study gave a new estimate of bias in consumer price inflation measurement for Germany (about 3/4 percentage points). Later studies (Hoffmann 1999a, 1999b) took into account the improved methods of quality adjustment. In 1998, the Bundesbank also hosted a workshop on problems of inflation measurement, to which experts from academia (Brachinger, Harhoff, Neubauer) and from statistical agencies (Haschka, Makaronidis, and Szenzenstein) made valuable contributions. The proceedings of the workshop were published in the Working Paper Series of the Deutsche Bundesbank (1999). Further research on price measurement for housing, which culminated later in two papers (Hoffmann and Kurz 2002, Kurz and Hoffmann 2004), indicated that there might be a negative measurement bias in the rental subindex. Finally, the estimate of overall measurement bias was revised downwards to up to 1/2% (Deutsche Bundesbank 2002).

Hedonics and the national accounts

The debate on the appropriateness of traditional quality adjustment methods received new impetus in Germany when the Bundesbank, in a short note in its Monthly Report of August 2000, summarised its own and international research on the contribution of quality adjustment methods to the GDP growth differentials established in the national accounts. It noted that while the deflator of investment expenditure in IT goods in the US declined by more than 80% in the period between 1991 and 1999, the corresponding decline in Germany had been no more than roughly 20%. In a special chapter in the Monthly Report May 2001, the Bundesbank came to the conclusion that the application of methods comparable to those used for the US national accounts would increase German measured real GDP growth by 0.2 percentage points.

While the Bundesbank emphasised that the purpose of this research was the comparability of the German and US real GDP growth figures and not the more far-reaching question of the adequacy of specific quality adjustment methods, the outcome was that the German Federal Government asked the Federal Statistical Agency to improve the quality adjustments methods in German price statistics.

The response of the official statistics

As already mentioned, the Federal Statistical Office had already started revising their methods for quality adjustment and improving the training of the price collectors in 1997/1998. More radical changes in the price statistics needed time and additional (academic) staff. While the technical staff for the price statistics is of excellent quality and highly motivated, the introduction of more advanced methods of quality adjustments called for different skills.

At the request of the Federal Statistical Office, the Bundesbank co-sponsored an international conference on quality adjustment methods ("Hedonic Methods in Price Statistics"), which was held in Wiesbaden in June 2001. Main contributors to this conference, which was chaired by Hans-Wolfgang Brachinger, were Erwin Diewert, Mick Silver, Jack Triplett and a number of practising statisticians from statistical agencies with some experience in hedonic methods. The purpose of this conference was to convince a sceptical audience that hedonics is a superior and feasible method of performing quality-adjustments, and to signal to the Federal Government the commitment of the Federal Statistical Office in tackling the quality adjustment problem with high priority.

It was at about this time that a research group with additional staff became established within the Price Statistics Division of the Federal Statistical Office. Its main task was research and development in the field of hedonics, although it was also concerned with other problems of price statistics. This group – consisting of economists and statisticians – is now well established and has since developed hedonic indices for PCs, other IT hardware, used cars, washing machines, TV sets and new dwellings. It also makes an active contribution to the discussion at the international level, most notably to the working of the Ottawa Group.

Later on, the Federal Government further stepped up the pressure on the Federal Statistical Office to speed up the introduction of hedonic indices for IT products, and the Federal Government asked the Bundesbank to give help to the Federal Statistical Office. In the end, it was decided that an economist from the Bundesbank should join the price statistics group of the Federal Statistical Agency for six weeks and write a feasibility report on hedonics in export, import and producer price statistics.

The main conclusions of this report (Hoffmann, 2002), which was very detailed with respect to the most important IT hardware components, were that it could be done, but that it would be hard going. The report, which was never published, also contained some exemplary hedonic estimates. Furthermore, the report proposed an integrated systems approach to the quality adjustment of hardware and software, which the German Federal Statistical Office now seems to be considering. With respect to the application of the hedonic methods, the report proposed a modest approach along the lines of the BLS practices. After some reflection, the Federal Statistical Office opted for a far more radical approach and, for IT hardware, abandoned the traditional collection of prices at the factory gate and at the border. Instead, the hedonic indices are derived from wholesale price data, partly gathered at the euro-area level.

The Federal Statistical Office released the hedonic price index for PCs in October 2002 (see Linz and Eckert 2002). The hedonically adjusted price indices for an impressive list of IT investment goods and components (desktop computers, notebooks, servers, inkjet printers, laser printers, multi-purpose printers, processors, memory chips, hard disks) followed in June 2004 (see Linz et al. 2004). With the release of the chain-linked national accounts in 2005, the deflators for expenditures on IT goods were revised backwards to 1991.

Residential property price indices

The Bundesbank residential property price index was originally compiled for monetary policy considerations only and was kept confidential. It had been developed by the General Economic, Capital Markets and Financial Statements Statistics Division of the Bundesbank, based on data of the BulwienGesa AG. The price data which feed into this index are not actual transaction data, but prices estimated by local property experts. In the years following the new economy bubble, a number of reports were published which gave the mistaken impression of a dramatic fall in residential property prices in Germany. After some reflection, the Bundesbank decided to publish the property price index, which did not show such a pronounced decline. The first data were released in spring 2004, and in September 2004 a special chapter of the Monthly Report ("Price indicators for the housing market") was devoted to the theoretical and practical problems of housing price indicators. It was also quite transparent with respect to the weaknesses of the Bundesbank/BulwienGesa indicator. Later on, the new residential property price index was presented at numerous conferences and workshops. Today, we can say, that the Bundesbank

property price indicator is the market-leader in Germany. Still, we are quite well aware of the deficiencies of this indicator, and the Bundesbank appreciates very much the efforts of the Federal Statistical Office in the development of a more satisfying, reliable house price indicator based on actual transaction data.

Present matters

The focus of recent work of Bundesbank (statistics and economics) staff has been on the adequate coverage of owner-occupied housing in the HICP (see Leifer 2001, 2006) and on methods for coping with the increasing impact of end-of-season sales on the price indices for apparel. Furthermore, the statistics staff at the Bundesbank are trying to improve the seasonal adjustment of price indices by introducing working-day adjustments (Deutsche Bundesbank 2004). And finally, we continue to review quality adjustment procedures critically, and the Bundesbank contributes to the work of CENEX, which is an initiative for improving the quality of price statistics in the euro area.

Conclusions

I think that there are clear indications that the involvement of the Bundesbank in the measurement debate has speeded things up with respect to the improvement of price statistics. Most importantly, it has led to a significant increase in the number of academic staff in the federal price statistics and to the establishment of a price index research centre at the Federal Statistical Office. Nowadays, Germany is the country with the most advanced hedonics program in the euro area. Still, the management of the Federal Statistical Office sometimes seems to fear that a public debate about price statistics could undermine the credibility of the official statistics. Therefore, they prefer close and confidential cooperation, which is typical of day-to-day business. But without a public debate it is sometimes not possible to achieve the shift in resources necessary for more radical improvements in price statistics.

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Summary of discussion

With very few exceptions, national statistical institutes compile CPI, a key statistic for central banks in their conduct of monetary policy operations. As key stakeholders, central banks need to be involved in methodological as well as practical compilation issues concerning the CPI. The focus of this session was to discuss the ways in which the cooperation between central banks and the compilers of inflation statistics is organised and the types of institutional arrangements that may be set up to ensure good co-operation between the institutions involved.

In this context, two major points were made to initiate the discussion. Central banks cannot ignore the statistical issues and methodological questions relating to the measurement of inflation. CPI is a primary statistic in this regard and the central banks would like appropriate institutional arrangements and agreements to ensure such involvement. However, such arrangements remain equally valid for any other data that is of interest to a central bank.

Central banks should not be in charge of the compilation of inflation measures. Indeed, they may face serious communication problems if they are also responsible of the compilation of an indicator, which is a target of their monetary policy.

Central banks are often both users and producers of economic and financial statistics. In the case of the CPI, central banks are usually not the compilers. For example, in Europe, the methodology of the HICP is not determined by the ECB but by the European Commission, which runs the statistical office, Eurostat. The ECB is only requested to issue an opinion on the methodology of the HICP.

In order to ensure good communication between the ECB and Eurostat, some institutional arrangements are required so that Eurostat is aware of and takes into account the statistical requirements of the ECB. Very often, such issues can be resolved by expert level interaction and goodwill. However, it is also useful to have some institutional arrangements in place. For instance, at different levels of EU, there are regular meetings: a EU commissioner is invited to the Governing Council meeting of the ECB, and there is a forum to bring together the managers of the statistics departments of the 25 EU central banks and the representatives from the corresponding national statistical agencies: the Committee on Financial, Monetary and Balance of payments statistics (CFMB).

Similar arrangements can be found in other countries as well. In Indonesia, the central bank is involved in developing the methodology of CPI compilation (design of surveys, definition of the CPI weights) as well as in direct price collection. Central banks also typically support the statistical agency financially and logistically. In some cases, there are formal memorandums of understanding drawn up to ensure that the new data is publicly available. In some cases, as in India, there are formal mechanisms to ensure effective cooperation. For instance, whenever a new statistical event takes place, (large statistical surveys, and change of base) a technical advisory group consisting of government and central bank officials as well as academics is set up to evaluate and recommend changes to the compiling agency. As these suggestions are fully implemented by the statistical agencies, the procedure guarantees a high level of consensus.

In the case of the CPI manual produced by the IMF, the role of the central banks is very significant. There were many examples of central bankers who have been very influential in the CPI Manual discussions. The IMF is interested in the expertise provided by the central bank community and is ready to invite, in its working groups, central banks which are currently working on CPI methodology.

The fact that the central bank is in charge of the compilation of the CPI in Mexico is not questioned very much. This situation has lasted for 80 years and is now enforced by law. However, the parliament might very soon make changes to the law so that the task of CPI compilation is handed over to the statistical agency. If this happens, a working group will be set up to ensure that the quality remains the same as before. The Statistical Institute has a good reputation in Argentina and during the hyperinflation period, the quality of the CPI data was never questioned. The relationship between this institute and the central bank is very good but informal.

The situation of central banks and statistical institutes are globally very different. The central banks are used to cooperate among each other, for instance in the Eurosystem where the infrastructure was created within a few years to run a common monetary policy. On the contrary, statistical institutes do not have the same degree of cooperation with each other. Consequently, the process of harmonisation of CPI methodologies is rather slow across the EU. There is clearly

a lack of incentive for the national agencies to move forward and the Eurostat cannot direct the national statistical agencies to change their methodologies. Several formal agreements for cooperation have been implemented between the central bank and the statistical agency in the Netherlands but they cover areas other than the CPI. Indeed the central bank is only one of the numerous users of inflation statistics. Consequently, the statistical institute has no reason to sign a formal agreement with the central bank in the CPI area.

In the US, a formal Advisory Council including the BEA, BLS and the Federal Reserve exists but its functioning is very academic. As the Federal Reserve is a major consumer of data, its staff regularly meet and exchange information with representatives of all statistical boadies.

Annotated list of background papers

International methodological standards for CPI and national practices

- Comparing inflation between the United States and Europe using the Methods of the European Union's Harmonized Index of Consumer Prices, W. Lane and M. Schmidt, Bureau of Labour and Statistics, 2006.

  Abstract: This paper proposes an alternative measure of the US CPI based on the HICP methodology. This experimental exercise requires different corrections especially in terms of the population coverage with the broadening of the US CPI to the non-rural population, and in terms of product coverage with the exclusion of owner-occupied housing. The authors find that the US HICP has risen more slowly than the official US CPI has.

- The harmonised Index of Consumer Prices: Concept, Properties and Experience to date, ECB, Monthly Bulletin, July 2005.

  Abstract: This article provides a comprehensive description of the HICP from a monetary policy perspective. It gives a review of the main harmonisation progress achieved since the adoption of the HICP (i.e. coverage, timely inclusion of new products, frequent weight revision) in order to ensure comparability across countries and promote standards for price statistics that follow international recommendations. Next, it describes the key conceptual basis of the HICP. Finally, this article deals with the priorities for improving the HICP (quality adjustment and owner-occupied housing).

- What happened to the price measurement since the Boskin Report? The U.S. Experience. D. Johnson et al., Bureau of Labour Statistics, *paper presented at the OECD conference Inflation Measures: too high-too low- Internationally Comparable in Paris, 21–22 June 2005.*

  Abstract: This paper describes the main changes, which have been implemented by the Bureau of Labour Statistics to the US CPI after the publication of the Boskin Report in 1996, which pointed out an important upward bias in this price index. It deals mainly with the following measurement issues: the introduction of geometric means at the elementary level, the introduction of the C-CPI-U, the use of hedonic methods, the frequency of weight update and the introduction of new products.

- The Boskin Report and Price Measurement in Australia, K. Woolford, Australian Bureau of Statistics, *paper presented at the OECD conference Inflation Measures: too high-too low- Internationally Comparable in Paris, 21–22 June 2005.*

  Abstract: This paper presents the main changes undertaken by the Australian Bureau of Statistics since 1997. In particular, it focuses on the following issues: elementary aggregate formula bias, quality adjustment bias and the development of a price index for financial services. It also addresses the methodological changes the ABS plans to implement in the short to medium term (e.g. reliable measurement of price changes for services).

- Comparability of Statistics for the Euro Area, the United States and Japan, ECB, Monthly Bulletin, April 2005.

  Abstract: This article focuses on the statistical comparability of key economic indicators for the Euro Area, the United States and Japan. After presenting an overview of the main underlying factors impairing the comparability of statistics in general, the article provides a detailed analysis of the comparability of 6 economic indicators (CPI, GDP, unit labour costs, bank credit aggregates, indebtedness indicators and government surplus/deficit). For the CPI, the principal factor restricting the comparability across countries is the product coverage, especially the treatment of owner-occupied housing, which is not yet included in the HICP, while it is accounted for in the CPI for the US and Japan. Other issues such as quality adjustment, sampling practices and population coverage might also impair the comparability.

- Consumer Price Indices, International Standards – an overview, V. Stoevska, ILO, *paper presented at the IFC conference on Central Bank Issues Regarding National and Financial Accounts*", IFC Bulletin 19, 2004.

  Abstract: This article summarises the key objectives and the main issues contained in the new "Consumer Price Index Manual: Theory and Practice". It addresses mainly the following issues: nature of a CPI; the uses of CPI; the scope of a CPI; acquisition, use or payment; basket and weights; sampling; index calculation; collections; replacements; quality changes and accuracy.

- The New Price Index Manuals, P. Armknecht, IMF, *paper presented at the IFC conference on Central Bank Issues Regarding National and Financial Accounts*", IFC Bulletin 19, 2004.

  Abstract: This article briefly reviews the main revisions carried out in the two manuals "Consumer Price Index Manual: Theory and Practice" and "Producer Price Index: Theory and Practice" (e.g. use of formula, quality changes, seasonal products, coverage of services, different indices for different users). It also provides a short description of the main international working groups, which have contributed to the revision of these manuals.

- Consumer Price Index Manual: Theory and Practice, ILO/ IMF/OECD/UNECE/WB, Geneva, 2004.

  Abstract: This manual constitutes a deep revision of the "CPI manual; Theory and Practice" published in 1989. The objective of this version is to provide guidelines and assist CPI compilers to promote international comparability and improve understanding of the CPI by users. To achieve these goals, the manual provides detailed information and explanations on compiling a CPI (e.g. formulae, the frequency of weight updates, procedures for quality adjustment, and the introduction of new goods and new outlets). It presents for each topic the different practices currently in use, proposes alternatives whenever possible, and discusses the pros and cons of each of them.

- Compendium of HICP reference documents, European Commission (Eurostat), Brussels, 2001.

  Abstract: The compendium constitutes a set of compiled texts including technical and non-technical documents, as well as the entire legal framework. The first part provides a detailed description of the conceptual basis, the coverage, the accounting conventions, the nature of the basic data and the compilation practices of HICPs. The second part covers all the legal documents adopted by the Council Regulation for the establishment of a harmonised methodology for compiling the HICPs in the Member States.

Inflation measures from the perspective of monetary policy

- Inflation measurement for Central Bankers, Robert Hill, RBA Annual Conference Volume, 2004.

  Abstract: This article discusses the choice of the inflation target for monetary policy (COGI vs. COLI, fixed base vs. chained price indices, quality changes, the treatment of owner-occupied housing and the use of scanner data). The author argues that the decision of choosing a COGI or COLI might have some importance since in practice, it sets the tone with regard to a number of imputations. The national statistical institute opting for COLI tends to make more quality adjustments and to use rental equivalence for owner-occupied housing. Scanner data might be very useful in the future for compiling CPI as they provide detailed expenditure weights at a high frequency and at a low level of aggregation.

- The definition of price stability: choosing a price measure, G. Camba-Mendez, in: O. Issing (ed.), Background Studies for the ECB's Evaluation of its Monetary Policy Strategy, ECB, 2003.

  Abstract: This article provides a general assessment of the characteristics that a price measure must display from a perspective of monetary policy. It deals, in particular, with practical issues (e.g. credibility, comparability) as well as with technical ones (coverage, index formula and valuation principle). Finally, it addresses two important concerns: the role of asset prices and the potential role of measures of underlying inflation. Regarding the former, the author

suggests not including asset prices in the index used for quantifying the price stability objective. For the latter, he mentions that although core inflation measures constitute useful indicators for monetary policy, these measures lack credibility and present a large degree of uncertainty in terms of computation.

- The new inflation target: the Statistical Perspective, Office for National Statistics, 2003.

  Abstract: In 2003, the Chancellor of the Exchequer decided to change the UK inflation target from one based on the Retail Price Index excluding mortgage interest payments (RPIX) to one based on the HICP. This article provides an overview of the differences between the CPI and RPI in the UK. It focuses in particular on population coverage, item coverage, the price measurement and the formula.

- What weight should be given to Asset Prices in the measurement of Inflation?, C. Goodhart, The Economic Journal, 2001.

  Abstract: The author discusses the pros and cons of introducing asset prices into the CPI. He recommends including asset prices in general only if asset price fluctuations are closely related to output movements. He shows that this relationship is rather weak for equity prices; in contrast, house prices exhibit fluctuations that are strongly correlated with output developments. Therefore, he concludes that house prices should be included in the CPI, mentioning however that the choice of the appropriate methodology to incorporate these prices remains an urgent and important issue.

- A Comparison of the CPI and the PCE Price Index, T. Clark, FRBKC Economic Review, 3rd Quarter, 1999.

  Abstract: The article presents a detailed and clear review of the differences between the CPI and the PCE in the United States, especially in terms of formula, scope, nature of the price data, weights and treatment of revisions. It also examines the advantages and disadvantages of these price indices based on their respective differences. Based on these factors, the author concludes that it is not clear which price index is superior from a monetary policy perspective, as the PCE has the advantage of a better formula and the CPI has an edge in dealing with specific item prices.

- Inflation, the Cost of Living and the domain of a Consumer Price Index, P. Hill, *paper presented at the ECE/ILO meeting on Consumer Prices*, October 1999.

  Abstract: The article provides a well-described explanation on the differences between a cost-of-living index (COLI) and a cost of goods index (COGI). It especially deals with substitution bias and the domain of goods and services (e.g. social transfers in kind, new goods).

The measurement of housing services in the CPI

- International Comparability of the Consumer Price Index: Owner-Occupied Housing, A. Christensen, J. Dupont and P. Schreyer, paper presented at the OECD conference Inflation Measures: too high-too low- Internationally Comparable in Paris, 21–22 June 2005.

  Abstract: This article firstly reviews the rationale for including versus excluding owner-occupied housing (OOH) from the CPI. Secondly, it provides an overview of the different approaches to record and evaluate OOH (acquisition, payment, user cost, and rental equivalence). Finally, it presents a detailed analysis of the comparability of the different methods at the international level and a quantitative assessment of the choice of the different methods. The authors point out that by most measures, the weight of OOH is quite high and that it generates a potential for significant impact on total CPI if the price of OOH moves differently from the average of the other items. Furthermore, they show that, in the short term, different methods might cause significant divergences.

- House Prices and Inflation in the Euro Area, B. Cournede, OECD Working Paper n 450, 2005.

  Abstract: The paper briefly discusses the rationale for including or excluding OOH from the HICP. Most importantly, it proposes a measure of user costs to include OOH in the HICP of each Euro Area Member States (except Luxemburg). This approach includes mortgage interest rate, property tax rate on owner-occupied houses, recurring holding costs (depreciation, maintenance, etc), expected house price inflation rate and house prices. The author concludes

that the inclusion of OOH, based on this method, in the HICP has a sizeable impact on inflation, which varies among countries.

- Owner-Occupied Housing: Market prices and user cost, R. Guðnason, Statistics Iceland, *paper presented at the OECD Conference, Inflation Measures: Too High – Too Low – Internationally Comparable? Paris, 21–22 June 2005.*

  Abstract: The paper provides an overview of three market price methods used to measure OOH: rental equivalence, user costs and net acquisition approach. Next, it presents the method currently applied by Iceland, a simple user costs approach, which uses a real interest rate as approximation to capital gains and measures depreciation by an inverted geometric rate. The prices are measured by a total house price index. Finally, it addresses the problems related to the user cost measurement, in particular the price divergence between rental markets and changes in house prices in Iceland.

- Treatment of Owner-Occupied Housing in the CPI, R. Poole et al., Bureau of Labour Statistics, 2005.

  Abstract: The article firstly compares the alternative treatments of the cost of owner-occupied housing (acquisition, payment, user cost, and rental equivalence). It also justifies the conceptual framework currently used for the CPI in the United States (i.e. rental equivalence). Secondly, it describes the changes that the BLS has made over the last 50 years in the CPI methodology in measuring homeowner shelter costs. It also focuses on the current pricing methods for the OOH in the US CPI. Finally, it reviews the main research conducted on homeowner cost inflation measures.

- Treatment of Owner-Occupied Housing in Australia – Concepts and Practices, K. Woolford, Australian Bureau of Statistics, *paper presented at the OECD Conference, Inflation Measures: Too High – Too Low – Internationally Comparable? Paris, 21–22 June 2005.*

  Abstract: This paper reviews the main changes conducted in the Australian CPI in terms of owner-occupied housing measurement. In particular, it focuses on the main revisions carried out since 1997, when the Australian Bureau of Statistics decided to use the net acquisition approach. Therefore, the OOH index currently includes the purchase of dwellings (excluding land), local government rates and charges, house repair as well as maintenance expenses and charges for house insurance services.

- A Rental-equivalence Index for Owner-Occupied Housing in West Germany, 1985 to 1998, J. Hoffmann and C. Kurz, Discussion Paper 31/2004, Economic Research Centre of the Deutsche Bundesbank, 2004.

  Abstract: This research paper reviews the method used to include the OOH in the German CPI: the rental equivalence by increasing the relative weight of the rent index in the CPI. As the structure of owner-occupied housing differs substantially from that of rental housing, the authors mention that the rental equivalence approach might cause a bias in the German CPI. For assessing the appropriateness of this approach, the authors present alternative rental equivalent indices based on the yearly household panel (GSOEP), which provides information on housing conditions in Germany. They find two main results from their analysis: (i) the current method used in Germany seems to be reasonable; (ii) there is some evidence of a downward bias in the OOH, which is however not directly related to the imputation method.

- Owner-Occupied Housing in the Norway: Why is the rental equivalence approach preferred?, R. Johannessen, *paper presented at the Eight Meeting of International Working Group on Price Indices, 2004.*

  Abstract: This article describes the rental market of Norway and the use of rental equivalence to measure OOH in the Norwegian CPI. It presents an alternative CPI based on a user cost method and it shows differences between the methods. The paper also focuses on the underlying reasons for choosing the rental equivalence approach despite the characteristics of the rental market (e.g. small and different from the OOH).

- The Treatment of Owner-Occupied Housing and other durable goods in a Consumer Price Index, 2004.

  Abstract: The paper presents an overview of the different approaches of the treatment of durable goods in a consumer price index (e.g. acquisitions, rental equivalence, user cost and payments

approaches). A major component of the user cost approach is the depreciation component. The paper presents a general model of depreciation. A complication arises because many durables (like housing) are custom produced and thus the usual methods for determining the form of depreciation are not applicable. The special problems caused by these uniquely produced consumer durables are considered as well as some of the special problems involved in implementing the user cost and rental equivalence methods for valuing the services provided by owner-occupied Housing.

Dealing with quality adjustments

- Hedonic Quality Adjustment in the U.S. CPI for: Appliances and Audio and Video Equipment, Bureau of Labour Statistics.

  Abstract: These technical papers present detailed explanations of how hedonic methods are used by the BLS to adjust the prices of products for which the quality changes over time. They focus in particular on the use of hedonic approach for appliances and audio and video equipment.

- Experiences in German Price Statistics with the Application of Hedonic Methods, S Linz and T Behrmann, Federal Statistical Office of Germany, *paper presented at the OECD Conference, Inflation Measures: Too High – Too Low – Internationally Comparable? Paris, 21–22 June 2005.*

  Abstract: This article presents a review of the program and improvements carried out by the Federal Statistical Office of Germany in terms of quality adjustments. Hedonic methods are used for 13 products categories in consumer, import, export, wholesale and producer price statistics.

- Quality adjustment of European price statistics and the role for hedonics, G. Kenny and H. Ahnert, ECB Occasional Paper series n 15, 2004.

  Abstract: The paper constitutes an extended version of "Quality adjustment of European price data: what role for hedonics?" written by G. Kenny and H. Ahnert (2003). This paper presents the challenges posed by quality changes from the perspective of monetary policy (e.g. credible and transparent price indicators). Then, it reviews the different approaches to adjust for quality changes and focuses on the current practices of QA in Europe. Finally, the authors give a critical overview of hedonic approach (HM) from a user point of view; they provide some quantitative evidence of the impact of the use of HM and make some suggestions on how the work on quality adjustment in the EU can be further developed, focusing in particular on the role of hedonics.

- Conceptual and measurement issues to hedonic methods of quality adjustment prices: the UK experience and some practical experience, D. Fenwick and A. Ball, *paper presented at the IFC conference 54th ISI Session*", IFC Bulletin 19, 2003.

  Abstract: This paper reviews the conceptual basis of hedonics and its applications for the CPI. It identifies the main issues that would benefit from the resolution of guidelines in the context of international harmonisation and presents recommendations on best practices based on the work undertaken by the Office for National Statistics (UK).

- Quality adjustment of European Price data: What role for hedonics?, G. Kenny and H. Ahnert, *paper presented at the IFC conference 54th ISI Session*", IFC Bulletin 19, 2003.

  Abstract: This paper reviews the problems of quality changes for goods and services included in the CPI. In particular, it highlights the importance of using appropriate methods to account for quality changes from the perspective of monetary policy (e.g. credibility and transparency). It focuses in particular on hedonic methods (HM). In addition, it reviews the current practice of QA in the HICPs in Europe. Overall, while the authors favour the use of HM in Europe, they make some suggestions for enhancing the comparability of HICPs among Member States in terms of QA.

- Comparison of hedonic functions for PCs across EU countries, P. Konijn et al., *paper presented at the IFC conference 54th ISI Session*", IFC Bulletin 19, 2003.

  Abstract: This empirical paper presents some results of the wide project undertaken at the European level by the European Hedonic Center, focusing on hedonics functions for PCs in 3 European countries: Germany, France and the UK. It was found that, although the choice of

the variables and functional form of the hedonic functions are quite similar across these countries, individual coefficients differ significantly, reflecting some differences in the PC markets and consumer preferences. Therefore, the authors support the idea of estimating hedonic functions for a group of countries in a co-ordinated way in order to increase the comparability among countries.

Other measurement issues of concern to central banks

• Identifying Important Areas for Future Price Work at the International level, E. Diewert, University of Columbia, *paper presented at the OECD Conference, Inflation Measures: Too High – Too Low – Internationally Comparable? Paris, 21–22 June 2005.*

Abstract: The author identifies six important problems with the CPI methodology. He mentions, in particular, (i) the upward bias of the Young indices used by most statistical institutes, (ii) the treatment of quality changes and new goods, (iii) the inconsistency with the use of un-weighted indices at the elementary stages of aggregation and the use of the Laspeyres index at the higher level of aggregation, (iv) the treatment of seasonal commodities, (v) the measurement of complex services and (vi) the need for different CPI depending on the use of CPI.

• Improving the way we measure Consumer Prices, FRBSF Economic Letter, August 2003.

Abstract: This article examines the details and recent behaviour of the new index, Chained Consumer Price Index Urban Consumers, introduced in the U.S. in August 2002 and designed to be a better measure of consumer prices and cost-of-living than the traditional CPI. In particular, the article identifies the substantial differences between both indices. Furthermore, it explains how this new index might help to resolve the substitution bias.

• Outlet types and the Canadian Consumer Price Index, A. White, Canadian Journal of Economics, vol. 33, p 488, 2000.

Abstract: This article examines the consequence of the growing number of large warehouse/discount stores for consumer price measurement. Consumer substitution to such outlets might create a bias in CPIs, which may be exacerbated by unrepresentative sampling and discount outlets' apparent slower rates of price increases. The author found that in 1990–96 unit value indexes rose at a lower rate than the corresponding Canadian CPI sub-aggregate indexes for other household equipments, non-prescribed medicines, and audio equipments. In addition, biases arising from unrepresentative sampling and differential rates of price increases across outlets have resulted in an additional overstatement for these sub-aggregates.

• A Review of bias in the CPI, OECD, *paper presented at the ECE/ILO meeting on Consumer Prices*, October 1999.

Abstract: After providing a brief introduction to price indices, this article presents a clear and detailed overview of the different bias in the CPI and proposes possible solutions for each of them. It focuses especially on the following types of bias: substitution at the lower and upper level, quality changes, new products and outlets.

Quantifying the measurement bias in CPIs

• Monetary policy perspective on the accuracy of inflation measures, M. Wynne, IFC Bulletin, *paper presented at the IFC conference on Central Bank Issues Regarding National and Financial Accounts*", IFC Bulletin 19, 2004.

Abstract: Different developments have contributed to the great interest of central banks in the accuracy of inflation measures (low inflation, inflation targeting, innovation, and globalization). This article reviews the literature on measurement bias of the CPI, focusing on the US and the Euro Area. For the euro area, the author finds an estimated bias ranging from 1 to 1.5 percentage points per year. He also presents a simple framework for using the information of measurement bias in setting the inflation objective.

• Measurement Error in the Consumer Price Index: Where do we stand?, D. Lebow and J. Rudd, Journal of Economic Literature, March 2003, vol. XLI, pp 159–2001.

Abstract: After the publication of the Boskin Report in 1996, which pointed out a significant bias of about 1.1 per cent in the US CPI, the BLS has implemented major changes in order to make it a better measure of the cost of living (e.g. geometric mean, quality adjustment, more frequent weight update). This paper derives a new estimate of the CPI bias. The authors conclude that the CPI is at the current juncture overestimating the true change in the cost-of-living by about 0.9 per cent, with a confidence interval ranging from 0.3 to 1.4 percentage point per year. The largest bias is the quality bias, as described in the Boskin Report.

- Measurement bias in the HICP: What do we know, and what do we need to know?, Wynne and D. Palenzuela, ECB WP series n 131, 2002.

Abstract: This article addresses the problem of measurement bias of the HICP, given the importance of this indicator for monetary policy. After reviewing the conceptual framework of the HICP and the research carried out in Europe on this topic, the authors distinguish two strategies for assessing (indirect and direct) bias. They conclude that there is very little scientific basis for putting a point estimate in the likely magnitude of the overall bias of the HICP, given that practices are improved on a ongoing basis and that this exercise requires detailed knowledge of how the HICP is actually constructed. Finally, the authors suggest that important improvements have to be undertaken in terms of quality adjustment and new products.

- Bias in the CPI: "Roughly Right or Precisely Wrong, FRBSF Economic Letter, 1997.

Abstract: This article briefly reviews the different bias in the US CPI at the time of the Boskin Report, some progress made by the BLS to reduce it and it proposes additional solutions for further reductions. However, the author concludes that although there is significant uncertainty about the size of the remaining bias, he is convinced that the bias is not zero but positive.

- Toward a more Accurate Measure of the Cost of Living, Final Report to Senate Finance Committee from Advisory Commission to Study the Consumer Price Index, M. Boskin et al., 1996.

- The Consumer Price index as a measure of Inflation, M. Bryan and S. Cecchetti, NBE Working Paper series n 4505, 1993.

Abstract: The US CPI being a fixed weight index, it probably overstates the true cost-of-living. This article proposes a method to construct a CPI immune to this weighting bias. Based on a dynamic factor model, the authors find that there was a significant weighting bias during the period 1967–1980. However, since 1981 this bias seems to have been insignificant.

Inflation perceptions

- Recent developments in consumers' inflation perceptions, ECB Monthly Bulletin, July 2002, pp 18–19.
- Recent developments in perceived and actual inflation, ECB Monthly Bulletin, October 2002, pp 20–23.
- Recent developments in euro area inflation perceptions, ECB Monthly Bulletin, October 2003, pp 24–25.
- Consumers' inflation perceptions: still at odds with official statistics, ECB Monthly Bulletin, April 2005, pp 30–32.

Abstract: These articles present the issue of the divergence between inflation perception and official inflation since the euro cash changeover in the euro area Member States. They briefly present the current situation and the potential factors, which might explain such a perception gap.

- Is there a discrepancy between measured and perceived inflation in the euro area countries since the euro cash changeover?, L. Aucremanne and M. Collin, National Bank of Belgium, *paper presented at the OECD Conference, Inflation Measures: Too High – Too Low – Internationally Comparable? Paris, 21–22 June 2005.*

Abstract: This research paper examines the scope and the potential causes of the positive gap between perceived inflation and actual inflation since the euro cash changeover in the euro

area. Based on unit root tests for the difference between inflation perceptions, as measured by the EC survey with consumers, and actual inflation for 11 euro area countries, the authors find a break in the relationship between actual and perceived inflation for all euro area countries. In a control panel of non-euro area members no such break is found, implying that the cash changeover was an important triggering factor of the perception gap in the euro area. Results are more or less the same when national CPI inflation is used instead of HICP inflation. No strong econometric support is found for the hypothesis that inflation perceptions are based on a restricted sample of frequently purchased goods and services. Finally, they find some positive correlation between the scope of the gap at the current juncture and the recent developments in real house prices.

- Perceived inflation in Austria – Extent, Explanation and Effects, M. Fluch and E. Stixs, Monetary Policy and the Economy, 3rd Quarter 2005.

  Abstract: This paper examines the reasons underlying the appearance of a significant gap between actual inflation and perceived inflation by consumers in Austria since the introduction of the euro. The authors find that this difference is probably caused by the recent price evolution of goods and services frequently bought (e.g. petrol, food) and by the fact that consumers perceive price increases more strongly that price decreases. This gap seems to be reinforced by the fact that Austrian consumers still used outdated schilling reference prices when assessing prices in euro.

- Introduction of the Euro and the Divergence between Officially Measured and Perceived Inflation: The Case of Italy, P Giovane and R Sabbatini, Banca d'Italia, *paper presented at the OECD Conference, Inflation Measures: Too High – Too Low – Internationally Comparable? Paris, 21–22 June 2005.*

  Abstract: In Italy, the euro cash changeover has been accompanied by a sharp increase in the public's perceptions of inflation, although official inflation has remained relatively moderate. This research paper shows that the rise in perceived inflation can be largely explained by the stronger influence that large, upward, and frequently observed price movements exert on consumers' perceptions, together with the actual behaviour of prices in the period following the cash changeover, which saw many price changes, with larger increases for the more frequently purchased products and exceptional rises for some items. The extensive media coverage on the occasion of the cash changeover also appears to have been important.

Measures of core or underlying inflation

- An Evaluation of Core Inflation Measures, J. Armour, 2005.

  Abstract: After reviewing some conceptual and measurement issues of core inflation and discussing recent shocks to Canadian inflation, this paper provides a statistical evaluation of different core inflation measures for Canada (exclusion measures, order statistics, re-weighted measure and cutler measure) based on various criteria such as lack of bias, low variability relative to total CPI, ability to forecast actual and trend total CPI inflation. The author concludes that these core inflation measures are in general unbiased and less volatile than total CPI. However, they tend to have limited predictive ability. CPIW (every CPI component is included, but the original weights are multiplied by the inverse of the standard deviation of relative prices over a certain time period) seems to perform best on the basis of the chosen criteria.

- Assessment of Core Inflation measures for the target renewal, J. Armour, 2005.

  Abstract: This article reviews the different core inflation measures that the Central Bank of Canada has been using over time as a short-term operational guide in its formulation of monetary policy. It discusses the role of core inflation measures for monetary policy (indicator of current inflationary pressures, a gauge of the overall success of inflation targeting, communication tool). Furthermore, for each core inflation measure, the author evaluates the performance, their theoretical and statistical advantages based on different criteria (e.g. theoretical support; timeliness, unrevised, credible and easy to calculate and explain; unbiased reduced volatility relative to CPI; forecasting power; ease for control and robust to model and economic uncertainty). Based on these criteria, the author concludes that there is no perfect core inflation measure, and provides different recommendations for using core inflation in Canada.

- A Review of Core Inflation and an Evaluation of its Measures, R. Rich and C. Steindel, FRBNY Staff Report n 236, 2005.

  Abstract: The authors provide a review of the concept of core inflation and address the rationale for using core inflation as an intermediate target of monetary policy. Furthermore, they formally evaluate the performance of several proposed measures in the US on the basis of different criteria (transparency of construction, similar mean as headline inflation, ability to track the underlying trend in inflation, and to forecast future trend). The empirical analysis is carried out for two price indices, which are important for the US monetary policy: CPI and PCE and for each of them, seven candidates are examined: (i) headline excluding food and energy, (ii) excluding food, (iii) median (iv) exponentially smooth version proposed by Cogley, (v) exponentially smooth version excluding energy and food, (vi) exponentially smooth version excluding energy and (vii) exponentially smooth version of the median. The authors find that while there are number of viable candidates for core inflation, in the sense of filtering out noise in aggregate inflation and monitoring its current underlying trend, there is no individual measure that dominates others in terms of forecasting performance.

- A core Inflation Index for the Euro Area, R. Cristadoro et al., CEPR Discussion Papers n 3097, 2004.

  Abstract: This paper proposes a core inflation measure for the euro area based on a dynamic factor model, which allows for extraction of the medium- and long-run common component of inflation. The authors find that this core inflation measure provides good results in terms of forecasting inflation over horizons relevant for monetary policy and it tends to outperform other core inflation measures in this respect. It also gives a reliable picture of the price developments and it tracks past interventions of the ECB quite well.

- Core inflation: A Critical Guide, A. Mankikar and J. Paisley, Bank of England, Working Paper n 242, 2004.

  Abstract: This paper examines a range of measures of core inflation for the United Kingdom, both conceptually and empirically, setting out their motivation and highlighting their potential limitations. It distinguishes between two approaches: statistical-based (trimmed mean, exclusion-based, weighted median, persistence-weighted) and model-based (VAR). The authors find that no single measure performs well across the board, but they mention that it might be useful to follow each of them as these measures may provide a different insight into the inflation process.

- Implementing and interpreting indicators of core inflation: The case of France, H. Le Bihan and F. Sedillot, Empirical Economics, 2002.

  Abstract: This paper presents a review of different core inflation measures and the implementation thereof in the case of France. In particular, the authors focus on four measures, two based on the statistical approach and two based on the model approach: (i) inflation excluding food and energy, (ii) the trimmed inflation indicator, (iii) the Dynamic Factor Index and (iv) the structural VAR approach. They assess the performance of each estimator on the basis of different criteria: unbiasedness, volatility, theoretical foundations, usefulness for assessing short-run developments and ability to forecast. Although no indicator is fully satisfactory as all lack an explicit representation of monetary policy, each of them conveys valuable information for appraising short-term inflation developments. However, the authors tend to favour trimmed mean measures, as they are smoother and provide the best out-of-sample forecast of inflation.

- What do measures of core inflation really tell us? A. Mankikar and J. Paisley, Bank of England Quarterly Bulletin, Winter 2002.

  Abstract: This article provides clear explanations how core inflation might be useful for monetary policy makers and in particular, how a core inflation measure might help to distinguish between the relative price movements and changes in prices, which reflect the underlying inflationary pressures. Furthermore, the authors discuss the merits of various core inflation measures such as trimmed means, measures based on exclusion, re-weighted measures (e.g. Cutler), dynamic factor index, domestically generated inflation (DGI). They also provide an empirical assessment of different core inflation measures in the UK on the basis of the test proposed by Marques et al. (2000), which is based on cointegration analysis (i.e. core and headline should be cointegrated, core should be an attractor of targeted inflation,

targeted inflation should not be an attractor of core inflation). They find three measures passing the three conditions of this test: (1) RPIX excluding seasonal food and petrol, (2) RPIX excluding food, alcohol, tobacco and petrol and (3) DGI. The authors mention nevertheless that these results should be interpreted carefully, and suggest using a set of selected measures, which provide a different insight into the inflation process.

- Comparing measures of core inflation, T. Clark, FRBKC Economic Review, 2nd Quarter, 2001.

  Abstract: This article reviews the concepts underlying the idea of core inflation and five different measures in the US (CPI excluding food and energy, CPI excluding energy, the trimmed mean, the median CPI and the CPI excluding the eight most volatile components). The performance of these core inflation measures is evaluated on the basis of three criteria: the ability to track the trend inflation, to predict future overall inflation and its complexity. From this empirical analysis, the author concludes that two measures of core inflation might be viewed as superior: the trimmed mean and the CPI excluding energy.

- An Evaluation of some measures of core inflation, J. Vega and M Wynne, ECB Working Paper n 53, 2001.

  Abstract: This empirical article examines the performance of two core inflation measures: the limited-influence estimators of core inflation pioneered by Bryan and Cecchetti (1994); and the Edgeworth or variance-weighted price index discussed by Diewert (1995) and compares them to the traditional "Ex. Food & Energy"-type measures. The evaluation is based on two criteria: the ability to track movements in trend inflation and the ability to predict future headline inflation. The authors find evidence that trimmed means dominate the "Ex. Food & Energy"-type measure and the Edgeworth measure. However, these conclusions are subject to important caveats due to the short span of data on which reference can be drawn.

- Measures of underlying inflation in the euro area, ECB Monthly Bulletin, July 2001.

  Abstract: This article gives an overview of the different approaches and empirical methodologies used to measure core inflation. It states that these measures might be used as indicators for policy analysis as they summarise information on the nature and size of the shocks on headline inflation. A distinction is made between two broad categories: on the one hand, time series-based measures attempt to discriminate between persistent and transitory components of development in the headline index (e.g. smoothing techniques, dynamic factor model and vector autoregressions). On the other hand, cross-section-based measures attempt to differentiate the common component from relative price component. The former reflects monetary developments, while the latter reflects events that affect particular markets (e.g. exclusion-based measures, variability adjusted measures and trimmed means). This article also presents a brief illustration based on the HICP for the euro area.

- The use of a Robust Estimator as measures of Core Inflation, L. Aucremanne, National Bank of Belgium WP n 2, 2000.

  Abstract: This research paper examines various robust estimators of core inflation for Belgian CPI data and for the euro area HICP such as trimmed means (where the optimal trimming percentage is the lowest percentage for which the normality hypothesis is rejected) and Huber-type skipped mean. The author finds evidence of fat-tails in the cross section of price changes. The performance of these robust estimators was determined on the basis of two criteria: unbiasedness and volatility reduction. From this analysis, the author shows that robust estimators tend to outperform traditional core inflation measures such as headline CPI excluding energy and food. However, all core inflation measures – robust or not – tend to lag headline inflation, rather than to lead.

- Measuring core inflation in the euro area, C. Morana, ECB Working Paper n 36, 2000.

  Abstract: After having investigated the statistical properties of HICP and M3 in the euro area, this technical paper proposes a measure of core inflation to derive a persistent-non persistent decomposition of the inflation process in the euro area and which takes into account the information contained in money growth. The proposed measure is based on a Markov switching ARFIMA model, which generalizes the standard ARFIMA allowing for mean reversion. Although this model-based measure might not necessarily be superior to other traditional core inflation measures (e.g. HICP excluding energy and food) in terms of bias and volatility, it tends to outperform these measures in terms of forecasting ability.

- Core inflation and Monetary Policy, M. Nessen and U. Solderstrom, Sveriges Riskbank, 2000.

  Abstract: This research paper presents a framework for analysing the choice of the price index to target in an inflation-targeting regime. This model allows comparing the effect of having different measures of inflation in the central bank's objective function. Using this model, the authors examine the optimal monetary policy under three different regimes: Core inflation targeting (i.e. determined by the level of real activity), CPIX inflation targeting and CPI inflation targeting. The main findings are: (i) purely temporary shocks do not affect optimal monetary policy under any regime; (ii) second round effects of shocks need to be accounted for properly; (iii) it might be optimal to respond to changes in one measure of inflation even if the target is defined in terms of another.

- A Parametric Approach for Estimating Core Inflation and Interpreting the Inflation Process, M. Apel and P. Jansson, Sveriges Riksbank, 1999.

  Abstract: The paper presents a new parametric approach for measuring core inflation and analysing the inflation process. In a macroeconomic model, inflation (Philips type inflation equation) depends on three basic factors: long-run inflation, demand, and a set of special factors including proxies for supply shocks. Based on this model, the authors can generate estimates of core inflation that are economically interpretable and statically well defined.

- Core inflation: A Measure for Inflation for policy purposes, M. Johnson, BIS, 1999.

  Abstract: This paper introduces the notion of core inflation and its potential policy purposes (e.g. indicator of current and future trends in inflation, good measure of inflation for empirical work and viable target for monetary policy). It discusses two broad approaches to measure core inflation: (1) statistical approach, which focuses on exploiting the properties of the data (time series or cross-section) and (2) modelling approach, which draws on a conceptual notion of core inflation (e.g. VAR). In this context, the author presents the core inflation measures regularly monitored by the central bank of Canada in the conduct of monetary policy (CPIxFET, Meantsd, CPIX, CPIW and Wmedian) and offers an evaluation of these measures. From this analysis, the author finds that different measures do well along different dimensions and concludes therefore that it might be useful to monitor a selected set of measures.

- Core inflation: A review of some conceptual issues, M. Wynne, ECB Working Paper n 5, 1999.

  Abstract: This paper reviews different approaches to the measurement of core inflation (e.g. exclusion measures, moving average, trimmed mean, variance weighted index, dynamic factor index and VAR measures), and provides the competing merits of the various methods. The different problems associated with core inflation measurements are also discussed. Furthermore, the author proposes 5 criteria that the ECB could use to choose among the different core inflation measures: (i) core inflation should be computable in real time and should track the trend inflation rate, (ii) it should be forward looking, (iii) it should have some track of record and (iv) it should be understood by the public (v) it should have some theoretical basis.

- Inflation Measures for Monetary Policy: Measuring Underlying Inflation Trend and Its Implication for Monetary Policy Implication, S. Shiratsuka, IMES Discussion Paper Series n 97, 1997.

  Abstract: This paper examines the definition of price stability from a monetary policy perspective. It discusses the use of limited influence estimators (LIE), also called robust estimators, as measures of core inflation. The author pays special attention to the assessment of the performance of trimmed means, which are calculated by excluding the effects of items located at both ends of the cross-sectional distribution of individual price changes. He concludes that the use of seasonally adjusted month-to-month changes of LIE, in combination with other indexes, might be relevant for the conduct of monetary policy, since it allows the capturing of the level and the direction of the underlying inflation trend.

Other related papers

- Global Inflation, M. Ciccarelli and B. Mojon, ECB working paper series n 537, 2005.

  Abstract: This paper shows that inflation in industrialised countries is largely determined by global factors. First, the authors show, based on a factor analysis, that a simple average of

inflation rates of 22 OECD countries have a common factor that alone account for nearly 70 per cent of their variance. Secondly, global inflation might be described as a function of real developments at short horizons and monetary developments at longer horizons. Third, they find that global inflation is an attractor of national inflation based on an error correction mechanism. This model consistently beats the previous benchmarks used to forecast inflation 1 to 8 quarters ahead across samples and countries. They suggest that these results designate their Global Inflation model as a potential new standard for forecasting inflation in OECD countries.

- Evolving Inflation Process, BIS Working Party on Monetary Policy, 2005.

  Abstract: This note provides a broad overview of the research papers on inflation carried out the recent years. It deals especially with the change in the univariate inflation process over time, showing a general decline in the mean of inflation around the world and evidence of a decrease in the persistence of inflation in some industrialised countries. It also provides tentative explanations for this evolution, i.e. moderate wage behaviour coupled with increase in productivity, reduction in the pass-through of exchange rate changes and energy prices, and a decline in inflation expectations.

Inflation in countries with explicit inflation targets

Annual percentage changes; monthly data unless otherwise indicated

Australia[4]
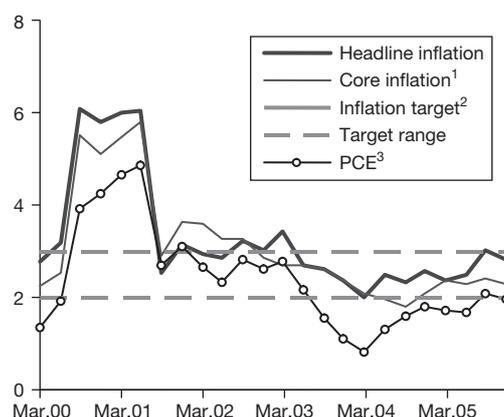
	Average[*]	Standard[*] deviation
Headline inflation	3.3	1.3
Core inflation	3.5	1.2
PCE	2.8	1.1

[*] *2000–2005*

1   *In Brazil, Korea, Indonesia, Mexico, Poland, core inflation is defined as CPI excluding food and energy. In Canada, CPI excluding the 8 most volatile components and indirect taxes. In Sweden, CPI excluding household mortgage interest expenditure and direct effects of altered indirect taxes and subsidies (UND1X). In South Africa, core is defined as CPI excluding, food, interest rates on mortgage bonds, and overdrafts/personal loans, changes in VAT and assessments rates (taxes determined by the local government). In UK, core inflation is defined as CPI excluding energy and unprocessed food.*
2   *Headline CPI is targeted by Australia, Brazil, Canada, Indonesia, Mexico, Poland, Sweden and UK. In Korea, the central bank targets core inflation defined as headline inflation excluding energy and food (except grains). In South Africa, CPIX (CPI excluding interest rates on mortgage bonds) is targeted. In Thailand, the central bank targets core inflation defined as headline inflation excluding raw food and energy prices.*
3   *Personal consumption expenditures; Quarterly data.*
4   *Quarterly data.*

Source: National Statistic Institutes, National Central Banks.

Brazil
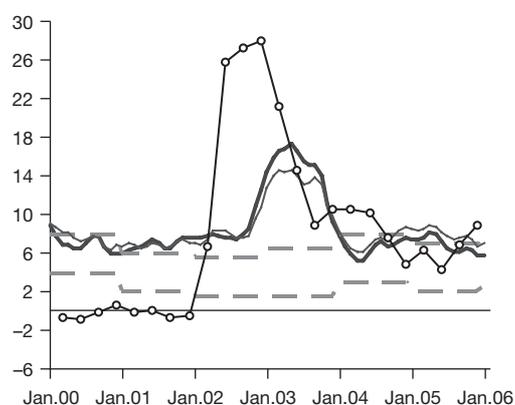
	Average[*]	Standard[*] deviation
Headline inflation	8.5	3.2
Core inflation	8.6	2.3
PCE	8.6	3.6

[*] *2000–2005*

Canada
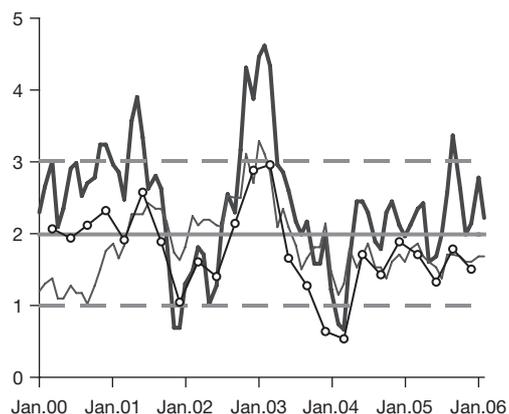
	Average*	Standard* deviation
Headline inflation	2.4	0.9
Core inflation	1.9	0.5
PCE	1.8	0.6

* *2000–2005*

Indonesia
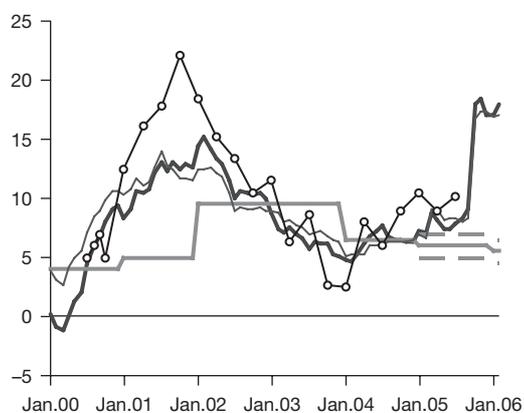
	Average*	Standard* deviation
Headline inflation		4.0
Core inflation	8.9	3.1
PCE	12.9	5.2

* *2000–2005*
** *2001.1–2005.*

Korea
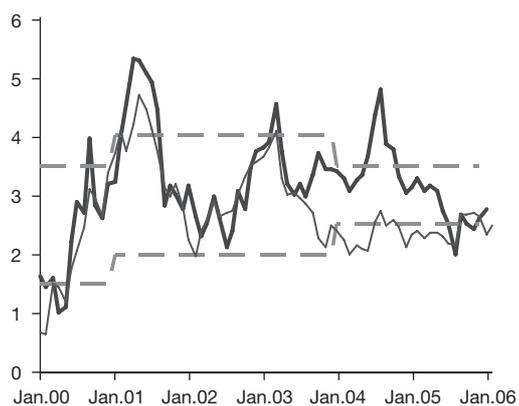
	Average*	Standard* deviation
Headline inflation	3.2	0.9
Core inflation	2.8	0.8
PCE		

* *2000–2005*

Mexico
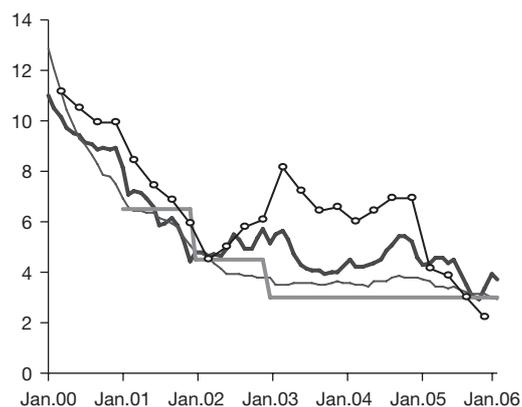
	Average*	Standard* deviation
Headline inflation	5.7	2.0
Core inflation	5.1	2.3
PCE	6.7	2.3

* *2000–2005*

Poland
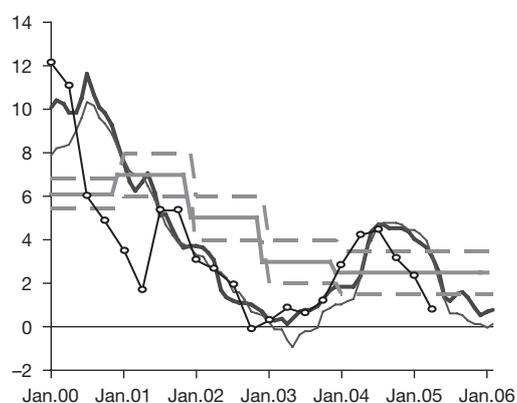
	Average*	Standard* deviation
Headline inflation	4.0	3.3
Core inflation	3.6	3.2
PCE	3.8	3.1

* *2000–2005*

Thailand
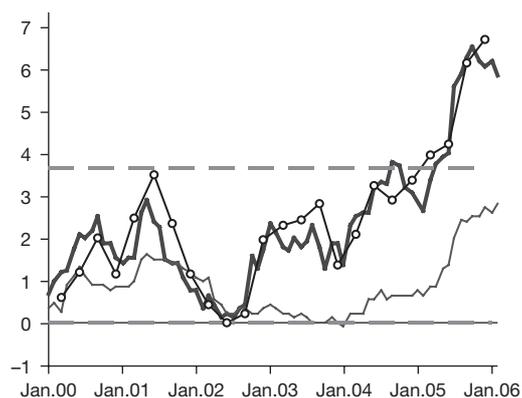
	Average*	Standard* deviation
Headline inflation	2.7	1.6
Core inflation	0.8	0.6
PCE	2.2	1.6

* *2000–2005*

South Africa
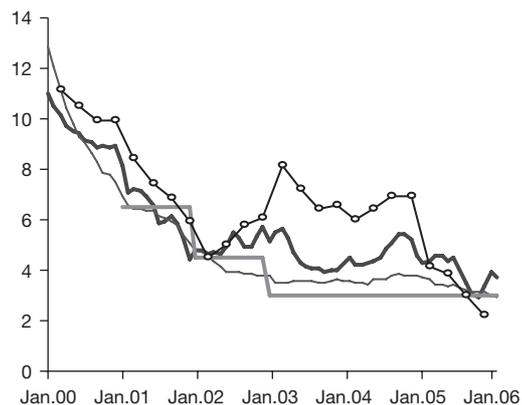
	Average*	Standard* deviation
Headline inflation	4.0	3.3
Core inflation	6.6	1.9
PCE	6.7	2.3

* *2000–2005*

Sweden
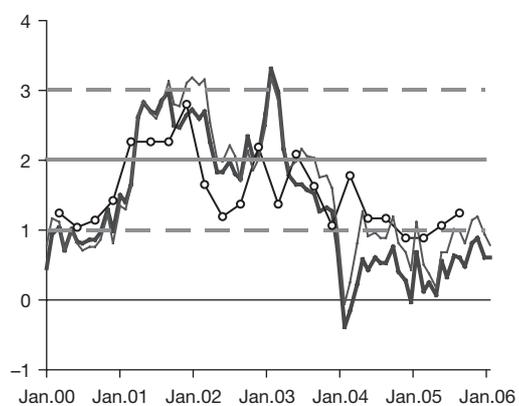
	Average*	Standard* deviation
Headline inflation	1.4	0.9
Core inflation	1.8	0.9
PCE	1.7	0.5

* *2000–2005*

The United Kingdom
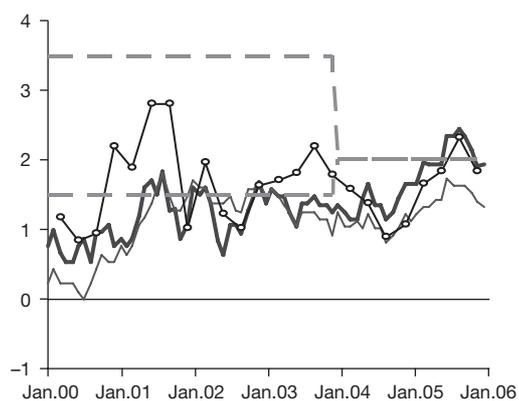
	Average*	Standard* deviation
Headline inflation	1.3	0.5
Core inflation	1.1	0.4
PCE	1.8	0.6

* *2000–2005*

Inflation measures in other countries

Annual percentage changes; monthly data unless otherwise indicated

Argentina
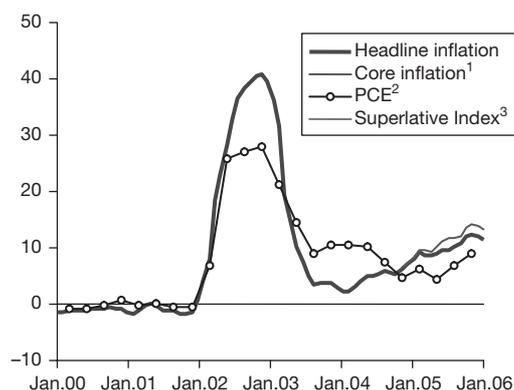
	Average*	Standard* deviation
Headline inflation	8.9	12.5
Core inflation	7.1	2.3
PCE	6.8	9.1

* *2000–2005*
** *2004–2005*

1 *In Argentina, CPI excluding products with high volatile and/or seasonal components and goods and services with a high tax rate or these with administered prices. In Japan, CPI excluding fresh food. In Switzerland, CPI excluding food, beverages, tobacco, seasonal items and energy. In the US, CPI excluding food and energy.*
2 *Personal consumption expenditure deflator, Quarterly data. Except for Singapore and India, annual data and for the US, monthly seasonally adjusted data (Chained-type PCE). For Russia, total consumption deflator.*
3 *Superlative index refers here to the CPI constructed with a Tornqvist formula, i.e. a geometric mean of a geometric Laspeyres and geometric Paasche Indices.*

Source: National Statistic Institutes.

China
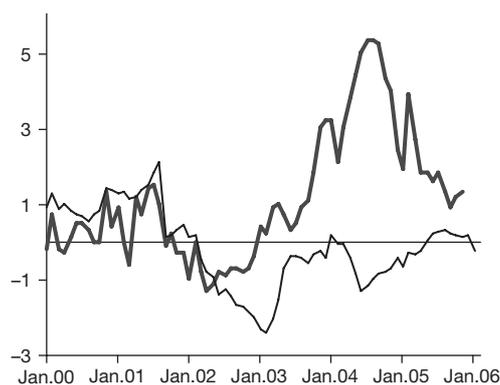
	Average*	Standard* deviation
Headline inflation	1.1	1.7
Core inflation	−0.1	1.0
PCE		

* *2000–2005*

Hong Kong SAR
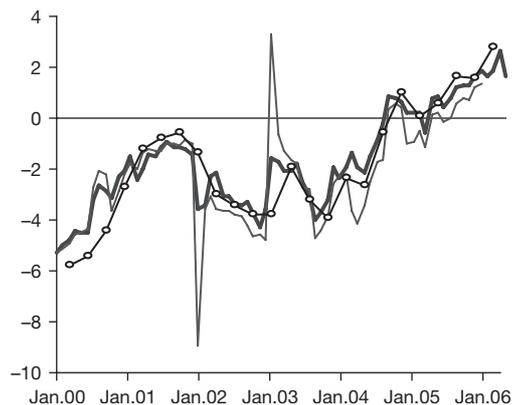
	Average*	Standard* deviation
Headline inflation	−1.7	1.9
Core inflation **	−2.1	2.0
PCE	−1.9	2.0

*_2000–2005_

India
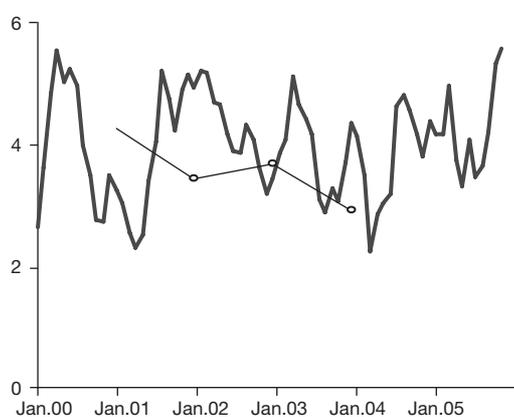
	Average*	Standard* deviation
Headline inflation	4.0	0.9
Core inflation	–	–
PCE**	3.6	0.6

*_2000–2005_
**_2001–2003_

Japan
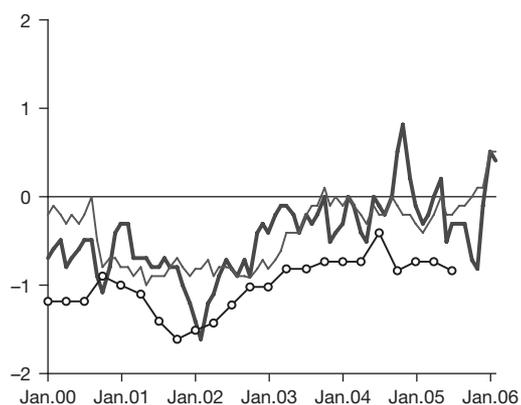
	Average*	Standard* deviation
Headline inflation	−0.5	0.4
Core inflation	−0.4	0.3
PCE	−1.1	0.3

*_2000–2005_

Russia

	Average*	Standard* deviation
Headline inflation	16.0	4.4
Core inflation	12.7	6.0
PCE**	19.7	4.5

* *2000–2005*
** *2001–2004*

Saudi Arabia
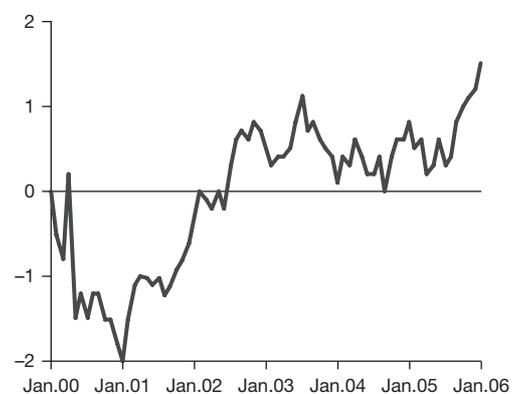
	Average*	Standard* deviation
Headline inflation	0.0	0.8
Core inflation		
PCE		

* *2000–2005*

Singapore
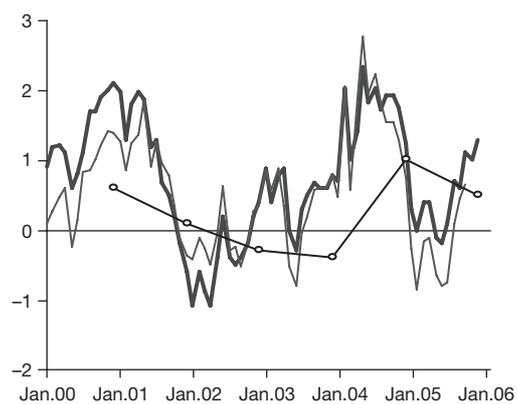
	Average*	Standard* deviation
Headline inflation	0.8	0.9
Core inflation	0.5	0.8
PCE	0.3	0.6

* *2000–2005*

Switzerland
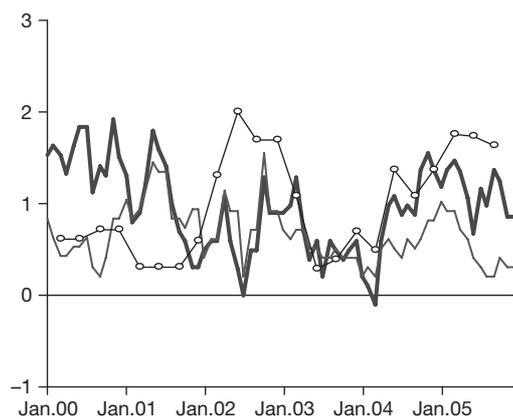
	Average*	Standard* deviation
Headline inflation	1.0	0.5
Core inflation	0.7	0.3
PCE	1.0	0.6

* *2000–2005*

The United States
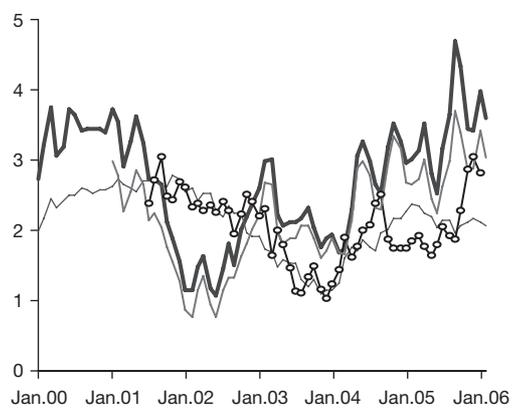
	Average*	Standard* deviation
Headline inflation	2.7	0.8
Core inflation	2.4	0.5
PCE	2.1	0.5
Superlative Index (C-CPI-U)**	2.2	0.7

* *2000–2005*
** *2001–2005*

Inflation in the Euro Area

**Annual percentage changes; monthly data unless otherwise indicated**

Euro Area
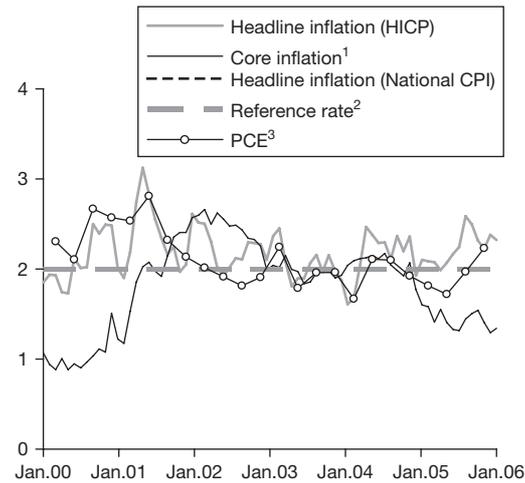
	Average[*]	Standard[*] deviation
HICP	2.2	0.3
Core inflation (HICP)	1.8	0.5
National CPI	–	–
PCE	2.2	0.3

[*] *2000–2005*

1 *HICP excluding unprocessed food and energy.*
2 *Upwards limit in the quantitative definition of price stability.*
3 *Personal Consumption expenditure, Quarterly data.*

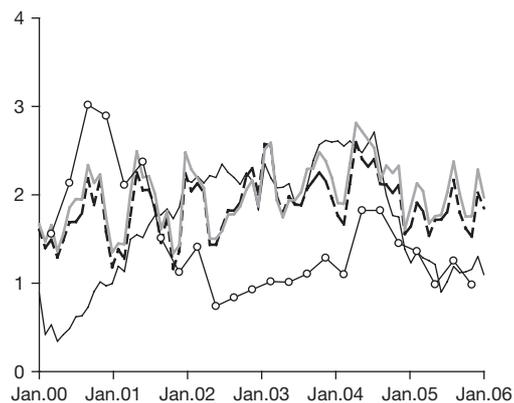*Sources: EC, National Statistic Institutes.*

Belgium
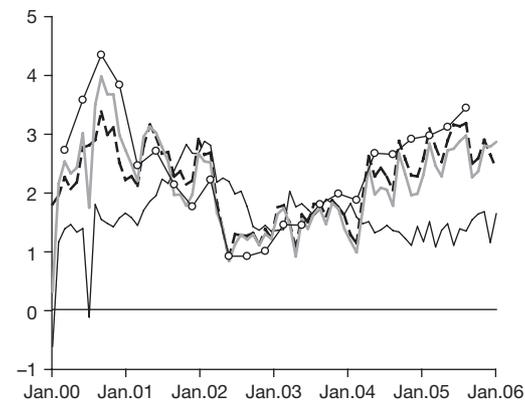
	Average[*]	Standard[*] deviation
HICP	2.1	0.7
Core inflation (HICP)	1.6	0.5
National CPI	2.2	0.6
PCE	2.3	0.9

[*] *2000–2005*

France

	Average*	Standard* deviation
HICP	2.0	0.4
Core inflation (HICP)	1.7	0.7
National CPI	1.9	0.3
PCE	1.5	0.6

* *2000–2005*

Germany
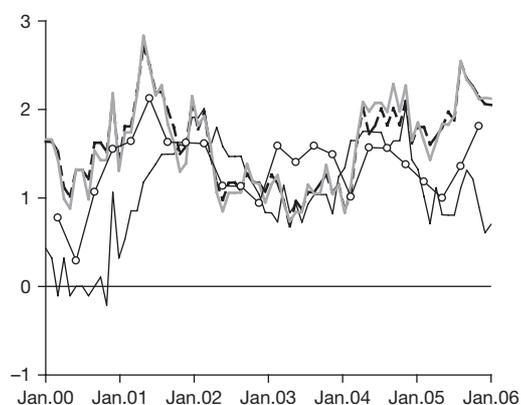
	Average*	Standard* deviation
HICP	1.6	0.5
Core inflation (HICP)	1.6	0.6
National CPI	1.6	0.5
PCE	1.4	0.4

* *2000–2005*

Italy
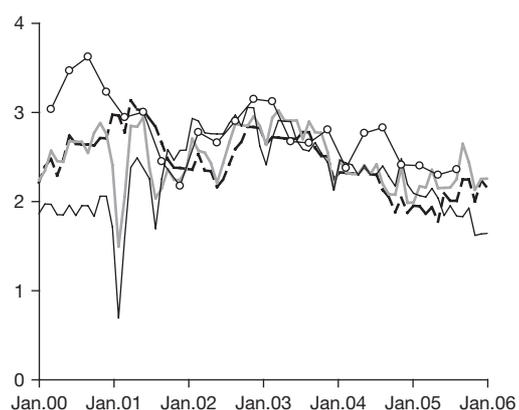
	Average*	Standard* deviation
HICP	2.5	0.3
Core inflation (HICP)	2.3	0.4
National CPI	2.5	0.3
PCE	2.7	0.4

* *2000–2005*

The Netherlans
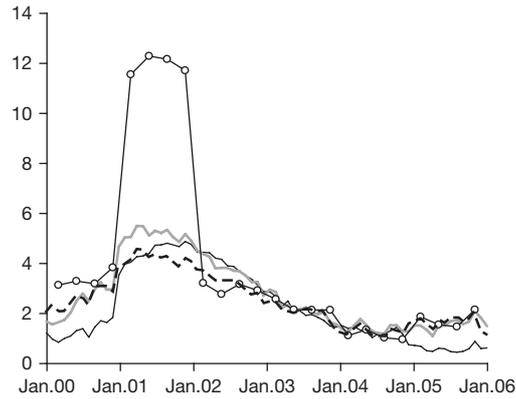
	Average*	Standard* deviation
HICP	2.8	1.4
Core inflation (HICP)	2.3	1.5
National CPI	2.5	1.0
PCE	5.7	3.8

* 2000–2005

Portugal
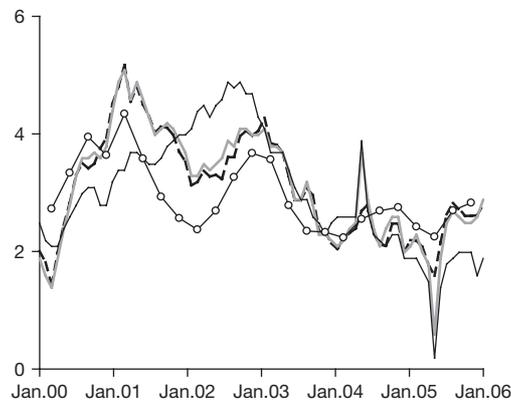
	Average*	Standard* deviation
HICP	3.2	0.9
Core inflation (HICP)	3.1	1.0
National CPI	3.1	0.9
PCE	3.1	0.6

* 2000–2005

Spain
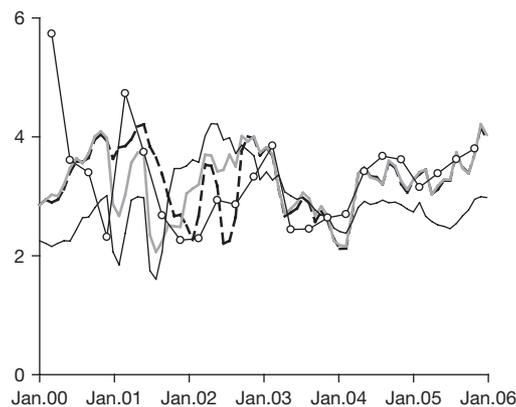
	Average*	Standard* deviation
HICP	3.3	0.5
Core inflation (HICP)	2.9	0.6
National CPI	3.3	0.5
PCE	3.3	0.8

* 2000–2005

The basic statistical returns system – a mirror to the trends in Indian banking

Pardeep Maria and Praggya Das (Reserve Bank of India)

1. Introduction

The Reserve Bank of India (RBI), the Central Bank of the country, has a Basic Statistical Returns (BSR) System for collecting statistics, relating to banking business from its commercial banks. The system has been in existence for more than three decades. The BSR System is a non-statutory system, which was initiated following recommendations of Committee on Banking Statistics constituted by RBI in April 1972.

The RBI compiles data on several aspects as per its statutory requirement. This includes data on the liabilities and assets of Reserve Bank, the business of scheduled commercial banks in India, money stock measures, etc. The stock data for RBI is available on weekly basis and for commercial banks on a fortnightly basis. Some of this data is supplied to the International Monetary Fund and disseminated under the Special Data Dissemination Standards.

The data collected by RBI, as its statutory obligation for providing general and health status of the banking industry to the public and the government, has limitations in its scope and coverage as it presents only broad information at macro level. It does not contain information on important parameters like the rate of interest, maturity pattern of deposits, the size of deposits and credit, the organisation and occupation of the borrower, gender-wise break-up of deposits and credit, details on migration of credit, etc. Data on credit migration assumes significance in a developing country as information collected only on sanctions of credit, through the statutory returns, gives a lop sided picture. The potential of an area to absorb credit comes out only by gaining knowledge on utilisation of credit in the area. This also answers many of the queries raised in a federal polity like India.

With a view to overcome these limitations, the Committee, set up in 1972, designed the BSR reporting system for collecting up-to-date, detailed and reliable statistics from a fast growing network of branches. The main purpose of BSR system has been to provide information at disaggregated level pertaining to commercial banks about their operations on deposits, credit and investment, which are not otherwise obtained from banks as part of regulatory measures. Among others, the Planning Commission, for giving directions to the Indian economy, used detailed data generated through the BSR system, in earlier years. These days, market analysts utilise this information to assess the development, consumption and market potentials of a region and to rank the states and districts. The data are also used for preparing male and female development indicators. The information on contractual and residual maturity patterns of deposits helps the banks in asset-liability management. Industry wise assessment of credit and the associated risk can also be obtained from the BSR system.

With passage of time, a number of revisions have been made in the BSR system to keep it abreast with changes occurring in the banking system. A Committee of Directions in Banking Statistics (CDBS) has been in existence, since inception, to suggest changes in the BSR System. The members of CDBS are representatives from the data providers (the commercial banks) and the data users. Latest revisions carried out in the BSR System were in the year 2002 when, as suggested by the National Statistical Commission, CDBS decided to align the uniform coding system for occupation/activity classification of credit with National Industrial Classification (which follows the International Standard Industrial Classification). CDBS also decided to collect information on residual maturity pattern of term deposits from March 2003. Presently this collection is restricted to computerized branches of scheduled banks excluding Regional Rural Banks (RRBs) as only they can provide this information accurately and with ease.

Through such revisions, over the years, existing returns in the BSR System are modified and new returns introduced. Presently, there are 7 returns in the BSR system, numbered, BSR1 to BSR7. A brief description of contents and periodicity of these returns is provided in the Annexure. The BSR1 and BSR2 returns are broadest in terms of scope and coverage. Detailed account wise data on deposits and credit are collected through these returns; therefore, in the remaining part of this paper, we would focus on these two returns only. The data compiled through these returns is brought out in the form of a publication and is also available on the web site of Reserve Bank of India (www.rbi.org.in).

This paper is organised into seven sections. In section 2, the details on contents of BSR1 and BSR2 are described. The next section takes a look at the network of commercial banks in India. Section 4 describes the trends in deposits that emerge from the BSR2 data according to different population groups, bank groups, types of account, maturity periods and interest rate brackets. In section 5, the employment position in commercial banks is depicted. The trends in credit according to different population groups, bank groups, organisations and occupation/activities of borrower, types of borrowal account and size brackets of credit limit, are laid down in section 6. Section 7 presents overall trends in rate of interest on credit and its trends according to occupation and organisation of borrowers and as per the account-type. The trends in different sections have been studied for 1973, 1983, 1993, 2003 and the latest status as on 2004. Finally section 8 summarises the paper.

2. The contents of BSR1 and BSR2 data

BSR1: This return relates to gross bank credit and comprises term loans, cash credit, overdrafts, bills purchased and discounted, bills rediscounted and also dues from banks. Money at call and short notice is not included in this return.

The BSR1 return is collected in two parts – BSR1A and BSR1B. The credit exceeding Rs.200,000/- is individually classified and reported in BSR1A, while the credit of Rs.200,000/- or less is clubbed according to activity/occupation of borrower and classified in BSR1B. In the BSR1A return, details on the following items are collected for each credit account.

- *Place of utilisation of credit*: This is the place where credit is actually utilised and could be different from the place where the sanctioning branch is located. The district and population group code are reported for the place of utilisation of credit. Information given in these columns is used for ascertaining the state, district and population-group where the credit flows. The population group, according to which a centre is classified as rural, semi-urban, urban or metropolitan, is given in the Annexure.
- *Type of account*: The type of borrowing facility extended to borrower is reported here. In case a borrower is given several types of facility, each facility is reported separately. The broad types of accounts (facilities) are – cash credit, overdraft, demand loan, loans through credit card, term loan, packing credit (pre-shipment finance under any type of facility, i.e., cash credit, overdraft and demand loans are classified as packing credit) and bills purchased/discounted/advanced against (export and inland bills are treated separately).
- *Type of organisation*: The borrower is classified based on the institutional/ organisational set up it belongs to. The organisations are Public Sector; Cooperative Sector; Private Sector – Corporate and Others; Individuals – Male/Female (Singly or jointly); Joint Sector; and Foreign Government & foreign banks having no branches in India.
- *Type of activity/occupation*: The occupation code appropriate to occupation or activity of the borrowers for each account is reported under this head. In case of consumption or personal loans, such as housing loan or education loan, occupation code is given for the purpose for which credit is extended and not on the basis of activity of borrower. The codes for activity/occupation of borrower have been designed in accordance with National Industrial Classification.
- *Nature of borrowal account*: The nature of borrowal account for each individual loan account classifies it into Artisans/Craftsman, Village/Cottage Industry, Tiny Industry; Other Small Scale Industry; and all Others.
- *Asset classification of borrowal account*: Information on assets classification of each account with credit limit over Rs.200,000 is recorded in BSR1A. In BSR1B, consolidated asset classification of all accounts less than Rs.200,000 is recorded. Assets are classified as Standard, Sub-standard, Doubtful or Loss Asset in accordance with guidelines prescribed by the RBI (Prudential norms on Income Recognition, Asset Classification and Provisioning pertaining to Advances).

- *Rate of interest*: The rate of interest charged by banks is reported for each account above Rs.200,000. Where slab rates are charged on advances, the rate corresponding to the largest portion of Advances is recorded. In case of Bill purchased or discounted, this information is not required to be reported. In case of sub-standard, doubtful or loss asset, the rate of interest last applied is to be reported.
- *Credit limit*: The credit limit in force as on date of return is reported against this item. In case of term loans, operative limit (credit limit minus principal repaid/due) is reported. Where no specific credit limit is sanctioned, amount outstanding is treated as the credit limit. In case of consortium lending, branches report net credit limit allocated to them.
- *Amount outstanding*: The actual amount outstanding in each account as at close of business on the date of reporting, rounded off to nearest thousand of rupees is reported as the amount outstanding.

BSR2: The BSR 2 return contains information on employment and deposits. A separate return is furnished by each branch/office. Administrative Offices including Head and Regional Offices, which do not transact banking business with public, supply information on their staff position as well as on any deposits, which they may hold.

Employment details: Banks report details of all permanent and temporary full-time staff on rolls of branch/office in three categories – Officers, Clerks and Subordinates. The reporting relates to actual working strength of the branch and excludes part-time or casual employees. Category-wise number of female employees is also reported separately.

Deposits' details: Classification of deposits is recorded in five parts. In all the parts, information on deposits is collected under two broad ownership categories, viz., Individuals and Others. Interest accrued and payable on these deposits is treated as "Other liabilities" and are not included in this part of the return.

- Part I: This part of BSR2 is divided into two blocks. Information on type of deposits is reported in the first block. The deposits are classified according to type as – Current deposits; Savings deposits; or Term deposits. The additional information on female accounts for each type of account is also collected in this block. The second block contains information on inter-bank deposits.
- Part-II: Classification of Term Deposits according to Maturity: This part of return obtains information on outstanding amount of term deposits, classified according to *original period of maturity* for which deposits have been placed with the branch by depositors.
- Part-III: Classification of Term Deposits according to Interest Rate Range: This part of return obtains information on distribution of term deposits according to *broad interest rate ranges*.
- Part-IV: Classification of Term Deposits according to Size: The information on outstanding amount of term deposits as on the date of return, classified according to *size of deposits* is collected in this part of the return.
- Part V: Classification of term deposits according to residual period of maturity: This information is presently called from only the computerised branches of commercial banks other than the Regional Rural Banks.

3. The network of commercial banks in India

Before talking about the enormity of BSR1 and 2 data, it will not be out of place to have a look at the population of bank branches that these returns relate to. India has a vast commercial banking network with 286 scheduled commercial banks operating through their 68,645 bank offices (the position is as on March 2004). These banks had a total business (deposits + credit) of Rs.23,916 billion through 457 million deposit and 66 million credit accounts in that year. The 286 banks belonged to the categories of State-owned banks (State Bank of India & Associates (8) and nationalised banks (19)); district level Regional Rural Banks (196); private sector banks (30); and foreign banks (33). Over the last 33 years, the BSR system has provided a consistent reporting of detailed banking data of the bank network that has attained such a magnitude, growing through various phases of branch expansion as presented below.

Branch expansion: The first decade since 1973 saw rapid branch expansion. The growth was most rapid in case of Nationalised banks where in a course of two decades, the number of branches increased four folds from about 8000 to about 31,000. To take the banking to the rural masses, a new group of district level Regional Rural Banks (RRBs) were promoted from the year 1975 onwards and this bank group expanded its branch network rapidly in the earlier years of its presence. The following graph shows that the number of RRBs more than doubled from about 6800 in 1983 to about 14,700 in 1993.

Bank group wise branch growth
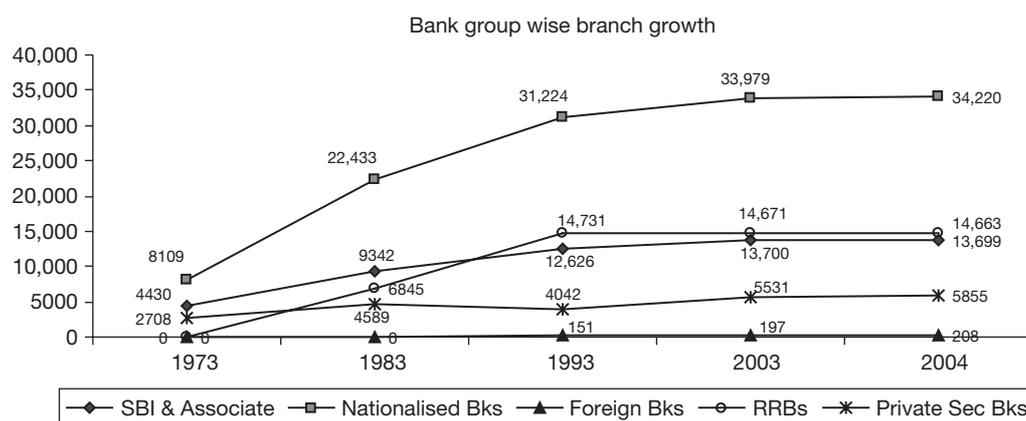
The number of overall bank branches rose sharply from 15,362 in 1973 to 42,079 in 1983 and further to 61,169 in 1993. In the year 1973 only about 36 per cent of branches were located in rural areas. With the Government policy of taking banking to the masses, and as preponderance of population was in these areas, their share of branches in these areas soared rapidly to reach 58 per cent by 1993. The decade since 1993 has actually seen shrinkage of bank branches in rural India. During this period, there was closure of some branches in rural areas, which were non-profit centres for banks. But the primary cause of decline in the bank branches in rural areas was that, over various decadal population censuses, several areas got classified upward to higher population brackets. The last decade saw a concentration of branch expansion in the urban and metropolitan area. Apart from new centres coming into this category on account of population increase, the newly setup private sector banks emerged in these areas and over a few years expanded their presence mainly in these areas.

Number of branches according to population group

|	1973	1983	1993	2003	2004
Rural	5561	22,686	35,389	32,283	32,107
Semi-Urban	4751	9081	11,465	15,042	15,252
Urban	2764	5917	8562	11,423	11,703
Metropolitan	2286	4395	5753	9330	9583
Total	15,362	42,079	61,169	68,078	68,645

4. Trends in deposits

The trends in deposits of commercial banks as compiled through data reported in BSR2 returns over years are presented in this section. The deposit-trends are presented according to population group, bank group, type of deposits, period of maturity of term deposits and rate of interest on term deposits.

A. *Population group wise pattern of deposits*: The graph below shows that rural credit grew at a rapid rate from 1973 to 1983, which corresponded to the mass expansion of rural branches. In the two subsequent decades the growth of deposits in metro centres surpassed the growth in other areas, sharpening further in the latest year.

Population group wise distribution of deposits   (*Rs. in Million*)
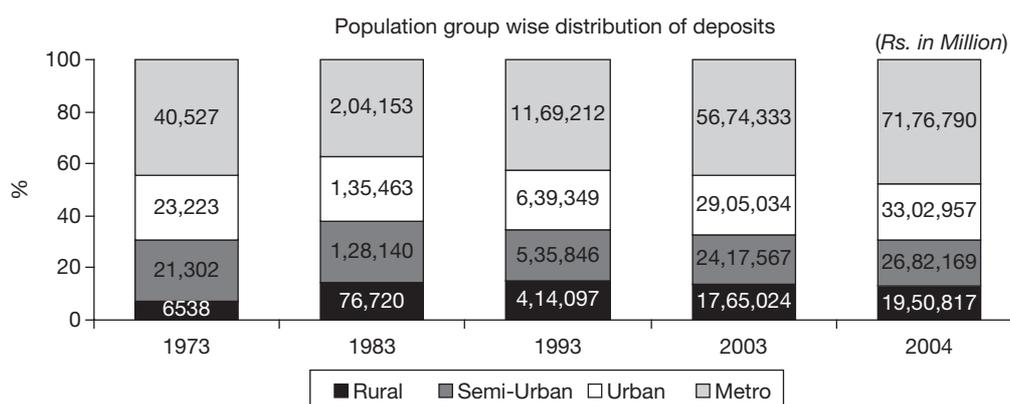
B. *Bank group wise pattern of deposits*: A decline in the share of private sector banks from 1973 to 1983 has emerged from the BSR data. This decline was due to nationalisation of six private sector banks and merger of several other private sector banks with the nationalised banks during this period. The share of private sector banks rose sharply from 5 per cent in 1993 to 18 per cent in 2004 as in this period, consequent to liberalisation, several new private sector banks were set up. These new private sector banks bit into the share of deposits of public sector banks (i.e. SBI & Associates and nationalised banks) as well as that of foreign banks.


Bank group wise distribution of deposits (Rs. In Million)
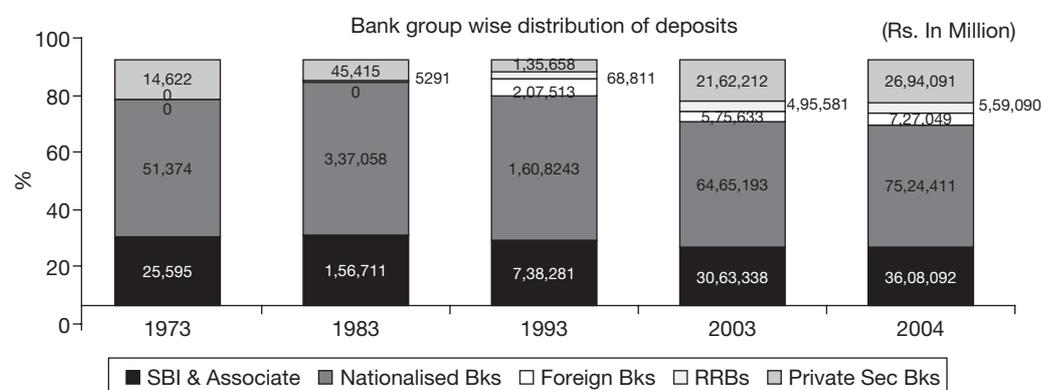
C. *Pattern of deposits by type of account*: The data shows a steady growth in the share of term deposits. The term deposits rose from a little above 50 per cent in 1973 to a little less than 65 per cent in 2003. In 2003 the share of savings deposits was about 28 per cent and 10 per cent of the deposits were current deposits (which are kept for business purposes); as against 22 per cent and 26 per cent respectively in 1973. Though in the short term from 2003 to 2004 there has been an increase in the share of savings and current deposits, over the long time band, there was a decline in the share of current deposits and rise in the share of term deposits. This indicated that the banks were becoming true facilitators to the savers during this period and branch expansion was in the regions from where savings of household could be tapped even though the regions had less commercial activities. This also points to the fact that there is an improvement in clearing house facilities, so the business enterprises are not required to maintain large balances in their current accounts. Maria and Das (2004) observed a relationship between the proportion of current accounts in a region and the degree of economic activity in that region.


Distribution of deposit by type of account (Rs. in Million)
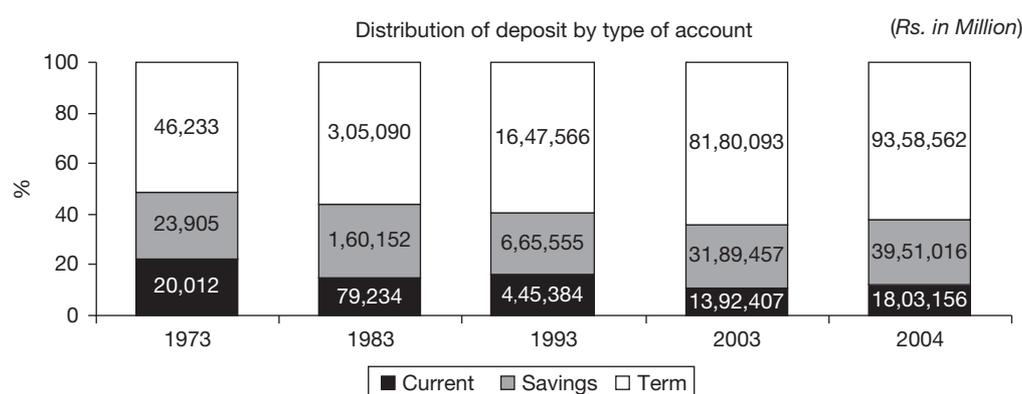
D. *The distribution of term deposits according to period of maturity*: The graph below shows the period of maturity wise distribution of term deposits. The distribution is shown for the period 1993 onwards since this information was not collected through the BSR2 returns earlier. The period of maturity of term deposits is presented for the ownership category of deposits, viz., Individuals and Others. It is observed that the Individuals have a preference for keeping larger proportion of their funds for longer maturity period as compared to Others. Individuals used these facilities as a platform for savings, whereas Others, mainly comprising of commercial

entities, parked their funds for short duration. With the reduction in interest rate differential between short and long term deposits, the advantage for Individuals to keep their deposits for long term peters out from 1993 to 2004. Therefore, the deposits of Individuals with maturity of one year or more declined from about 80 per cent in 1993 to about 70 per cent in 2004.
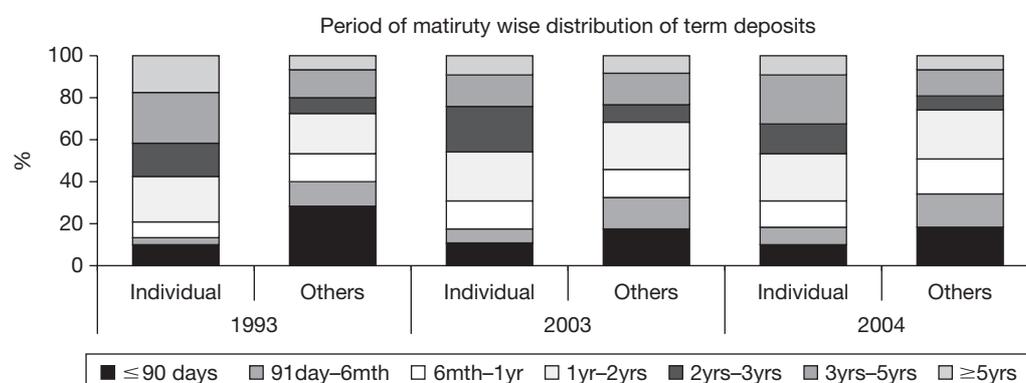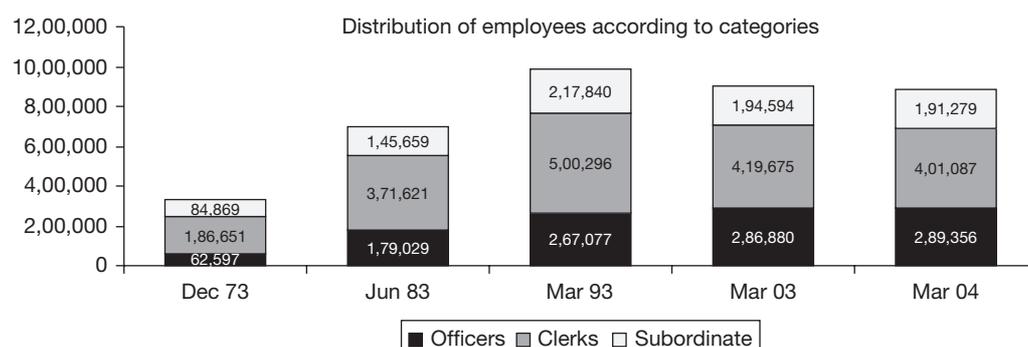
Period of matiruty wise distribution of term deposits

E. *Rate of interest wise distribution of term deposits*: The distribution of term deposits according to various interest-rate brackets was introduced in the BSR system from 1996. The data below is therefore shown for 1996 onwards. The graph shows declining interest rate scenario. In 1996 only a little over 30 per cent of term deposits were kept with the banks at the rate of interest of 11 per cent and below, while in 2004 about 95 per cent of such deposits were held with the banks. In fact nearly three fourths of deposits bear interest of less than 8 per cent in 2004 (in which, 46 per cent was for "less than 6 per cent") as against merely one-tenth of such deposits in 1996. The interest rates had been declining sharply in recent years, and were in the range of 4 to 5.5 per cent in 2004, but due to the earlier commitments, one-tenth of the banks" funds still belonged to high interest of 10 per cent and more.

Rate of interest wise distribution of term deposit
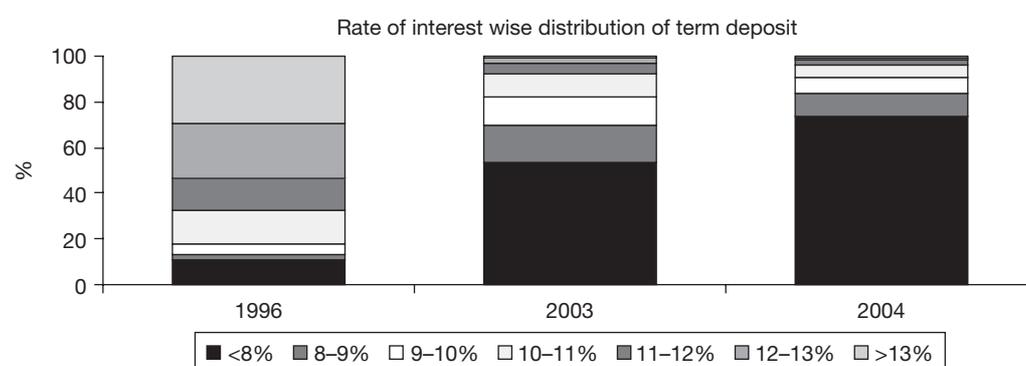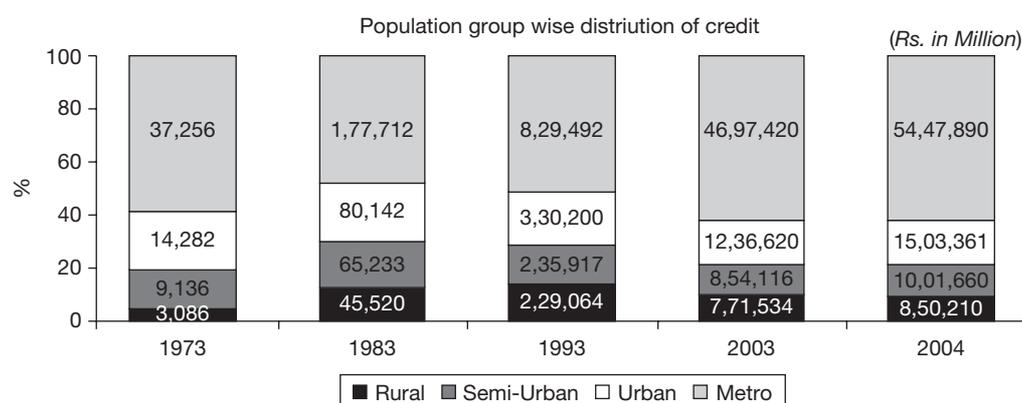

5. Trends in employment in banks

There was a steady growth in the number of bank employees from 1973 to March 1993 when the number of employees grew three-folds from three hundred thousand to about one million corresponding to the growth in number of branches. In the last one-decade the bank employees reduced to less than nine hundred thousand in spite of 11–12 per cent increase in bank network. The category-wise break up shows that this decline was in the subordinate and clerical staff, while the number of officers grew steadily. In this decade, the new private sector banks that came up were technologically savvy, had relatively flat organisational structure and recruited less employees at clerical/subordinate level. Even the older banks resorted to Information-Technology use and could reduce their staff strength especially at clerical level. It is interesting to note that per branch employees in 1973 were 22, which reduced to 16 in 1993 and further to 13 in 2004, indicating increase in employee efficiency with the help of Information Technology.

Distribution of employees according to categories

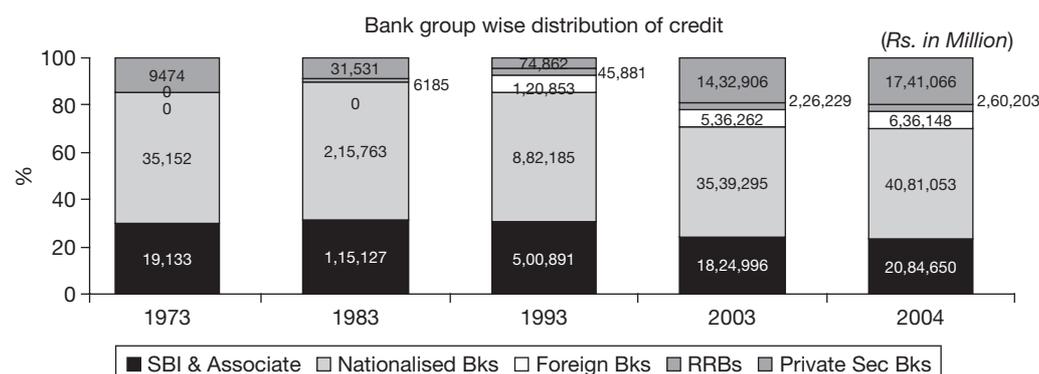|	Dec 73	Jun 83	Mar 93	Mar 03	Mar 04
Subordinate	84,869	1,45,659	2,17,840	1,94,594	1,91,279
Clerks	1,86,651	3,71,621	5,00,296	4,19,675	4,01,087
Officers	62,597	1,79,029	2,67,077	2,86,880	2,89,356

■ Officers ■ Clerks □ Subordinate

6. Trends in credit

The trends in the outstanding amount of credit disbursed by the Indian banks over the last three decades as captured through the BSR1A and 1B returns is presented in this section. As described earlier, through the BSR 1 returns classified information on each credit is collected. The picture of credit has been presented according to various classificatory variables.

A. *Population group wise credit*: The branch expansion of early 80s increased the rural branches, so also their share in the overall credit. The decline in the share of rural credit in last one decade owes to the fact that several rural centres, by definition based on population, got converted to semi-urban centres over decadal censuses. Secondly, the incremental growth in branch network is totally concentrated in metropolitan and urban centres. Moreover, in the last one-decade increase in number of branches was seen primarily in the private sector banks and their lending to rural areas was meagre as among other constraints, they were not having organisational reach for lending to those areas.

Population group wise distriution of credit *(Rs. in Million)*

	1973	1983	1993	2003	2004
Metro	37,256	1,77,712	8,29,492	46,97,420	54,47,890
Urban	14,282	80,142	3,30,200	12,36,620	15,03,361
Semi-Urban	9,136	65,233	2,35,917	8,54,116	10,01,660
Rural	3,086	45,520	2,29,064	7,71,534	8,50,210

■ Rural ■ Semi-Urban □ Urban ■ Metro

B. *Bank Group wise Credit*: The public sector banks (i.e., the nationalised banks, SBI and its associate banks) had a share of about 90 per cent in the entire banking business in 1983. During the last decade the private sector banks expanded their business and the share of public sector banks fell to about 70 per cent. The RRBs expanded their business from 1983 to 1993 but their share in all India credit almost remained constant beyond 1993.

Bank group wise distribution of credit *(Rs. in Million)*

	1973	1983	1993	2003	2004
Private Sec Bks	9474	31,531	74,862	14,32,906	17,41,066
RRBs	0	0	45,881	2,26,229	2,60,203
Foreign Bks		6185	1,20,853	5,36,262	6,36,148
Nationalised Bks	35,152	2,15,763	8,82,185	35,39,295	40,81,053
SBI & Associate	19,133	1,15,127	5,00,891	18,24,996	20,84,650

■ SBI & Associate ■ Nationalised Bks □ Foreign Bks ■ RRBs ■ Private Sec Bks

C. *Occupation wise distribution of Credit*: The distribution of credit according to occupa-tion/activity of the borrower is presented in the chart below. In the period prior to 70s, the banks were primarily located in industrial/trading centres, dealing mainly in industrial and trade credit and were scarcely lending to other sectors. This trend was changed when lending to agricultural sector became obligatory as norms were prescribed for agro lending. The chart shows an increase in share of credit to agriculture from 1973 to 1983, consequent to the government"s policy to provide implicit subsidy by making funds available at concessional rates for the rural areas. However, somewhere in the post 1983 era, the share of credit to agriculture as a propor-tion to the total credit started declining.
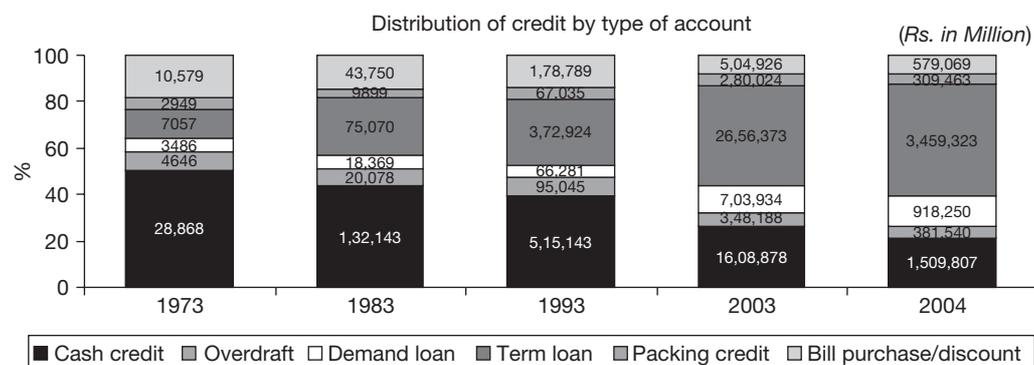
A decline can also be observed in the share of credit extended to industry and trade since 1973. This is due to the fact that in post 1983 era, other sectors of the economy also started hav-ing claims on the banking credit. The services sectors, like, hotels, transport and tourism showed significant growth and therefore, their credit requirements increased many folds. Also, in the post reform period, credit rationing through selective credit control, moral suasions or other means, was done away with and banks were exploring ways of having efficient credit allocation to different sectors in the diversified economy. The personal and consumer loans, hitherto restricted for general public, started getting attention of the banks. At the moment the Indian consumer loan segment is the fastest growing financial services market in the world (Tamal Bandhopadhyay, 2005). Therefore a substantial growth is noticeable in personal loans, which from nearly 4 per cent in 1983 increased about five folds to 20 per cent in 2004. Under these cir-cumstances though sufficient credit went to the conventional sectors like industry, trade and agriculture, yet, their respective shares in the total credit declined.
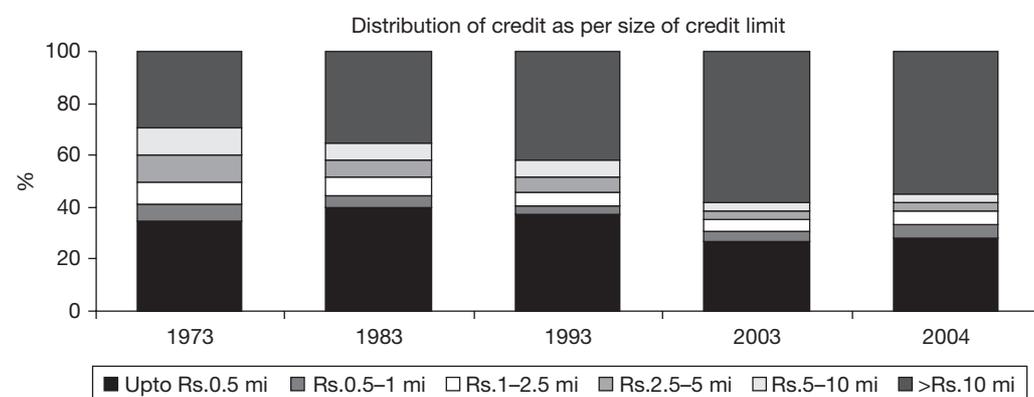

Occupation wise distribution of credit
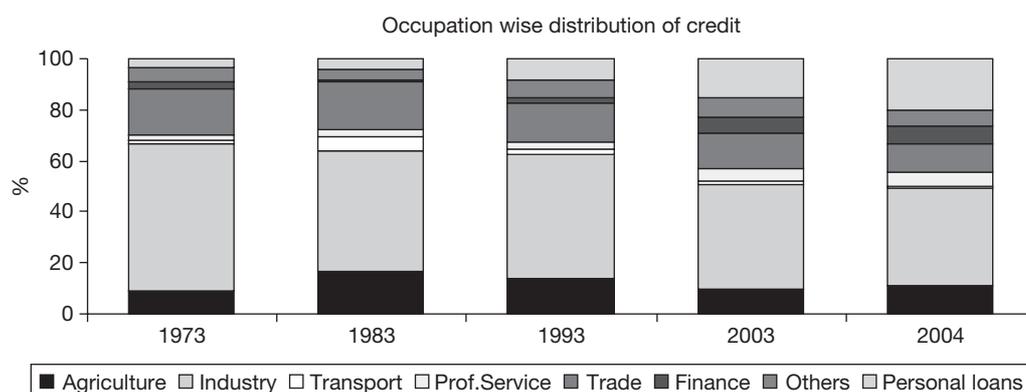
D. *Organisation wise trends in credit distribution*: The organisation wise distribution of credit, as depicted below, is presented using data collected through the BSR1A returns only, since in BSR 1B return the organisation classification is not called for. Thus, the picture in 2003 and 2004 is of the accounts with credit limit above Rs.2,00,000 (In 1993 the cut off limit for reporting a credit in BSR1A was Rs.25,000, while up to 1983 it was Rs.10,000). The loans to Individuals have shown steady increase across the board which is in consonance with the fact that the consumer loan is now driving the credit market. (The decline in such loans from 1993 to 2003 was owing to the fact that with upward revision in cut-off limit for BSR1A, a majority of such loans got out of its purview and got reported through BSR 1B where information on organisation of borrowers is not available.)

Organisation wise distribution of Credit
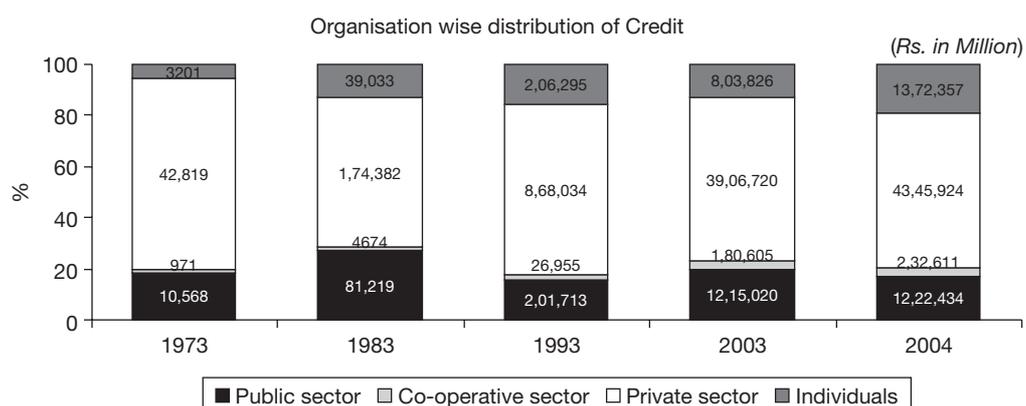
E. *Distribution of credit by type of account*: The trend analysis of the type of account, based on BSR 1A over the study period reveals that there is a steady decline in advances extended in the form of "cash credit". This decline was policy driven to bring about greater discipline in credit utilisation vis-à-vis sanctions and to gain better control over flow of credit. The progressive move by banks from cash credit system to a loan system was visible from sharply declining share of cash credit and rising share of loan component. The sharp increase in the term loan component seen in the last decade was due to the fact that the banks were permitted to provide project loans also. In March 2002 the largest private sector term lending institution merged into a commercial bank, bringing along its term lending portfolio and resultantly creating a sizeable impact on the size of total term lending by the banks.

Distribution of credit by type of account (Rs. in Million)

Cash credit — Overdraft — Demand loan — Term loan — Packing credit — Bill purchase/discount

F. *Distribution of credit as per size of credit limit*: The distribution of credit as per size of credit limit shows sharp increase in loans above Rs.10 million. This was on account of (i) banks entering into project financing, (ii) the general economic development over the years and (iii) inflation. Merger of the largest private sector term lending institution with a bank as mentioned above has also contributed to the higher share of top bracket. This size group of loans, increased from nearly 30 per cent in 1973 to about 55 per cent in 2004. The increase in share of small size loans of up to rupees half a million from 1973 to 1983 was consequent to the spread of branch network by banks to smaller centres. A boom in personal loans (including housing) in 2004, which were in the smallest three size brackets, resulted in increase in the share of small size loans and a consequent decline in the share of loans above Rs. 10 million.

Distribution of credit as per size of credit limit

Upto Rs.0.5 mi — Rs.0.5–1 mi — Rs.1–2.5 mi — Rs.2.5–5 mi — Rs.5–10 mi — >Rs.10 mi

7. Rate of interest on credit

The BSR system captures detailed account wise information on rate of interest at which credit is extended through its BSR 1A return. However, the interest rate data was not presented in the initial years of the BSR system. In the early 80s, the interest rates were mostly controlled and they depicted the policy to provide directed credit as per prescribed interest brackets. The credit behaviour according to various classes of interest rate is presented in this section. Where average rate of interest has been used, the same has been arrived at by using weighted average with loan amounts as weights.
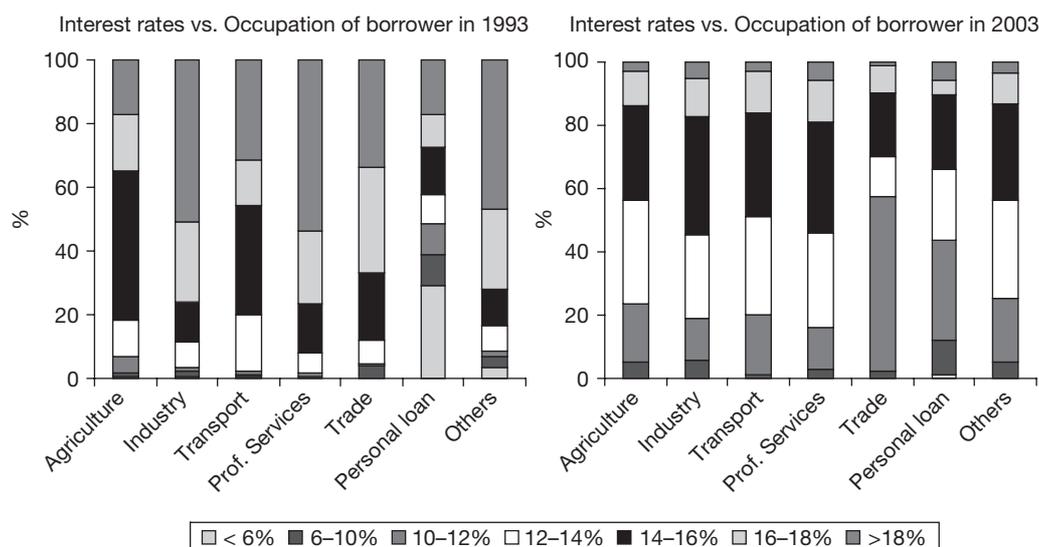
A. *Interest rate range wise distribution of credit*: The pattern in distribution of credit according to interest rate brackets since 1983, based on BSR1A, is presented below. The chart shows declining interest rate scenario in the post liberalisation period. It is seen that the share of advances at the rate of interest of above 15 per cent declined from about 78 per cent in 1993 to about 28 per cent in 2004 clearly pointing to the soft interest rate regime being followed in the country during the last several years. The increase in highest interest rate bracket is due to the increase in consumer loan which includes loans given through credit cards.

Distribution of credit for interest rate range

■ <6% ■ 6–10% □ 10–12% ▨ 12–13% ▨ 13–15% ▨ 15–16% ▨ 16–17% ▨ 17–18% ▨ >18%
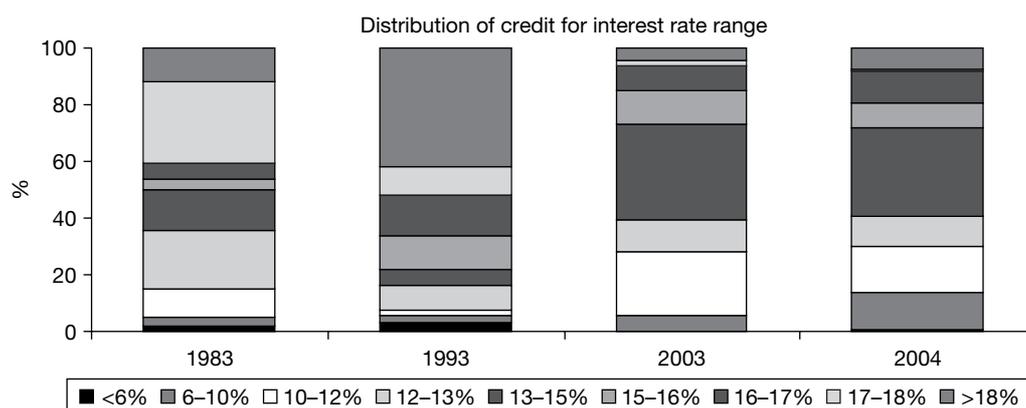
B. *Rate of interest and occupation of borrower*: The average rates of interest for different occupation of borrower since 1983 are presented in the graph below. In 1983 among various occupation groups, the credit provided to Industry was at the highest average rate of interest, while in 1993 it was the Services sector that received on an average the costliest credit. The agricultural loans were priority sector loans and were extended at concessional rates. Within this priority sector also, loans made available to weaker sections of the society and also smaller agriculture loans were at a rate further lower than the general concessional rate applicable to agricultural sector. Each such loan amount was very small and the details of such loans got excluded as they were not included in BSR1A. Such exclusion and the fact that after liberalization, the loan above the credit limit Rs. 2,00,000 was not required to be offered at concessional rate, raised the average rate for this category. In the pre-liberation era, personal and consumer loan were primarily lent to staff at a considerable lower rate, usually as a part of their perquisites. This is getting reflected in lower interest rate observed for personal loans from 1983 to 1993. During the last few years, with aggressive marketing of consumer, housing loans etc., the average rates gradually increased and came close to rates offered for other activities.

Average rate of interest vs. Occupation of borrower


■ 1983 ■ 1993 □ 2003 ▨ 2004
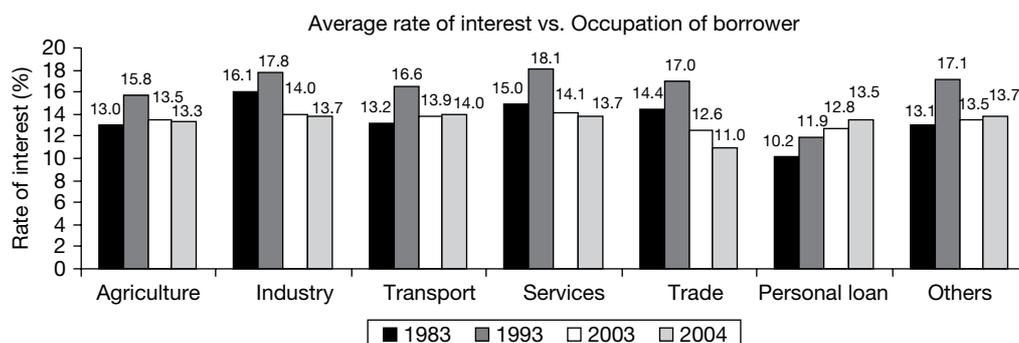
A look at the distribution of credit to different occupations of borrowers into interest rate group for the years 1993 and 2003 shows how proportions of loans in different interest groups changed over this period. While the decline in the rates of interest is seen across the board, it was more prominent for trade followed by services and industry. More than a quarter of personal loans were extended at less than 6 percent rate in 1993, as they were mainly given to staff, while in 2003 very few loans were given at this rate as the banks were free to market for personal loans and that too at rates close to the general rates prevailing in the banking industry.

Interest rates vs. Occupation of borrower in 1993

Interest rates vs. Occupation of borrower in 2003

Interest rates vs. Occupation of borrower in 2004

Legend: □ < 6% ■ 6–10% ▨ 10–12% □ 12–14% ■ 14–16% ▨ 16–18% ▨ >18%

A look at the interest rate distribution for 2004 shows that as against 2003, in the year 2004 there was a further decline in average rate of interest for loans extended to Agriculture, Industry, Professional Services and Trade while the personal loans became costlier as there were more takers for such loans.
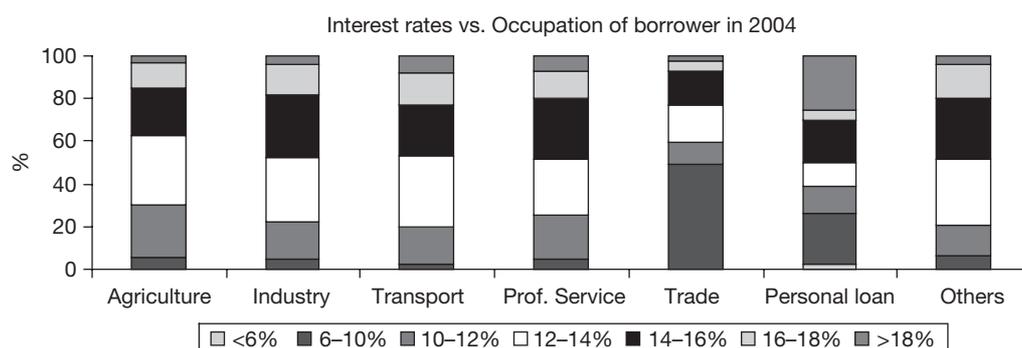
C. *Interest Rate and Organisation of Borrower*: The organisation wise trends of borrowings for various interest-rate classes were presented through the BSR system only from1996. The annual changes in the average rates for different organisation groups since 1996 are presented below. Along with the decline in rates of interest for all organisation groups of borrowers, the band of interest rates also narrowed from three percent to around two percent. The individuals that were getting cheapest loans in the mid 90s did not remain at the bottom of the band after 1998 as reasoned in the earlier section. After liberalisation, although banks fixed their Prime Lending Rates (PLR) for providing loans to their top-end clientele, yet this level was used more as a benchmark and not for loan disbursement. During late 90s, providing loan at that level became quite common. The beneficiaries for PLR-based funds were mainly larger companies. Therefore, the decline in lending rates to the public sector, which were larger companies and considered less risky, has got reflected in the graph below. On the other hand, the loans to private corporate sector, which covered complete spectrum of economic size and activities, and to private sector – others (like loans to Partnership, Proprietary concerns, Self help groups & NGOs, Association, Clubs and Trusts) were disbursed on an average at the highest rate.

Average interest rate vs. Organisation of borrower
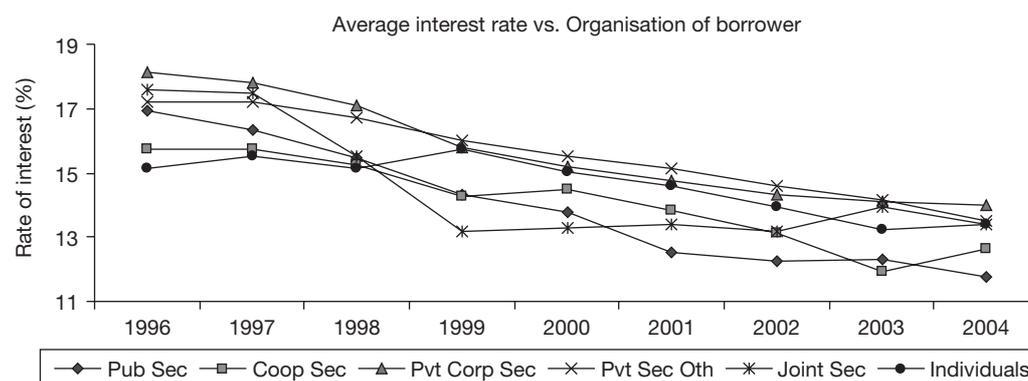
D. *Rate of Interest and Type of Account*: The average rate at which credit was extended to various types of account is shown in the graph below. It is seen that the interest rate band reduced from four per cent to less than three per cent. The loans given for packing credit (that is pre shipment credit for exporters) were at the bottom of the band since these were extended at low rates as per the export promotion policy of the government. The average lending rate for credit extended as overdraft was highest for a major part of the period. The loans given out as cash credit (and availed by commercial entities) were costliest till 2000, but subsequently they became less expensive even as compared to term loans. The decline in the medium and long-term loans was less steep than the other types of account.

Average interest rate vs. Type of account
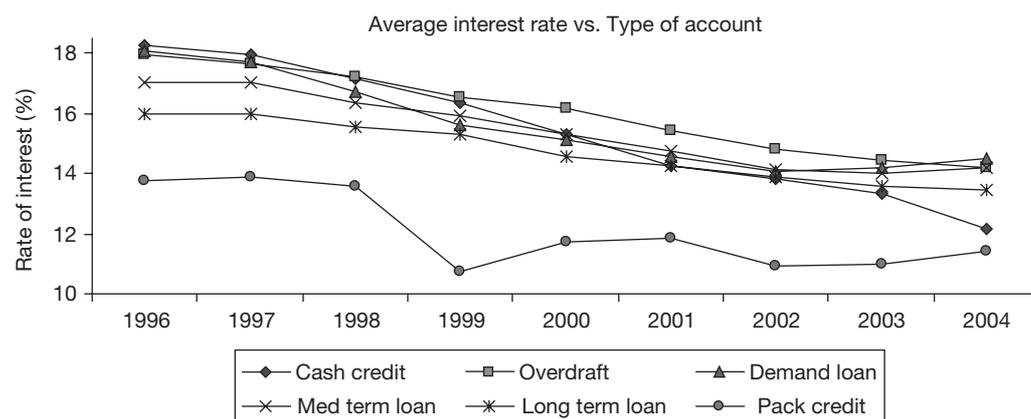
8. Summary

This paper describes the Basic Statistical System of the Reserve Bank of India with a special emphasis to BSR1 and BSR2 returns. The BSR system has been in existence since 1972 and is possibly unique to India. The vastness of the micro data generated by the system has been highlighted and the progress and trends in the banking sector in India since 1973 have been depicted in the paper. The trends have been studied for four time points 1973, 1983, 1993 and 2003. Further, the latest results based on data for 2004 have also been presented in all the sections.

While presenting the trends in growth of branch network, it was observed that during the 70s and 80s the economic policies guided the expansion of public sector banks while post liberalisation, more private sector players were allowed to participate. It has been observed that the expansion of branch network into the hinterland led to high growth of term deposits and banks were able to mobilise the domestic savings which were hitherto untapped. This garnering of higher quantum of deposits facilitated them to serve the ever increasing fund requirements of the economy both for developmental work and commercial activities. Due to softening of deposit rates, interest rate differential for different maturity periods has diminished and accordingly, the share of deposits for longer maturities has come down in the last decade. However due to earlier commitments a tenth of the banks deposits are still outstanding as high cost deposits at a rate of 10 per cent or more.

The trend in employment in the banks emerging through the BSR2 data that has been portrayed in a separate section, clearly points out to the increase in employee efficiency over the years.

In 80s, the analysis revealed that it was credit flow to the rural sector that increased, while in the late 90s with the higher influence wielded by the private and foreign banks, share of credit made available to urban and metro centres increased. The analysis also showed that the bank-credit market had matured in the sense that the variation in credit availed by various organisations – public, private, cooperative or individuals – have come down, the band of interest rates at which the funds are provided has also narrowed down and disparities in the share of various borrowing facilities provided to borrowers have reduced. The decline in share of cash credit, as intended, has brought greater discipline to fund management as inflows and outflows are better predictable.

Interest rate analysis of credit, covered in BSR1A, apart from pointing out towards softening of credit rates during the new millennium, has disclosed that credit rates are cost driven and arrived at considering the risk perception of the borrower and not on his occupation per se.

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Pardeep Maria and Praggya Das (Reserve Bank of India)

Annex

A. List of Statistical Returns to be submitted to the Reserve Bank of India under the Basic Statistical Returns (BSR) System

Return	Data content of the return and coverage	Frequency
BSR1A	This is a return on large size advances. All borrowal accounts with credit limits over Rs.0.2 million are individually listed along with particulars of district and population group of the place of utilisation, type of account, organisation, occupation, nature of borrowal account, asset classification, rate of interest, credit limit and amount outstanding in respect each loan or advance. All branches of commercial banks submit this return	Annual (March 31)
BSR1B	This is a return on small size advances. All borrowal accounts with credit limits of Rs.0.2 million and less are classified according to occupation and aggregate figures for each occupation are furnished in a consolidated from for each branch	Annual (March 31)
BSR2	This return covers data on deposits and staff position. Details of category-wise number of staff, number of deposits accounts and amount outstanding according to type of deposits and classification of all term deposits according to maturity, broad interest rate ranges, size of deposits and residual maturity are reported by each branch	Annual (March 31)
BSR3	Bank"s advance against security of selected sensitive commodities. Submitted by the Head Offices of each bank	Monthly (last Friday)
BSR4	Deposits classified into Government, Private Corporate, Financial, Household and Foreign Sectors according to its ownership pattern. Submitted by selected sample branches of banks	Annual (March 31)
BSR5	Pattern of Investment of bank in Central and State Government Securities, Other Trustee Securities, shares, etc. Submitted by Head Offices of each bank	Annual (March 31)
BSR6	Survey of Debits to Deposits Accounts for April to March of the year. Submitted by selected sample branches of banks	Quinquennial
BSR7	Quarterly survey on Aggregate Deposits and Gross Bank Credit. Branch-wise information to be prepared by Head Offices of the banks as on last Friday of June, September and December, and as on March 31	Quarterly (Mar 31 & last Fridays of Jun, Sep & Dec)

B. Classification of a centre according to population group

S.No.	Population group	Population of centre
1	Rural	Less than 10,000
2	Semi-urban	10,000 and above but less than 0.1 million
3	Urban	0.1 million and above but less than 1 million
4	Metropolitan	1 million and more