Measurement Issues in European Consumer Price Indices and the Conceptual Framework of the HICP

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Measurement Issues in European Consumer Price Indices and the Conceptual Framework of the HICP:

Summary and Conclusions of the CEPR/ECB Workshop on Issues in the Measurement of Price Indices

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A Workshop on Issues in the Measurement of Price Indices was hosted by the European Central Bank (ECB) on the 16th and 17th of November, 2001. The main objective of the workshop was to provide a forum for central bankers, statisticians and academics to discuss price measurement issues, particularly in relation to the Harmonized Index of Consumer Prices (HICP). No comprehensive research on measurement issues related to the HICP was previously available. The Workshop was a first step towards filling this gap, and advanced our knowledge in two major areas: i) Partial estimates of measurement biases in European consumer price indices; ii) The conceptual framework of the HICP. The Workshop was jointly organized with the Center for Economic Policy Research (CEPR). The composition of the Scientific Committee responsible for the programme was as follows: Ernst R. Berndt (Massachusetts Institute of Technology), Gonzalo Camba-Mendez (ECB), Vítor Gaspar (ECB) and Dietmar Harhoff (Universität München and CEPR). Participants in the Workshop included staff of the ECB, several National Central Banks of the Eurosystem, Eurostat, several European National Statistical Institutes, as well as leading academics from North America and Europe.

1. Introduction

The reliability of price indices in general, and consumer price indices in particular, is key for economic policy decisions. Consumer price indices are widely used as economic indicators, not only by governments or central banks, but also by economic agents. Many central banks have been mandated to maintain price stability. Sometimes an inflation target is made explicit. Sometimes the definition of price stability is left implicit. Consumer expenditure is usually the preferred domain of definition of the price indices chosen as a reference for central banks with an explicit inflation target. Consumer price indices are also used by goverments to determine the rate of increase in social transfer payments. Failure to measure this index properly would mean that the composition of the public budget will differ from that initially planned by the government. It is therefore important to ensure that consumer price indices are accurate reflections of the price developments they are designed to capture.

Over the past forty years, there have been three comprehensive studies of the accuracy of the US Consumer Price Index (CPI). In 1961 a committee chaired by George Stigler highlighted the difference between the CPI as it was then constructed and a true "Cost of Living Index" (COLI)[1]. This committee recommended that the US Bureau of Labor Statistics (BLS) adopt the COLI as the conceptual framework for the CPI, and make a number of other changes that would make the CPI better approximate the COLI ideal. In 1996 a committee chaired by Michael Boskin (the Boskin Commission) assessed the measurement bias of the US CPI.[2] They concluded that the US CPI was overstating the annual rise in the cost of living (COL) by about 1.1-percentage points. This committee had been appointed by the US Congress as a result of concerns about overspending by the federal government. It was suggested that the government might be overspending because social security allowances were linked to an index that might be overstating the true increase in the cost of living. In 2001, a report from a committee of experts from the Committee on National Statistics of the U. S. National Academy of Sciences on the conceptual, measurement, and other statistical issues in the development of COL indices was published.[3] This report was commissioned by the BLS partly in response to the Boskin Commission Report. It addressed many of the conceptual issues that arise in the construction of a measure of consumer price inflation in today's economy, and

[1] *Stigler, G. J. (1961): 'The Price Statistics of the Federal Government: Report to the Office of Statistical Standards.' Bureau of the Budget. New York: National Bureau of Economic Research.*
[2] *Boskin, M. J.; Dulberger, E. R.; Gordon, R. J; Griliches, Z. and Jorgenson, D.W. (1996): 'Towards a More Accurate Measure of the Cost of Living.' Final Report to the Senate Finance Committee from the Advisory Commission to the Study of the Consumer Price Index.*
[3] *National Research Council (2001). At What Price? Conceptualizing and Measuring Cost-of-Living and Price Indexes. Panel on Conceptual, Measurement, and Other Statistical Issues in Developing Cost-of-Living Indexes, Charles L. Schultze and Christopher Mackie, Editors. Committee on National Statistics, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.*

contained a series of recommendations for the BLS to further improve the US CPI (some of which have already been adopted).

In Europe, the prospect of Economic and Monetary Union (EMU) brought a new dimension to the problem of accurately measuring consumer price inflation. The Maastricht Treaty set the convergence criteria to guide decisions on the passage to stage three of EMU, i.e. how to decide which countries would qualify for adoption of the single currency. One of the criteria was (and still is for countries that might join the euro area in the future) that inflation does not exceed by more than 1.5 percentage points the inflation rate of (at most) the three best-performing member states in terms of price stability. In October 1995 the Council of Ministers of the European Union adopted the framework regulation for the establishment of a harmonized methodology for the construction of consumer price indices in EU member states for the purposes of assessing convergence[4]. The conceptual frameworks of the existing consumer price indices of the member countries of the European Union were different, as were their coverage of items of consumption expenditure and the measurement of price changes. The National Statistical Institutes (NSIs) of the member states and the European Commission (Eurostat) took on the task of developing the "Harmonized Index of Consumer Prices" (HICP). The coverage of the initial HICP was mainly that which was common to the CPIs of member countries. The coverage extends now to almost all items of consumers' expenditure. The HICP has been adopted by the European Central Bank (ECB) in its quantitative definition of price stability. It is therefore very important from a European perspective to identify weaknesses, if any, in its conceptual framework and construction, as well as ways in which both can be improved.

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The Workshop on Measurement Issues in Price Indices aimed at providing a forum where economists and statisticians could discuss areas of common interest. While the bulk of the papers presented at the workshop focused on problems associated with the measurement of inflation at the consumer level, the importance of measurement issues extends well beyond the domain of consumer spending. The rapid pace of technological innovation in the information technology (IT) sector in recent years has created major challenges

[4] *Council Regulation (EC) No 2494/95 (OJ L 257, 27.10.1995, p.1).*

for the construction of accurate deflators for high-tech goods. The US has used hedonic prices rather more than European countries for the deflation of investment spending in the national accounts, and some have argued that this accounts for part of the better measured performance of the US economy in the latter half of the 1990s. Understatement of the true rate of price decline for important categories of investment goods may lead to understatement of GDP growth. For the purposes of monetary policy, accurate measures of real GDP and productivity growth are crucially important.

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Section 2 presents the views of the ECB on the importance of reliable price indices and the use of the HICP. This section summarizes the speeches made at the workshop by Otmar Issing and Eugenio Domingo Solans, both members of the Executive Board of the ECB. Section 3 presents the main conclusions of the workshop from the perspective of the ECB. The major conclusions refer to issues related to: 1) Partial estimates of measurement biases in European consumer price indices, and 2) Issues related to the conceptual framework of the HICP. Section 4 elaborates on the former, while section 5 elaborates on the latter. Some other relevant issues discussed during the workshop are presented in section 6. Section 7 discusses potential areas for future research work.

2.

Monetary Policy and the Reliability of Price Indices

For the ECB the issues under discussion at this workshop are of utmost importance. Otmar Issing[5] (member of the Executive Board of the ECB) opened the workshop with a speech on *'The relevance of reliable statistical systems for monetary policy making in the euro area'*. In his speech Professor Issing stressed the fact that statistics have played a key role in many political agreements that lead to the construction of the European Union. As examples, he cited the rules on the provision of cohesion funds and the convergence criteria which guided decisions on the passage to the third stage of monetary union. Furthermore, economic policy in general, and monetary policy in particular, cannot operate properly without reliable statistical systems. Differences in measured productivity across countries that might result from different techniques to measure prices might be wrongly used to justify a certain regulatory framework or certain changes in educational policies. Also, since many public expenditure items are linked to price indices, a bias in these price indices might cause the final composition of the budget to differ from that initially planned by the government. Mismeasurement of prices is also problematic for monetary policy. The ECB took the issue of potential mismeasurement of prices into consideration when it formulated and adopted its monetary policy strategy. A key component of the ECB's monetary policy strategy is the following quantitative definition of price stability: "Price stability shall be defined as a year-on-year increase in the Harmonized Index of Consumer Prices (HICP) for the euro area of below 2 percent". There are several features of this definition that are linked to the issue of measurement biases in price indices. First, the use of the HICP for assessing price stability reflects the fact that national consumer price indices are not sufficiently comparable with one another. The Monetary Union Index of Consumer Prices (MUICP) or the HICP for the euro area is the only consumer price index that is available for the euro area as a whole. Second, a ceiling for inflation was set, but not a floor, due to the potential existence of measurement problems that might cause the MUICP to overstate the true rate of inflation. Otmar Issing drew attention to a speech by Alan Greenspan in which the latter stated that measurement problems in US price indices were so prevalent that a specific numeric inflation target would represent '…an unhelpful and false precision.' In contrast, the Governing Council of the ECB is of the view that the quality of the HICP made it feasible to set a precise definition of price stability in the euro area.

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[5] *Issing, O. (2001): 'The relevance of Reliable Statistical Systems for Monetary Policy Making in the Euro area'. Speech delivered at the CEPR/ECB Workshop. Downloadable from http://www.ecb.int*

Eugenio Domingo Solans[6] (member of the Executive Board of the ECB) made a speech under the title *'Issues concerning the use and measurement of the HICP'*. He stressed that as a user of price statistics the ECB wishes to monitor whether there are criticisms of the data and naturally wants to hear ideas for improvement. He also emphasized the three main functions that the HICP performs: first as a measure for assessing the nominal convergence of a country wishing to qualify for membership of monetary union; second as a quantitative definition of price stability in the ECB's monetary policy strategy; and third as a benchmark for indexing economic and financial magnitudes. Eugenio Domingo Solans emphasized that the HICP was the only serious contender for the measurement of inflation in 1998. The HICP is more closely harmonized than other commonly used measures of prices and costs. From the perspective of the ECB, the HICP possesses some very attractive qualities, namely:

- It covers a large proportion of household expenditure.
- It is available monthly and in a timely manner.
- It is aggregable in the sense that the country pieces fit together without gaps or overlaps.
- It is subject to only minor revisions.
- It is based on actual monetary transactions.

He nevertheless welcomed Eurostat's efforts to make further improvements, especially in the areas of quality adjustment and treatment of owner-occupied housing. While the accuracy of the index is key, it is also important for decision making in monetary policy to have a short lag between the time period to which an index refers and its publication date, i.e. timeliness is important. In this respect the publication of flash estimates of MUICP MUICP (which began with the October 2001 data) are very much welcome.

[6] *Domingo Solans, E. (2001): 'Issues Concerning the Use and Measurement of the HICP'. Speech delivered at the CEPR/ECB Workshop. Downloadable from http://www.ecb.int*

3

Main Conclusions of the Workshop

This workshop contributed to our knowledge on two major areas:

1. Partial estimates of measurement biases in European consumer price indices.

The Workshop confirmed the view that the potential bias in the HICP should not be regarded as constant over time, but should rather be understood as changing as a function of the economic environment. Substantial evidence was presented that suggested that the measurement bias for certain items is downward rather than upward, contrary to the widely held belief that measurement error always causes inflation statistics to overstate the true rate of inflation. In recent years, many analysts have noted the absence of a comprehensive report on the potential for measurement bias in European price indices. No broad studies of the accuracy of European consumer prices indices comparable to those conducted in the US by the Boskin Commission in 1996 or by the National Academies in 2001 is available in the European context, and therefore no overall assessment of the sign or size on any bias in the HICP is possible. This is true for each of the national HICPs in the European Union and euro area, and, as a consequence, also for the euro area aggregate HICP (the MUICP) which is a weighted average of the results of all euro area countries. The workshop did, however, put together a collection of studies conducted in Europe, and was therefore a step in the right direction in filling this gap. The conclusions from these studies validate the views of those who strongly warned against i) extrapolating the results obtained in the US to Europe, and ii) transferring the results for certain index sub-components (such as IT goods) to other components in the index. As an illustration in this regard, some evidence was presented of a slight understatement of rent inflation in the rent component of the consumer price index for West Germany. Evidence was also presented of measurement problems that may result from the methods commonly used by NSIs to control for quality changes, i.e. the matched model approach. This suggested that the matched models approach is not always well suited to today's dynamic markets. In this regard, it was shown that both the size and sign of any resulting biases depend crucially on the structure of the markets concerned.

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2. The conceptual framework of the HICP.

There was general agreement on the appropriateness of building the HICP on the foundations of economic theory (consumer theory or inflation theory). However, the precise theoretical concept was not regarded as major issue by most participants in view of the actual practice of statistical agencies. For example, there was consensus that one source of bias which is often cited in the discussion about "cost of living indices" (COLI) – namely the substitution bias – may not be a major issue in practice in Europe, because of the use of frequently updated weights in price indices. In addition the practice of the NSIs to carefully ensure that the sample basket of goods is representative of the consumption patterns, may also serve to minimize any substitution bias. On the basis of this broad consensus, discussions held suggested that, rather than focusing on theoretical debates, the main issue was to focus on improvements for price statistics which lead to better practices for the treatment of new goods, housing, quality adjustment or the use of new data sources (e.g. scanner data).

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4

Partial Estimates of Biases in European Consumer Price Indices

4.1. Results with Scanner Data

Mick Silver[7] presented results from a hedonic and matched model experiment using scanner data. Results in the paper showed that a form of sampling bias, not previously identified, may exist as a by-product of the use of the matched model method to control for quality changes, because the matching excludes unmatched new and old models from the sample (i.e. there is sample depletion). This is not the case with the hedonic method. The failure of the matched model method is therefore more acute in very dynamic markets where new models replace old ones at a fast pace. The results presented were computed using scanner data on monthly prices for washing machines in the UK for 1998. Sample depletion was severe over the course of the year: for example, only 53 per cent of the January 1998 basket of varieties were used for the December/January index, and those accounted for just 48.2 per cent of the transactions in December. The results showed that quality adjusted prices fell faster for the matched sample, than for the unmatched samples. The exclusion of unmatched data seriously overstated these price falls. In any case all the estimates presented, whether based on hedonics or matched models, gave estimates of price changes that were vastly below the corresponding official estimates. David Fenwick, acting as discussant for this paper, pointed that there is indeed the potential for biases as large as that found in this work for certain items of the UK RPI. The use made of scanner data in the UK Office for National Statistics points in this direction for some cases. For example, some of the most popular models of dishwasher representing 70 per cent of sales in scanner data figures, represent only 2 per cent of the quotes in the construction of the RPI. Nonetheless, more work is needed before techniques such as those used by Mick Silver can be implemented by NSIs. The reasons for this are not only related to the robustness of hedonic regressions, but just as importantly, the quality of scanner data and the lack of complete correspondence between what is provided in scanner data and the definitions used in the construction of the RPI. This is not to say that scanner data is of no use in the computation of consumer price indices. Scanner data can play a very important role even now in checking and controlling the representivity of the base sample in assisting with an effective replacement strategy as well as providing a mechanism for adjusting for quality changes. He emphasised the importance of the sort of quality assurance work that had been conducted in the UK and that further

The failure of the matched model method is more acute in very dynamic markets where new models replace old ones at a fast pace.

[7] *Heravi, S. and Silver, M. (2001): 'Why the CPI Matched Models Method May Fail Us: Results from an Hedonic and Matched Experiment Using Scanner Data'. Paper downloadable from http://www.ecb.int*

work needed to be done to identify and test solutions. In this respect it was important that countries learned from one another and found common solutions.

4.2. Apparel Prices in the US

Robert J. Gordon[8] presented a paper on apparel prices in the US using Sears Catalog data for the period 1914 to 1993. Results in the paper showed also that the matched model indices may be flawed because price increases that occur at the same time as model changes are excluded from the matched model index. Gordon showed that a hedonic price index for women's dresses always increases faster than the corresponding matched model index, and suggested that his findings raise the possibility that price indices for goods subject to frequent fashion or taste changes (such as clothing) may be subject to significant downward bias. John Muellbauer suggested some caution before extrapolating this estimated bias to the figures reported in the CPI for apparel prices. There had probably been significant methodological changes over the period under study, and it might be that some of the divergences in prices found in the study could be attributed to this. Ernst Berndt pointed to the fact that many clothes were made at home during the early part of Gordon's sample. This means that the prices found in catalogues do not reflect changes in the price of textiles, and this might alter the results presented.

4.3. Price Indices for Housing

There are difficulties in measuring price changes for goods and services whose characteristics are changing rapidly. As highlighted in the previous two papers, the matched model method, though widely used in statistical offices, might not always be the solution. Hedonic methods have been introduced to deal with such problems, but there are also difficulties associated with the use of hedonic techniques. One major difficulty is the fact that omitted unobserved characteristics correlated with those included in the hedonic regression can bias the hedonic estimates. Olympia Bover[9] presented a hedonic house price index for Spain that controls for characteristics which are unobservable in their sample such as location, transport, traffic and so on. This was possible by relying on data that provided information on a site identifier for flats, and also information on the number of dwellings built on that site. Data employed in this study is regularly collected by the Spanish *Ministerio de Fomento*. The study reports a difference with respect to the Spanish residential construction deflator used in the National

There are difficulties in measuring price changes for goods and services whose characteristics are changing rapidly.

[8] *Gordon, R. J. (2001): 'Apparel Prices and the Hulten-Bruegel Paradox'. Paper downloadable from http://www.ecb.int*

[9] *Bover, O. and Velilla, P. (2001): 'Hedonic House Prices without Characteristics: The Case of New Multi-unit Housing'. ECB Working Paper No17. Paper downloadable from http://www.ecb.int*

Accounts of around -3.5 percent per year. The authors suggest that the disparity may not all be due to quality adjustment but also to the fact the Spanish deflator is an index based on the cost of the construction inputs, while this was not the case for the hedonic index reported. Spain has one of the highest owner-occupancy rates in Europe (85 percent), and new dwellings account for most of the residential construction, which in turn represents a substantial part of Gross Fixed Capital Formation. The impact of biases in the house price index can therefore have a significant impact on overall GDP. The relevance of mismeasurement of house prices could also be of major concern if owner occupied housing is included in the HICP and measured by the price of new dwellings.

Johannes Hoffman and Claudia Kurz[10] presented a study on rent indices for housing in West Germany, covering the years 1985-1998. Contrary to Spain, nearly 60 percent of households in Germany live in rented dwellings. This explains why the weight of rents in the German HICP is much higher than for other European countries, 8.6 percent in 2001, compared with around 1.5 per cent in the Spanish HICP. A hedonic housing rent price index computed in this study concluded that for the period under review there is evidence of a slight understatement of rent inflation of around 0.5 percent in the official rent index for West Germany. Most of the divergence from the official rent index occurred in the years 1991 to 1994, when the housing market was under stress. The data employed was taken form the German Socio-Economic Panel.

Stephen Cecchetti acted as discussant for these two papers on housing prices. He started his discussion by pointing to three major uses of house price indices. First, they are needed to measure real GDP. Second, housing costs are relevant in the computation of a Cost of Living Index. Third, house price inflation is important for monetary policy purposes. The type of house price index that we may prefer will depend on the use we want to make of it. For a deflator for that part of Gross Fixed Capital Formation that corresponds to residential houses, the price index for new houses as computed in the paper presented by Olympia Bover is the right one, though it may not be for a cost of living index. This is because house owners are hedged against changes in these prices. But this approach could work with a percentage correction to account for new house owners only. Cecchetti expressed the view that the net acquisitions price approach is the right approach for monetary policy purposes. This is so

[10] *Hoffmann, J. and Kurz, C. (2001): 'Rent Indices for Housing in West Germany 1985-1998'. ECB Working Paper No 116. Paper downloadable from http://www.ecb.int*

because it is important to have a measure of asset prices. Following this reasoning, it would be very important to incorporate housing in the HICP.

Robert Gordon pointed out that the price of property includes the price of land and this is problematic as it should be separated from the price of housing. This may not be very important for the case of Germany because the housing stock is much more homogeneous, but this entails more problems in the case of the US. John Astin noted the interest of the Eurostat in the analysis presented by Olympia Bover. Eurostat is interested in incorporating owner-occupied housing on a net acquisitions basis in the HICP. Erwin Diewert commented on the need to disentangle the price of the land from the price of housing, but once more this depends on the purpose of the index. In a price index for the National Accounts the land should play no role, and the imputation should be exclusively for the structure. If on the other hand, one wants to compare owner occupied homes with rental homes, in order to compare like with like, the price of land should be included. The rent has the price of land included and it is therefore necessary to incorporate the opportunity cost of land in the home ownership category as well. Differences in the practices of NSIs (in terms of including or excluding the price of land in the cost of housing) can lead to huge cross country discrepancies. This applies also to the disparities across countries concerning the depreciation rate for housing. Ernst Berndt highlighted the fact that homeowners in the US pay taxes in accordance with the value of their properties, which generates a large business for appraisers, and noted that the use of hedonic techniques for this purpose is widespread.

4.4. Price Indices for Cars

A collection of papers on the potential for quality bias in car price indices for Spain, Italy and the Netherlands was presented at the workshop. Omar Licandro[11] presented results of a quality-adjusted index for new cars in Spain. The method adopted to adjust for quality was that of hedonic regressions. The data used are collected by the 'Instituto de Estudios de Automocion' in Spain. This dataset covers the whole population for new cars sold in Spain, together with information on 28 characteristics. Information on prices refers to catalogue (or list) prices rather than transaction prices. The Spanish NSI uses only a sample of this population in computing its car price index. To avoid multicollinearity, the authors adopt the strategy of grouping the indicators in a quality index by making use of principal components. The quality-adjusted index computed is then compared to an index

[11] *Izquierdo, M., Licandro, O. and Maydeu, A. (2001): 'Car Quality Improvements and Price Indices in Spain'. Paper downloadable from http://www.ecb.int*

built in line with the Spanish NSI strategy, namely the matched model method. Results show an overstatement of the price of new cars by as much as 3.1 percent per year over the period 1997-2000 in the official index. Gian Maria Tomat[12] presented results that suggested that the official Italian automobile CPI is also characterized by a positive quality bias of around 2.2 percent over the period 1988-98. The data employed in the analysis is the *Quattroruote Price and Characteristics Database*. The paper presented discussed measurement problems associated with the hedonic regression method, in particular problems associated with not being able to define in a quantifiable manner all relevant characteristics. The problem of unobserved characteristics introduces nuisance parameters in the hedonic regression function, which in turn can affect the precision of this method. The analysis presented in the paper suggests that the use of a chain index system should help to reduce measurement problems. Ben Bode[13] presented a paper that examined the difference between car model based user-cost indices and CPI based indices in the Netherlands. The user-cost approach presents an alternative to hedonic methods for quality adjustment. The user-cost approach attempts to improve the measurement of the cost of living by focusing on prices of the fundamental services rather than prices of inputs. It attempts to measure the cost of attaining a given level of utility. Two separate indices were built, a fixed cost index that included total depreciation, insurance premium and road tax, and an operating costs index which includes maintenance and repairs and fuel consumption. The data used for the analysis is built from three sources. First the Royal Dutch Tourist Office (ANWB) collects detailed information on prices and technical characteristics of cars. The RAI Data Center (RDC), responsible for car registrations in the Netherlands, provides the required information on sales and a limited set of characteristics. The data on user costs come from the ANWB. The annual growth of total user costs for the CPI based index was 1.45 percent over the period 1992-1999, while the car model based user-cost index increases at an annual average growth of 0.67 percent. This difference is mostly explained by large disparities in the indices for operating costs.

The problem of unobserved characteristics introduces nuisance parameters in the hedonic regression function, which in turn can affect the precision of this method.

Jack Triplett acted as discussant of this session and pointed that the correlation among the characteristics is a problem not on its own but if it comes together

[12] *Tomat, G. (2001): 'Durable Goods, Price Indexes and Quality Change: An Application to Automobile Prices in Italy 1988-98'. ECB Working Paper No 118. Paper downloadable from http://www.ecb.int*

[13] *Bode, B. and van Dalen, J. (2001): 'The Cost of Private Transportation in the Netherlands, 1992-1999'. Paper downloadable from http://www.ecb.int*

with large errors in the data. He warned that employing principal components brings the problem of interpreting the coefficients. He warned that the user cost approach tends to over-adjust as some of the savings in user costs might already be incorporated in the prices. Triplett also noted that the findings in the papers contrasted with what was typically found in US studies of quality adjustment of auto prices using hedonics, specifically that the hedonically adjusted prices tend to rise faster than the official indices.

4.5. Outlet Substitution Bias

Joao Santos Silva[14] presented results on the evidence of retail outlet substitution bias in the Portuguese CPI. The size of this bias is much larger that that reported in other studies such as the Boskin report in the US where the estimated size of the bias was 0.1 percentage points a year. Results in this paper suggest that the size of this bias is 0.5 for the Portuguese CPI. The disparity is explained by the important changes in retailing in Portugal over the last decade. The authors suggest that as the expansion of these supermarkets is slowing down, the size of this bias should be reduced. Nick Oulton questioned this suggestion by pointing firstly to the fact that the potential for expansions of big retail outlets is still very high if one compares the market share they have in Portugal with that in countries like the UK and secondly because the study presented focused exclusively on food items, while these big retail outlets sell many other goods. The final impact of outlet substitution bias on the Portuguese CPI might thus be much larger.

[14] *Covas, F. and Santos Silva, J. (2001): 'Outlet Substitution Bias'. Paper presented at the CEPR/ECB Workshop. Paper downloadable from http://www.ecb.int*

5. The Conceptual Framework of the HICP

The last part of the workshop was devoted to a special session on the HICP. Two papers were presented and these presentations were followed by a panel discussion. Erwin Diewert[15] presented a paper on the conceptual foundations of the HICP. He explained that in choosing an inflation index for monetary policy purposes two decisions must be made. First one must select a set of transactions in the economy that should be in the domain of the index. The use of the GDP deflator is not a good choice because it could happen that all prices fall and the index rises because of the negative weight for import prices. The inclusion in the index of the price of investment goods is not to be recommended because the prices of investment goods are not relevant to deflate current household expenditure on goods and services. Diewert also ruled out the inclusion of a government expenditure price index because of the difficulties of obtaining meaningful prices for that index. This leaves the choice of the domain of consumption expenditure as the sole focus. Second an index number concept must be chosen. Regardless of whether we adopt a fixed-basket, stochastic, axiomatic or economic approach to index number theory, the same three index number formulae emerge as the 'best', namely the Walsh, Fisher and Törnqvist-Theil indices. Since all approximate each other reasonably closely, it does not matter much which is chosen. In fact, Diewert (1978)[16] has shown that the three formulas will approximate each other to the second order.

Diewert pointed to the following main characteristics of the HICP:

1) It encompasses only market transactions.
2) It does not include interest rates.
3) Owner occupied housing is at present excluded.
4) Use of Laspeyres formula.
5) Expenditure incurred for business purposes is excluded.
6) It includes the consumption expenditure of foreigners in the reference country but excludes the consumption expenditure of residents abroad.
7) It uses final demand prices. These include commodity and value added taxes.
8) Subsidised prices should incorporate the subsidy.

Some of these properties are shared with a cost of living type of index (namely properties 5, 7 and 8), while others are not consistent with a COL index (1 and 3). Diewert went on to enumerate the main problematic areas of the HICP and ways to bring it to a more consistent theoretical foundation.

[15] *Diewert, E. (2001): 'Harmonized Indexes of Consumer Prices: Their Conceptual Foundations'. ECB Working Paper No 130. Paper downloadable from http://www.ecb.int*

[16] *Diewert, W.E. (1978): 'Superlative Index Numbers and Consistency in Aggregation'. Econometrica, Vol. 46, pp. 883-900.*

• *The treatment of quality change.* The matched model method fails in the event of rapid sample degradation. The only choice we are left with to overcome this problem is the use of hedonic methods.

• *Representativity bias.* The concept of substitution bias may not apply to an 'inflation' type index as opposed to a COL index, but the same problem applies, although it should be renamed as representatitivity bias. This can be large, and frequent rebasing surely is needed. A further issue of concern is that Eurostat should eliminate any choice in the frequency of the rebasing of the national HICPs. The concern with representativity arises in the context of the fixed basket approach.

• *The computation of the elementary price indices.* This is done by simple averages of the prices of a sample of representative items. Member countries are allowed to use either an arithmetic mean or a geometric mean. If the relative prices of items in the commodity class under consideration were sampled using weights proportional to their base period expenditure shares in that commodity class, then the arithmetic mean would be consistent with a Laspeyres price index for that commodity. But the use of a geometric mean would not be consistent with a fixed based Laspeyres index.

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• *The treatment of housing.* At present the HICP does not include any imputations for owner occupied housing. The weight on rents is large in the HICP, and the percentage of people living in owner occupied dwellings differs dramatically across European countries (85 percent in Spain and only 40 percent in Germany). This means that omitting owner occupied housing from the HICP may render the indices incomparable across countries.

Mark Wynne[17] presented a paper on the Measurement Bias in the HICP. He started his presentation by saying that fifteen years ago the interest in measurement error in inflation was not as high. The fact that inflation has been brought down to levels not seen in decades, and the shift of central banks towards inflation targeting explain the high degree of attention this topic has nowadays. Wynne focused his presentation on two issues. First he reviewed how much is currently known about measurement biases in European consumer price indices in general and in the HICP in particular. He noted the paucity of studies at the level of the member states, and suggested that to date there is not enough evidence to allow a reliable estimate of the magnitude of the overall measurement bias in the HICP. He also noted some difficulties associated with

[17] *Wynne, M. and Rodriguez-Palenzuela, D. (2001): 'Measurement Bias in the HICP: What Do We Know and What Do We Need to Know?'. ECB Working Paper No 131. Paper downloadable from http://www.ecb.int*

employing indirect methods (that have been employed with some degree of success in the US) to infer the extent of bias in the HICP, and presented illustrative calculations showing that the potential for downward bias should not be ignored. Wynne noted the difficulties in getting an answer to the question of how well the HICP measures inflation because the HICP is still undergoing significant methodological changes, and also because detailed information on how the HICP is constructed is not available. Second, Wynne made suggestions as to which are the main research priorities on measurement biases related to the HICP. He suggested that the theoretical framework of the HICP must be more fully elaborated. Other areas that require further work are those of quality change and new goods.

After the presentation of the two previous papers, John Astin talked about the work in progress at Eurostat on the HICP. He started by explaining the role of the Eurostat in the development of the HICP. The collection and data processing is done by the member states. Eurostat is responsible for preparing the regulations and is intending to produce a manual bringing together all relevant texts. Eurostat takes an interest in academic research but does not have the resources to contribute significantly to the literature. Astin expressed the view of Eurostat on issues related to the HICP that had been repeatedly mentioned during the workshop.

- *Quality adjustment.* Astin said that there is a misconception among many people that the HICP is computed without quality adjustment. This is far from the truth. Quality adjustment was from the beginning the most important factor for comparability of national CPIs. Quality adjustment is covered in one of the implementing regulations of the HICP. Member states are required to make appropriate quality adjustment based on explicit estimates, and where no estimates are available, price changes should be estimated as the difference between the price of the selected substitute and the price of the item it has replaced. Astin acknowledged that the regulation on quality adjustment was not specific enough, and leaves countries with far too much flexibility of choice. At present Eurostat monitors disparities in quality adjustment in different member states through the so-called implicit quality indexes (IQIs), and these show that quality adjustment does indeed vary significantly among countries.
- *Owner-occupied housing.* It is the intention of the Eurostat to correct the omission of owner occupied housing from the HICP. From a pragmatic viewpoint the

only feasible method to include it is the net acquisitions price. The majority of member states found unacceptable other approaches, such as imputed rents, or the user cost.

• *Incorporating interest rates such as mortgage interest payments.* There is no intention on the part of Eurostat to bring those into the HICP. This is because there is a preference to remain within the concepts of the National Accounts, and according to the ESA95 interest payments are neither a produced good nor a service.

• *The conceptual framework.* John Astin envisaged further work on the definition of the HICP with a view to helping direct decisions on sampling, replacing and matching issues. Work on the conceptual framework will be done without abandoning the Laspeyres type index concept. There is no intention to move towards a COLI, as doing so would require a change in the current regulation.

Ernst Berndt gave a presentation on the major issues addressed by a recent report commissioned by the US Bureau of Labor Statistics (BLS) from the Committee on National Statistics of the National Academy of Sciences (NAS)[18]. The focus of this report was on the conceptual, measurement, and other statistical issues in the development of COL indices. The committee of experts was asked to give their recommendations on what efforts should be undertaken to further improve inflation measurement in the US. Ernst Berndt served as a member of that committee. The main issues addressed in the study were the following:

- Assessment on the validity of a Costs of Goods index versus a COL index;
- The scope and domain of the index;
- How to best account for substitution behaviour;
- Wider the use of hedonic methods;
- Use of virtual prices to deal with the problem of new goods.

Wolfgang Schill presented an assessment on the relevance of the topics discussed during the workshop from the ECB viewpoint as a user of statistics. He highlighted a list of features of the HICP that are highly appreciated by the ECB. This list includes the following points:

- Harmonisation.
- Common ground with ESA95.
- Excludes interest rate developments. This avoids confusion about the working of Monetary Policy.
- It is accepted by the public.
- Builds upon prices from transactions, which is what monetary policy wants to see.
- Broad coverage.
- Timeliness and reliability.

[18] *National Research Council (2001). At What Price? Conceptualizing and Measuring Cost-of-Living and Price Indexes. Panel on Conceptual, Measurement, and Other Statistical Issues in Developing Cost-of-Living Indexes, Charles L. Schultze and Christopher Mackie, Editors. Committee on National Statistics, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press. http://www.nap.edu/catalog/10131.html*

He highlighted that the main challenges in the future developments for the HICP will lie in dealing with new products and quality improvements. Also, transactions in the services sector are more difficult to classify in well-defined categories. This is potentially important in view of the growing importance of the services sector. Furthermore, innovation technology is affecting the nature of transactions themselves, for example through the use of the Internet. This is of concern as it might be the case that traditional practices for data collection could become obsolete.

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Vítor Gaspar praised the achievements of the statisticians who produced the HICP. The mandate of the statisticians was to focus on harmonization, i.e. on comparability, and the main motivation for this was to facilitate assessment of the convergence criteria for EMU. But the statisticians had the vision that an index should be available for the Monetary Union. The Protocol on the convergence criteria established a clear link between the notion of price stability in the European Union Treaty and price measurement on the basis of consumer price indices. It constrained the domain of prices to consider when assessing the success of the ECB in delivering on its price stability mandate. It is therefore beyond doubt that the motivation for the production of the HICP is closely linked to the process leading to economic and monetary union in Europe. In any case the need to compute a monetary union indicator, labelled Monetary Union Index of Consumer Prices (MUICP) in Article 2 (c), of the regulation, was not the dominant concern. Most Council and Eurostat regulations would have been enacted even without the specific requirements deriving from the need to calculate an index for the euro area. As required by the framework regulation, HICPs, for each Member State, have been produced and published, since March 1997[19]. These indices were immediately accepted by the Commission and the European Monetary Institute (EMI) as satisfactory for assessing the achievement of convergence. The official publication of the HICP for the euro area as a whole (the MUICP) began as from the start of Stage 3 of Monetary Union in January 1999. As important users the EMI, and subsequently the ECB, have been closely involved in all the conceptual work

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[19] *The Interim Indices of Consumer Prices (IICPs) were released In February 1996 and reflected the progress in harmonisation achieved up to then. The Convergence Report referred to the IICPs as: "Though not yet fully comparable, IICPs are considered to constitute a much better basis for the assessment of inflation convergence among member states than the national CPIs"*

behind the harmonization of national consumer price indices. This work has been led throughout by the European Commission (Eurostat) in co-operation with the National Statistical Institutes.

Despite the high quality of the HICP, Vítor Gaspar enumerated four areas which could benefit from further improvement. First, systematic documentation of methodologies and practices. Second, the treatment of quality change and new goods. The importance of quality change is closely related to the dynamism of modern economies. And this is particularly important in two respects: i) services rather than goods have now the largest share of output, and heterogeneity and product differentiation are prevalent; ii) The pace of innovation leading to the introduction of new goods has substantially increased over the last years. Third, the treatment of owner-occupied housing. The inclusion of owner occupied housing is particularly important from the perspective of the representativity of the index. This is so because the importance of rental homes versus owner occupied homes varies widely across member states. Finally, further work on the general index type or the index formula may be needed.

6.

Some Other Issues

The workshop made clear that research by economists is providing valid tools aimed at circumventing measurement issues in price indices. It is worth mentioning that the mandate of the committee of experts of the NAS mentioned above was to provide new methods and recommendations to improve measurement of consumer prices. This was a *de facto* acknowledgement that a useful input from economists is expected in this area. Papers at the workshop covered a range of techniques to deal with measurement problems.

Jacques Mairesse[20] presented an analysis of the consistency of the French producer price index with data on price changes published in the French Business Survey. They found that the dispersion between these two types of measures was extremely large and attempted to develop a model of friction that could explain this inconsistency. Peter Hill acting as discussant of this paper pointed that the two French enquiries are not treated symmetrically, and therefore one does not know whether to expect consistency or not. As for the model of friction developed, he pointed that the thresholds (for a no-change in prices reply in the French Business Survey) appear to be too large to be those expected from people to be in doubt about changes in prices. Stephen Cecchetti pointed that the implicit levels of inflation computed from survey data are usually wrong, but there is valid information in this survey about changes in inflation. He pointed out that it is also important to look not only at first and second moments, but the third and fourth moments as well. The third moment of inflation is important to know whether there are downside price rigidities. Mick Silver asked whether the form in which the question on price changes is put to the company managers in the French Business Survey includes quality adjustment.

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Ian Crawford[21] presented a revealed preference method for calculating a virtual price for valuing new goods. Rather than a virtual price, the nonparametric method proposed computes a lower bound for that virtual price. This technique allows the computation of a cost of living index when the number of goods available changes over two periods. He applied this technique to the case of the UK National Lottery, and showed that the failure to include the National Lottery in a superlative measure of consumer price inflation in the UK caused an upward bias of 0.156 percentage points. Pedro Neves pointed that the revealed preference approach

[20] *Desplatz, R. and Mairesse, J. (2001): 'Assessing the Consistency of Price Changes at the Firm Level in Two Widely Different Data Sources: The French Producer Price Surveys and the French Business Surveys'. Paper downloadable from http://www.ecb.int*

[21] *Blow, L. and Crawford, I. (2001): 'A Non-Parametric Method for Valuing New Goods'. Paper downloadable from http://www.ecb.int*

could be used to deal with other types of biases such as quality bias and substitution bias. But the success of this technique depended very much on having enough variation in relative prices. He also noticed that, despite the theoretical merits of the revealed preference approach, its implementation raises some difficulties for statisticians, given the very strong data requirements. Gabriel Fagan questioned the use of these techniques by NSIs. He pointed that looking at the practicalities of the HICP, NSIs take time before they incorporate new goods, and therefore information on previous prices is available at the time this good is incorporated. David Fenwick pointed out that the lottery is not in the UK RPI and that the latter is not a COL index. He questioned therefore the appropriateness of using the revealed preference approach outside the framework of a COL index. In addition he also cast doubt on the realism underpinning the restrictive conditions under which revealed preference theory can be applied. Mick Silver mentioned that for a COL index it is essential to do something about new goods, but given the difficulties of the method proposed by Ian Crawford, he pointed that it might be possible to use an alternative 'dirty method' like for example to conduct a survey on consumers asking if they would be willing to buy a certain good if the price went down by a certain amounts.

Nicole Jonker[22] compared the hedonic method for quality adjustment with a method based on the use of discrete choice models. She pointed that while the hedonic method was based on both consumer and producer theory, the discrete choice model concentrates on consumer utility maximising behaviour. A drawback of the discrete choice-model is that its computation requires information on individual consumers income, information that is not typically available to working statisticians on a real time basis.

Irwin Collier[23] computed comparable cost of living indices for East and West Germany over the period 1989-1998. The official price statistics available are only able to observe the parallel development of consumer prices in East and West Germany, but in order to calculate the purchasing power of the DM in East and West Germany detailed price comparisons are needed. On the basis of a study on comparisons of consumer prices for 1993 Collier gauged the difference in the costs of living. Axel Weber pointed to the fact that price deregulation needs to be accounted for in the computation of the index. Price changes related to changes in regulation are particularly drastic in the energy and house rental markets.

[22] *Jonker, N. (2001): 'Construction Quality Adjusted Price Indexes: A Comparison of Hedonic and Discrete Choice Methods'. Paper downloadable from http://www.ecb.int*

[23] *Collier, I. (2001): 'The DM and the Ossi Consumer: Price Indices During Transition'. Paper downloadable from http://www.ecb.int*

[24] *Cummins, J. G. and Violante, G. (2001): 'Equipment-Embodied Technical Change in the US (1947-1999): Measurement and*

Gianluca Violante[24] presented a paper in which by extrapolating the quality-bias in the official price indices measured in Gordon (1990)[25], they constructed quality adjusted price indices by type of equipment from 1947-2000 in the US and used them to measure embodied technical change at the aggregate level. The results presented showed a great variation in the rates of embodied technical progress across industries. Embodied technical change, and not total factor productivity, was shown to be the main driving force of growth outside durable goods manufacturing. Results also showed that the aggregate rate of equipment embodied technical change accelerated to more than 6 percent a year during the 1990s (from a postwar average of 4 percent), and that the technological gap between the frontier (or state of the art) technology and the average machine increased substantially in all industries since the 1970s.

Jorge Duran[26] presented a paper that employed the economic approach to index number theory to define the growth rate of real output in an economy with growth driven by embodied technical change. He showed that the chained Fisher index used to measure real output growth in the US National Income and Product Accounts provides an accurate estimate of output growth when technical change is embodied in new capital goods and that the contribution of embodied technical change to per capita GDP growth in the US is as large as 69 per cent.

Applications to Growth Accounting'. Paper downloadable from http://www.ecb.int

[25] *Gordon, R. J. (1990):The Measurement of Durable Goods Prices, Chicago, IL: University of Chicago Press.*

[26] *Duran, J., Licandro, O. and Ruiz-Castillo, J. (2001): 'The Measurement of Growth Under Embodied Technological Progress'. Paper downloadable from http://www.ecb.int*

7. Summary and Areas for Future Research

The primary objective of the workshop was to establish a dialogue between central bankers, statisticians and academics on the state of price measurement in Europe, with particular reference to the HICP. The workshop must be judged a success in this regard, and the issues addressed at the workshop provide a rich research agenda for the future. The two main conclusions of the workshop from an ECB perspective were, first, that there is no strong presumption concerning the sign and magnitude of possible biases in the HICP as it is currently constructed; and second, that the gaps in the conceptual framework of the HICP need not be a barrier to future improvements in price statistics in the EU. The papers presented at the workshop showed that there is a significant amount of research underway on the thorniest issues in price measurement, specifically how to deal with new goods and quality change. In addition to the traditional hedonic approach to quality adjustment, work is under way assessing the viability of variants of hedonic analysis, along with completely new approaches. However, it will require the accumulation of a significant number of additional studies of components of the HICP before we can begin to put a more precise estimate on the extent of the bias in this index, if any. It is important that the large components of the HICP that have not so far attracted attention (such as apparel, food, transportation and so on) be included in future studies so as to fill out the gaps in our knowledge.

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Discussions that took placed during the Workshop pointed to three main priority areas for further research:

1) *The use of list as opposed to transaction prices.* A topic that seems to have been overlooked in the literature is the problem of bias due to the use of list as opposed to transaction prices. This issue received prominent attention in the Stigler Commission Report in 1961. However the concern then was only with its impact on the Wholesale or Producer Price Index, where the data are collected from firms directly. The issue was not mentioned by the Stigler Commission in its discussion of the CPI, and the Boskin Commission did not mention it either. Most reviews of measurement error have tended to follow the taxonomy of sources of bias introduced by these studies, with the result that the list versus transactions issue does not

receive a lot of attention, as Mark Wynne noted. From the perspective of the ECB this is potentially an important problem, as excessive reliance on list as opposed to transactions prices in the HICP might cause that index to systematically overstate inflation during slowdowns, and understate it during cyclical upswings. The issue of list versus transactions prices also arises as a potential caveat on the interpretation of the results of some of the papers presented during the workshop. It is obviously not an issue for the paper presented by Mick Silver, given the manner in which scanner data are collected.

2) *Alternative approaches to the hedonic method to the problem of quality adjustment.* The recent NAS report suggested that the BLS should adopt a more cautious approach to the integration of hedonic indices into the US CPI. There seems to be concern in some quarters that hedonics may over adjust for quality change in certain circumstances, even though the hedonic approach is still probably the best method of quality adjustment available. There appears to be a need for further work on alternative approaches to the problem of quality adjustment and also to the related problem of new goods. Indeed, some of the papers presented during the workshop provided some contributions in this area. The paper presented by Mick Silver provided a detailed discussion of the matched models method and its possible shortcomings. Those papers presented by Olympia Bover, Omar Licandro, Nicole Jonker and Ian Crawford explored some new methods.

3) *Measuring output growth and productivity.* Some of the research presented at the workshop had relevance to price measurement issues in other areas, specifically the deflation of investment expenditures and the measurement of productivity growth. In light of the significant amount of attention that the workshop succeeded in bringing to bear on measurement issues in the HICP, a follow-up workshop on measurement of output growth and productivity might be worthwhile.