An Estimate of the Measurement Bias in the HICP

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Abstract: This paper provides an estimate of the measurement bias in the Harmonised Index of Consumer Prices (HICP) that the European Central Bank uses to define price stability in the euro area. The estimate is based on a comparison of the rate of increase in consumer prices as measured by the HICP and the responses to a question about recent changes in the cost of living on the European Commission's monthly Harmonised Consumer Survey (HCS). I find that the HICP may overstate the true rate of inflation by about 1.0 to 1.5 percentage points a year.

Keywords: Harmonised Index of Consumer Prices, Harmonised Consumer Survey, measurement error

JEL Codes: E3, C8

This paper uses the information in the European Commission's monthly Harmonised Consumer Survey (HCS) to estimate the magnitude of potential measurement error in the Harmonised Index of Consumer Prices (HICP). The HICP plays a central role in the policy deliberations of the European Central Bank (ECB) yet relatively little is known about how well it tracks the true rate of inflation.

The European Central Bank has defined its treaty mandate of price stability as "a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%." Amongst the rationales provided for defining price stability as prevailing at some positive measured rate of inflation is the possibility that measured inflation may overstate the true rate of inflation (see, for example, European Central Bank, 2004). It is well known that official inflation statistics may overstate the true rate of inflation (or more specifically, the true rate of increase in the cost of living) by failing to account for substitution responses to changing relative prices, failing to incorporate new goods and services in a timely manner and failing to take account of improvements in the quality of existing goods and services. The issue of measurement bias in measures of consumer price inflation has attracted greater attention in recent years, due in part to the decline in inflation in many countries. The Boskin Commission (Boskin et al. 1996) estimated that the US Consumer Price Index overstated inflation by 1.1 percentage points a year, with a range of estimates from 0.8 to 1.6 percentage points. Lebow and Rudd (2003) revisited the question of measurement bias in the US CPI to see whether recent changes in the construction of the index have made it more accurate, and found that it still overstated inflation by as much as 0.9 percentage points a year, with a range of plausible estimates of between 0.3 and 1.4 percentage points.

To date, there has only been one comprehensive survey of the accuracy of the HICP. Wynne and Palenzuela (2003) conclude with the observation that the paucity of basic research on the accuracy of the components of the HICP makes it difficult to arrive at a meaningful estimate of overall bias. Indeed, the only comprehensive survey of the accuracy of national consumer price indexes within the European Union is Hoffman's (1998) study of the German CPI. Hoffman concluded that the overall bias in the German CPI was of the order of 0.75 percentage points a year. Hoffman later revised his estimate

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of bias down to 0.5 percentage points based on improvements in the German Federal Statistics Office's methods.

We may classify existing approaches to estimating measurement bias in price indexes into two broad categories. The direct or bottom up approach followed by Boskin et. al. (1996) Lebow and Rudd (2003) and Hoffman (1998) considers each component of the price index and how these components are aggregated to arrive at an estimate of overall bias. The indirect approach looks at whether the measured rate of inflation is consistent with other data. For example, Costa (2001) and Hoffman (2001) estimate bias in the US CPI by examining the stability of estimated Engel curves for food and recreation. Both authors find evidence of leftward movement in estimated Engel curves for food in the US, which they interpret as being due to of upward bias in the CPI. Bils and Klenow (2001) estimate quality Engel curves for a range of durable goods to estimate quality bias in the US CPI. Another good example of the indirect approach is Nordhaus' (1998) estimate of the bias in the US CPI based on a comparison of the change in median household income deflated by the US CPI with the responses to the University of Michigan's consumer survey. The idea is that if the CPI is accurately measuring changes in the cost of living then when equal numbers of households report themselves as being better off as report themselves as being worse off, real median household income deflated by the CPI should be unchanged. If measured real median income is falling when equal numbers of households are reporting themselves as being better of as are reporting themselves as being worse off, then this would suggest the presence of upward bias in the CPI. And indeed this is what Nordhaus finds. His inferred bias of 1.5 percentage points over the period 1968 to 1994 is remarkably close to the Boskin Commission's estimate that the CPI overstated inflation by about 1.3 percentage points prior to 1996, and is cited by Gordon as important independent evidence supporting the Boskin Commission's estimate.

However an important shortcoming of Nordhaus' method is that it assumes that the entire distribution of income moves with the median. As Krueger and Siskind (1998) point out, if the distribution of income moves in a way that is not related to the median,

then the Nordhaus approach may overstate or understate the degree of bias.[2] Rather than rely on households' perceptions of how their standard of living has evolved over time, even cleaner estimate of bias could be based on a comparison of measured inflation and household's perceptions of changes in the cost of living. Such a comparison would not be susceptible to Krueger and Siskind's (1998) critique of Nordhaus' method. Estimates of bias based on a comparison of measured inflation with households perceptions of inflation have not been made for the US due to the lack of data, but are feasible for the EU, given the long history of the European Commission's Harmonised Consumer Survey.

The HICP and the HCS

The HICP has its origins in the requirement of the Maastricht Treaty that, for the purposes of assessing the convergence criteria to be used in determining which EU member states were ready for monetary union, inflation should be measured on a comparable basis. Prior to the introduction of the HICP, all of the member states of the EU compiled measures of consumer price inflation, but the conceptual frameworks and coverage of these indexes differed significantly. [3]The purpose of the HICP is to measure inflation in a comparable manner across the EU. Interim HICPs (which were based on national CPIs) were first published in 1996, with publication of the HICP proper beginning in 1997.[4]

The European Commission's monthly Harmonised Consumer Survey (HCS) is conducted every month across the European Union as part of the joint harmonised EU program of business and consumer surveys.[5] The program began in 1961 with surveys of business. The consumer survey was initiated in May 1972, and is now carried out in all 25 current members of the EU. The survey is conducted on behalf of the European

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[2] For example, suppose the economy consists of five households. Suppose further that the two households at the top of the income distribution experience an increase in their real income, while the household at the bottom experiences a decline and the remaining two household experience no change. Real median household income will remain unchanged, but more households will report themselves as being better off than will report themselves as being worse off.

[3] See Tables 3-5 of the 1998 *Report from the Commission to the Council on the Harmonization of Consumer Price Indices* in the European Union in Commission of the European Communities (2001)

[4] For more details, see Commission of the European Communities (2001).

[5] For more details see European Commission (2004).

Commission by various national survey organizations. The sample size in each of the fifteen countries that were members of the EU prior to the most recent expansion ranges between 1,000 and 3,300 consumers. The survey asks a standard set of questions in all countries, and the results are reported each month by the European Commission, and used as inputs to the monthly economic and consumer sentiment indexes.

Question 5 of the HCS asks

"How do you think that consumer prices have developed over the last 12 months? They have

PP	risen a lot
P	risen moderately
=	risen slightly
M	stayed about the same
MM	fallen
N	don't know.

The answer to this question are reported as balances defined as $B = (PP + \frac{1}{2} P) - (\frac{1}{2} M + MM)$, which will clearly range from -100 to +100 depending on the distribution of responses. Note that the midpoint of the admissible responses, which is typically a "no change" response, is that the prices have risen, albeit slightly.[6] The HCS also asks consumers about what they expect to happen to prices over the next twelve months. The responses to this question have been used to construct measures of households' inflation expectations.

Figure 1 shows HICP inflation and the balance statistics for question 5 from the HCS for the 15-member EU since 1990. The two series track each other reasonably well,

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[6] Note that the original phrasing of the question was in terms of the cost of living. Specifically, consumers were asked "Compared with what it was 12 months ago, do you think that the cost of living is now:

PP	very much higher?
P	quite a bit higher?
=	a little higher?
M	about the same?
MM	lower?
NSP	don't know"

See Commission of the European Communities (1991).

and more detailed examination of the survey responses show that they make sense: the percentage of consumers responding that consumer prices have increased tends to rise as the measured rate of HICP inflation increases; the percentage of consumers responding that prices have stayed the same or declined tends to fall as the measured rate of inflation increases. Perceived inflation fell steadily over the course of the 1990s as measured inflation declined in the run up to monetary union. Figure 1 also shows the well-documented surge in perceptions of inflation around the time of the euro cash changeover.

To assess the potential for measurement error in the HICP, we can compare the measured rate of inflation with consumers' perceptions of inflation over a comparable time period. However, the balance statistic as reported each month is not appropriate for this task, since the mid-point of the responses still allows for some inflation. I recalculated the balance as B* = (PP + P + '=') – (MM), that is as the percentage reporting that consumer prices have risen minus the percentage reporting that consumer prices have fallen. Figure 2 shows a scatter plot of HICP inflation against the alternative balance statistic, along with three alternative kernel regressions using the Epanechnikov kernel with bandwidths 7.5, 15 and 22.5 fitted using Nadaraya-Watson regression.[7] The scatter includes data from all of the countries that were members of the EU at the beginning of 2004, except Luxembourg. The data are for the period January 1996 through May 2004.[8]

One would expect that if HICP inflation were properly measured, then measured inflation should be about zero when equal numbers of consumers are reporting that prices have risen as are reporting that prices have fallen. In fact, we see that when B* = 0, measured HICP inflation is somewhere between 1.0 and 1.5 percent a year, suggesting that the HICP has an upward bias of this magnitude. This number is similar to the estimates of bias in measures of consumer price inflation that have been produced by other means for other countries, and is comparable to (although somewhat higher than)

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[7] Use of alternative kernels (Gaussian, Cosinus etc.) does not alter the substantive point. The default bandwidth set by EVIEWS is h = 18.27.

[8] I focus on the post 1996 period since survey data for Austria, Finland and Sweden are only available from October 1995. Luxembourg only started participating in the HCS in 2002.

the number used by Cecchetti and Wynne (2003) in their discussion of the ECB's definition of price stability.

Examination of the scatter plot shows that while this estimate is being driven by a relatively small number of observations (for Finland and Austria), it will be relatively robust to the use of alternative kernels or bandwidths. Nevertheless, the fact that there have been relatively few episodes of outright deflation (as measured by the HICP) along with large numbers of survey respondents reporting that prices have fallen should make us careful about reading too much into these numbers. But given that both the HICP and the HCS employ a common methodology across all EU countries (they are, after all, both harmonised), and given that the implied bias in the HICP is in keeping with prior expectations, the findings are of interest.

Concluding observations.

The idea of using the European Commission's monthly Harmonized Consumer Survey as a check on the accuracy of the HICP is appealing for a number of reasons. Foremost among these reasons are the paucity of studies in the accuracy of consumer price measurement in the EU, and the extensive data on consumers perceptions about inflation that is available from the Harmonized Consumer Survey. The results reported in this note are consistent with the presence of an upward bias of between 1.0 and 1.5 percentage points per annum on average in the HICP. A useful check on the accuracy of this estimate would be to see if it is confirmed by other means, such as estimates of Engel curves.

References

Bils, Mark, and Peter J. Klenow, 2001. Quantifying quality growth. *American Economic Review*, 91, 1006-1030.

Boskin, Michael J., Ellen R. Dulberger, Robert J. Gordon, Zvi Griliches and Dale Jorgenson, 1996. *Toward A More Accurate Measure of the Cost of Living*. Washington DC: US Senate.

Cecchetti, Stephen G. and Mark A. Wynne, 2003. Defining price stability. *Economic Policy*, 37, 395-434.

Commission of the European Communities, 1991. *European Economy; Supplement B, Business and Consumer Survey Results, Special edition, July*. CM-AT-91-050-EN-C. Luxembourg: Office for Official Publications of the European Communities.

-----, 2001. Compendium of HICP reference documents. Luxembourg: Office for Official Publications of the European Communities.

Costa, Dora L., 2001. Estimating real income in the United States from 1888 to 1994: Correcting CPI bias using Engel curves. *Journal of Political Economy*, 109, 1288-1310.

European Central Bank, 2004. *The Monetary Policy of the ECB 2004*. Frankfurt am Main: European Central Bank

European Commission, 2004. *The Joint Harmonised EU Programme of Business and Consumer Surveys User Guide.* Brussels: European Commission.

Hamilton, Bruce W., 2001. Using Engel's Law to estimate CPI bias. *American Economic Review*, 91, 619-30.

Hoffman, Johannes, 1998. Problems of inflation measurement in Germany. Discussion Paper 1/98 Economic Research Group of the Deutsche Bundesbank.

Krueger, Alan B. and Aaron Siskind, 1998. Using survey data to assess bias in the Consumer Price Index. *Monthly Labor Review*,

Lebow, David E., and Jeremy B. Rudd, 2003. Measurement error in the Consumer Price Index: Where do we stand? *Journal of Economic Literature*, 41, 159-201.

Nordhaus, William D., 1998. Quality change in price indexes. *Journal of Economic Perspectives*, Winter, 59-68.

Wynne, Mark. A. and Diego Palenzuela, 2004. Measurement bias in the HICP: What do we know, what do we need to know? *Journal of Economic Surveys*, 18, 79-112.

Figure 1
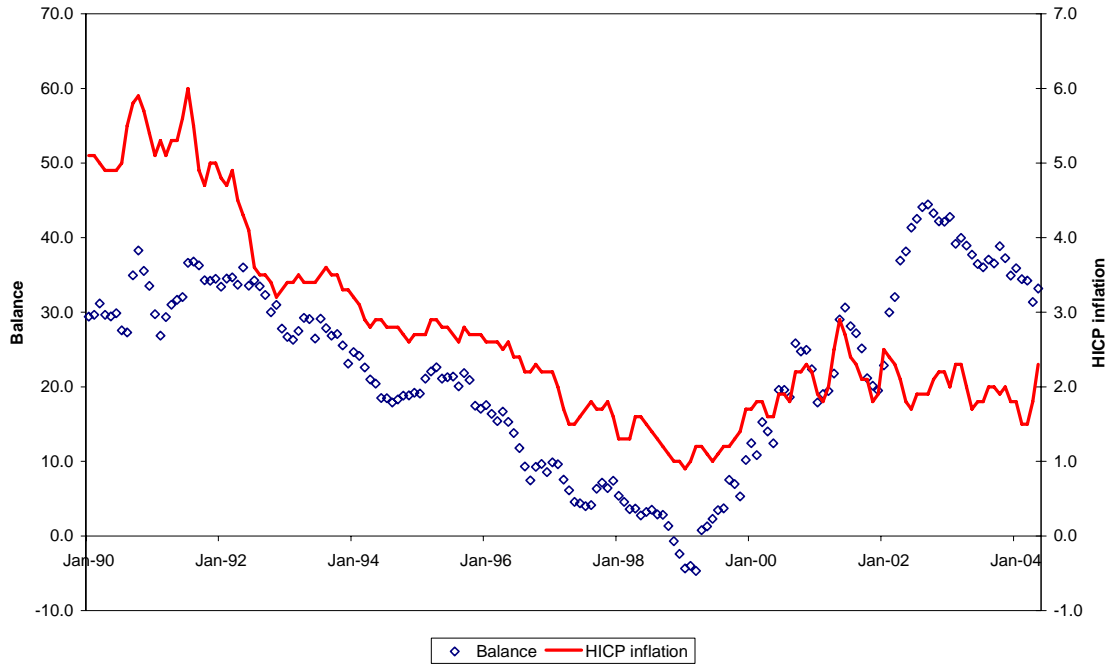**HICP inflation and balance statistic from HCS**

Figure 2
Measured HICP inflation and consumers' assessment of inflation

Alternative balance statistic from HCS
(Percentage of survey respondents reporting consumer prices have risen minus percentage of survey repondents reporting consumer prices have fallen)

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