Econometric Estimates of Hedonic Price Indexes for Personal Computers in Russia

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Abstract
Economists have noted for decades that Consumer Price Index (CPI) in the developed countries is overstating inflation by 0,5-2,0% per year. A significant part of this bias is found to be caused by the effects of new goods and quality change. Information and communication technology (ICT) products are mostly subject to these effects. An increasing weight of these products in the Russian CPI may lead to a substantial upward bias in the Russian CPI. Nowadays hedonic price indexes are believed to be one of the most efficient ways to eliminate the bias. They can be used in two ways: to estimate the bias in CPI and to elaborate an alternative to official price indexes for ICT products. In this study we estimate hedonic price and quality indexes for Personal Computers, the most widespread ICT product, in Russia. Using 21 months data (03.2004-11.2005) we estimated a 25% fall in PC prices for 20 months (about 17% on 12 months scale). We have also estimated that elementary price index for PC may be biased upward by 17-27% per year due to the usage of traditional matched models. Hence, the Russian CPI can be overstated by 0,19-0,31% per year. Hedonic quality indexes indicate a significant quality growth of PC (GAGR 19% per year) which is the best explanation for the rapidly falling prices.

Keywords: Hedonic Regression, COLI, CPI, Hedonic index, Personal Computer, CPI bias, Consumer Price Index, Quality-adjustment, ICT

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1 Long Abstract

In the last two decades considerable attention has been drawn to the methods of computing price indexes for Information and Communication Technology (ICT) products: the discussion started in the USA and then has been continued throughout the globe. Report prepared by Boskin Commission (1996) raised the problem of biases in the price indexes for ICT products: it showed that traditional matched models indexes can substantially overestimate inflation, because they are not able to measure the peculiarities of ICT industries (i.e. fast rotation of goods, huge quality differences among products on the market, short product life cycle, etc). The Commission showed that the use of matched model indexes leads to inflation rates overestimation by 0.6% per year in the US official CPI (CPI-U). Similar results were obtained by Crawford (1998) for Canada, Shiratsuka (1999) for Japan, Hoffmann (1998) for Germany and Cunningham (1996) for the UK.

But the growing discussion does not only concern price measurement (inflation), or price indexes, but also deflators. Deflators are crucial for computing such items as investment, labor productivity, economics growth measures, etc. For example, in the USA growth acceleration after the 1995 was mainly driven by the increased investment in ICT products that lead both to an increase in capital stock and labor productivity growth (Bosworth and Triplett, 2001). In this respect, correct measurement of deflators is crucial for understanding the sources of economic and productivity growth. Another issue to be solved concerns international comparability, especially for ICT deflators. Papers by Wyckoff (1995) and Eurostat (1999) demonstrate that there is a huge dispersion in ICT deflators in OECD and European countries, accordingly.\footnote{Wyckoff (1995) estimates the range for ICT deflators for OECD countries in the 1980s from -72% to +80% per year. Eurostat (1999) estimated a smaller dispersion for the period of the early 1990s for European countries – from -47% to -10%.

These differences are so huge that they cannot be explained by market conditions, regulation differences or other similar factors. As both studies suggest, most part of the variation comes from the differences in quality adjustment procedures across countries, and that makes international comparison of real investment in ICT impossible (as it is usually calculated through deflation). So, this also makes any attempt to estimate the impact of ICT on economy across countries quite challenging.

Despite the fact that price indexes are the main measures of inflation and are used to calculate real (deflated) values of macroeconomic indicators, little attention is paid to them in Russia and other former USSR countries (CIS). The inability of Russian statisticians to eliminate biases in the price indexes used will inevitably lead to biased measures of inflation and economic growth. Given that the Russian government is proposing the stimulation of ICT industries' development, the inability to eliminate biases for these products would lead to inefficient policy decisions, because the price indexes for ICT products would be most likely biased up, while productivity growth, investments, consumption would be underestimated.

In this paper we would like to estimate hedonic price and quality indexes for personal computers (PC) in Russia. That would help us to find out whether there needs to be as much concern about ICT products price methodology as in the OECD countries. Hedonic indexes and hedonic methods are very useful and are often used for calculating quality-adjusted price indexes. We have chosen PCs as an object of our research in order to make the comparison with the results obtained for OECD countries possible.

Recent studies of hedonic price indexes for PC show that quality adjusted prices decline by 25-35% a year in the USA (Pakes, 2002, Berndt, Ernst R. and Neal J. Rappaport, 2001, Berndt, Ernst R., Zvi Griliches and Neal Rappaport, 1995), 34% in Germany (Moch, 2001), 33-36% in France (Bourot, 1997) and 28-34% in Taiwan (Jang et al.,1996). There is no evidence about quality-adjusted price indexes for PCs in Russia: Russian statistical agency (Rosstat) computes a price index for PC as part of the CPI, but it is not publicly accessible.\footnote{Problems with methodology of price index computing for such goods as PCs might be the main reason why...}
Investment deflators for ICT are not developed as well.

This study provides evidence on quality-adjusted prices for PCs in Russia for the period of 03.2004-11.2005. We are using characteristic hedonic method to compute them. Using these data we calculate 10 hedonic price indexes and 8 hedonic quality indexes: we have added “superlative” Edgeworth-Marshall and Walsh indexes to the commonly used in hedonic literature Laspeyres, Paasche and Fisher indexes.

Our results demonstrate the importance of quality-adjustment in computing price indexes for PCs and other similar ICT goods in Russia. The hedonic PC prices are falling with GAGR from -22.56% to -16.50% during a 21-months period (03.2004-11.2005). Falling prices are accompanied by a significant growth in characteristics and quality. Hedonic quality indexes grow with GAGR of 19.12-28.42%. According to an overview by Triplett (2004), Berndt and Rappaport (2001), Moch and Triplett (2002), hedonic price indexes for the USA, Germany and other countries decline by 20-35% per year. In our paper we estimate a price fall of about 17% (in rubles). Taking into account currency rate change, a price fall estimate is 18% per year (in US dollars), that is lower than the average for OECD countries. We see several reasons for this difference: the level of competition on the Russian PC market, consumer heterogeneity, sample bias and method of calculating the currency volatility.

We also calculate PCs’ elementary price index bias (16.57-27.47% per year) and a corresponding possible CPI bias (0.19-0.31% per year), that arise presumably due to the use of traditional matched models.

This paper can also have a set of important implications and recommendations for the Rosstat. First, we strongly recommend to start research on whether hedonic methods should be applied into the official practice. Most OECD countries, Australia, Japan, and Taiwan are using hedonic methods for calculating price indexes for many ICT products, including PCs.

Secondly, we strongly recommend beforehand to start process of finding appropriate data for hedonic regressions. It might come either from vendors or research companies. In both cases, Rosstat would have to negotiate sample collection procedures to increase the quality of data. Thirdly, we find that such methods like ”time-dummy”, ”option-cost” or any other that use only a part of all estimated coefficients should be avoided. Methods that use all coefficients and, hence, estimate a price from hedonic regression are more reliable since they do not depend that heavily on omitted variable bias, multicollinearity and other issues.

As for the implementation of hedonic indexes in official practice, we would like to mention two option to be considered: first is either to implement hedonic methods at regional level or estimate single regression for the whole country. In the first case, each regional branch of Rosstat will estimate it’s own regression for it’s region that it will be using for quality-adjustment. Second option that Rosstat will estimate a single regression that will be used at regional levels for quality-adjustment.¹ Second option, concerns the hedonic method to choose. Indirect methods, that use price imputation, requires more resources and data, but reduces the variance of price indexes. Characteristic method is more simple, but requires timely data (each month).

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¹The same idea of a single regression for European Union is discussed by Konijn, Moch and Dalen (2002) within The European Hedonic Center, a project funded by Eurostat.
References


