November 2016

Hedonic Regression Models for Quality Adjustment
in the Corporate Goods Price Index and the Services Producer Price Index
- Computer Printers -

To account for price changes with the quality being constant, quality adjustments between old and new sample prices need to be done. The Bank of Japan employs various quality adjustment methods and hedonic regression method is one of them[1].

The Bank has updated the hedonic regression models[2] for inkjet and laser printers[3]. See the appendix 1 and 2 for the results. These hedonic regression models are used for "Computer printers" (Producer Price Index, Export Price Index, and Import Price Index) and "Communications & office equipment rental and machinery & equipment rental for service industries" (Services Producer Price Index).

The details of samples for the estimation are as follows.

I. The price data for inkjet and laser printers are taken from "BCN Ranking", the BCN Inc. database. The price data are retail prices at the large-size electrical appliance retailers.

II. Specifications for inkjet and laser printers are taken from the "BCN Ranking" and the brochures.

III. The numbers of the observations for inkjet and laser printers are 68 and 57 respectively. The data from 2014/Q3 to 2016/Q2 are used to estimate the hedonic regression models, which are adopted from October 2016 for the quality adjustment.

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[1] For more details, see the Outline of the Corporate Goods Price Index (CGPI, 2010 base) and the Outline of the Services Producer Price Index (SPPI, 2010 base) on the Bank's website.

[2] The Bank adopts two hedonic regression models, one for inkjet printers and one for laser printers.

[3] Laser printers include LED printers.

Estimation Result for Inkjet Printers

	2014/Q3-2016/Q2	(Ref.)2013/Q3-2015/Q2
Estimated Model	Double Box-Cox Model	Double Box-Cox Model
Box-Cox Parameter of Dependent Variable	0.052	0.157
Intercept	-545.006 ***	19.370 ***
Input Paper Capacity (Standard, sheets)	1.682E-07 ***	6.018E-06 ***
Box-Cox Parameter	2.308	2.030
Input Paper Capacity (Options, sheets)	7.200E-04 ***	0.020 ***
Box-Cox Parameter	1.109	0.801
Fax Memory (pages)	0.026 ***	0.086 ***
Box-Cox Parameter	0.523	0.394
Print Speed (Black, ppm)	1607.459 ***	0.102 ***
Box-Cox Parameter	-2.883	1.098
Number of Tray	0.164 ***	--
Box-Cox Parameter	1.104	
Dummy Variables		
Number of Ink		
not less than 6	0.548 ***	--
Printing Function		
A3 Size	--	1.689 ***
A3+ Size	0.738 **	--
CD/DVD Label	--	1.596 ***
Standard Accessory		
2 Cordless Telephones	--	1.939 ***
Preview Display	--	1.738 ***
Period		
2013/Q4	--	-0.907
2014/Q1	--	1.250 ***
2014/Q2	--	0.224
2014/Q3	--	-0.288
2014/Q4	-0.276	-0.768
2015/Q1	-0.227	-1.463 ***
2015/Q2	-0.137	-1.732 **
2015/Q3	-0.039	--
2015/Q4	0.304 **	--
2016/Q1	1.143 ***	--
2016/Q2	0.243	--
R^2	0.949	0.938
Adjusted R^2	0.935	0.926
Standard Error of Regression	0.346	1.024
Mean of Dependent Variable	13.413	25.379
Number of Observations	68	89

Note: ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

Estimation Result for Laser Printers

	2014/Q3-2016/Q2	(Ref.)2013/Q3-2015/Q2
Estimated Model	Double Box-Cox Model	Double Box-Cox Model
Box-Cox Parameter of Dependent Variable	0.119	0.125
Intercept	-127.233 **	43.897 ***
Print Speed (Black, ppm)	6.940E-05 ***	--
Box-Cox Parameter	3.009	
Input Paper Capacity (Standard, sheets)	109.594 **	1.910 ***
Box-Cox Parameter	-0.742	0.045
Standard Memory (MB)	--	2.860E-04 ***
Box-Cox Parameter		1.419
Auto Document Feeder Capacity (sheets)	--	0.208 ***
Box-Cox Parameter		0.288
Running Cost (Black, yen per page)	--	-101.651 ***
Box-Cox Parameter		-2.788
Dummy Variables		
Standard Memory		
not less than 256 MB	1.054 *	--
Auto Document Feeder Capacity		
not less than 50 sheets	1.276 **	--
Printing Function		
Color Printing	1.309 ***	1.414 ***
A3 Size	2.583 ***	1.233 **
PostScript Printing	1.119 ***	--
FAX Function	1.166 **	--
Period		
2013/Q4	--	-0.469
2014/Q1	--	-0.402
2014/Q2	--	-0.253
2014/Q3	--	-1.463 ***
2014/Q4	1.351 **	0.067
2015/Q1	0.724	-1.036
2015/Q2	0.271	-0.105
2015/Q3	0.893 *	--
2015/Q4	0.429	--
2016/Q1	--	--
2016/Q2	-0.056	--
R^2	0.897	0.937
Adjusted R^2	0.863	0.919
Standard Error of Regression	0.999	1.016
Mean of Dependent Variable	22.452	23.093
Number of Observations	57	60

Note: ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.