

**Hedonic Regression Models for Quality Adjustment  
in the Corporate Goods Price Index and the Services Producer Price Index  
- Desktop and Notebook Computers -**

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<sup>1</sup>.

The Bank has updated the hedonic regression models<sup>2</sup> for desktop and notebook computers<sup>3</sup>. See the appendix 1 and 2 for the results. These hedonic regression models are used for "Desktop computers" (Producer Price Index and Import Price Index), "Notebook computers" (Producer Price Index, Export Price Index, and Import Price Index), and "Computer rental" (Services Producer Price Index).

The details of samples for the estimation are as follows.

- I. The price data for desktop and notebook computers 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 desktop and notebook computers are taken from the "BCN Ranking" and the brochures.
- III. The numbers of the observations for desktop and notebook computers are 74 and 167 respectively. The data from 2015/Q3 to 2016/Q2 are used to estimate the hedonic regression models, which are adopted from August 2016 for the quality adjustment.

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<sup>1</sup> 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.

<sup>2</sup> The Bank adopts two hedonic regression models, one for desktop computers and one for notebook computers.

<sup>3</sup> The Bank estimates a hedonic regression model for tablet computers independently.

### Estimation Result for Desktop Computers

Estimated Model	2015/Q3-2016/Q2	(Ref.)2015/Q1-2015/Q4
	Double Box-Cox Model	Double Box-Cox Model
Box-Cox Parameter of Dependent Variable	0.783	0.659
Intercept	-1,777,971.338 ***	-723,177.900 ***
L3 Cache (MB)	491.304 ***	109.499 ***
Box-Cox Parameter	0.795	0.548
Main Memory (MB)	1,475,518.373 ***	602,566.800 ***
Box-Cox Parameter	-0.826	-0.830
Hard Disk Drive (GB)	97.207 ***	1.510E-05 ***
Box-Cox Parameter	0.321	2.199
Solid State Drive (GB)	238.740 ***	16.641 **
Box-Cox Parameter	0.295	0.330
Display Resolution (pixels)	0.177 ***	0.156 ***
Box-Cox Parameter	0.595	0.525
Dummy Variables		
CPU		
Intel Celeron	-682.932 *	-278.990 ***
Graphics		
Graphics Memory	2,508.447 ***	595.315 ***
Sound quality		
High Resolution Audio	--	336.101 ***
Pre-installed Application		
Microsoft Office Home and Business 2013 or Microsoft Office Home and Business Premium Plus Office 365 Service limited to 1year (available in Japanese only)	--	280.789 ***
Microsoft Office Home and Business Premium Plus Office 365 Service limited to 1year (available in Japanese only)	1,494.090 ***	--
Producer		
Producer A	5,354.595 ***	887.231 ***
Producer B	5,477.691 ***	683.199 ***
Producer C	4,017.317 ***	734.360 ***
Producer D	2,086.505 ***	--
Period		
2015/Q2	--	110.821
2015/Q3	--	271.725 ***
2015/Q4	-349.168	225.301 ***
2016/Q1	-1,250.250 ***	--
2016/Q2	-465.444	--
R <sup>2</sup>	0.978	0.973
Adjusted R <sup>2</sup>	0.972	0.965
Standard Error of Regression	821.074	213.052
Mean of Dependent Variable	11,759.300	3,354.481
Number of Observations	74	73

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

## Estimation Result for Notebook Computers

Estimated Model Box-Cox Parameter of Dependent Variable	2015/Q3-2016/Q2	(Ref.)2015/Q1-2015/Q4
	Double Box-Cox Model	Double Box-Cox Model
	0.656	0.255
Intercept	-29,181.532 ***	-85,527.244 ***
Clock Speed (MHz)	16,898.832 ***	--
Box-Cox Parameter	-0.534	
L3 Cache (MB)	108.385 ***	0.530 ***
Box-Cox Parameter	0.350	1.188
Main Memory (MB)	3.578E-05 ***	2.093 ***
Box-Cox Parameter	1.820	0.096
Hard Disk Drive (GB)	7.984 ***	--
Box-Cox Parameter	0.558	
Solid State Drive (GB)	7.685 ***	3.683E-04 ***
Box-Cox Parameter	0.791	1.676
Display Resolution (pixels)	--	58,580.268 ***
Box-Cox Parameter		-0.685
Battery Life (minutes)	0.824 ***	5.614E-06 ***
Box-Cox Parameter	0.965	1.970
Dummy Variables		
CPU		
Intel Celeron	--	-3.062 ***
Intel Atom	--	-9.018 ***
ADM E-series APU	--	-6.174 ***
Display Resolution		
not less than Full HD and less than WUXGA	381.197 ***	--
not less than WUXGA	526.055 ***	--
Graphics		
Graphics Memory	152.146 *	--
Display Type		
IPS Display	154.271 ***	--
IGZO Display	308.511 ***	--
Touch Screen Display with Stylus Pen	543.792 ***	2.706 ***
Touch Screen Display without Stylus Pen	277.877 ***	0.781 **
Optical Drive		
Blu-ray Disc Drive	218.820 ***	--
Secondary Storage Type		
Hybrid HDD	--	1.786 ***
Operating System		
Windows 7 Professional or Windows 8.1 Professional 64bit version or Windows 10 Pro 64bit version	329.406 ***	1.213 *
Chrome OS	--	-6.618 ***
Pre-installed Application		
Microsoft Office Home and Business 2013 or Microsoft Office Home and Business Premium Plus Office 365 Service limited to 1year (available in Japanese only)	--	3.670 ***
Microsoft Office Home and Business Premium Plus Office 365 Service limited to 1year (available in Japanese only)	246.351 ***	--
Producer		
Producer A	-448.044 ***	-6.807 ***
Producer B	--	-6.429 ***
Producer C	--	4.617 ***
Producer D	488.307 ***	4.803 ***
Producer E	-285.676 **	-4.328 ***
Producer F	-536.569 ***	-5.096 ***
Producer G	1,101.195 ***	12.885 ***
Period		
2015/Q2	--	1.065 ***
2015/Q3	--	1.175 **
2015/Q4	-247.572 ***	0.412
2016/Q1	-191.241 ***	--
2016/Q2	-133.891 **	--
R <sup>2</sup>	0.973	0.957
Adjusted R <sup>2</sup>	0.968	0.951
Standard Error of Regression	199.479	2.146
Mean of Dependent Variable	3,709.391	75.883
Number of Observations	167	218

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