

## **Hedonic Regression Models for Quality Adjustment in the Corporate Goods Price Index - Digital Cameras -**

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 compact digital cameras, mirrorless interchangeable-lens reflex cameras, and digital single-lens reflex cameras. See the appendix 1, 2 and 3 for the results. These hedonic regression models are used for "Digital cameras" (Producer Price Index) and "Video cameras & digital cameras" (Export Price Index and Import Price Index).

The details of samples for the estimation are as follows.

- I. The price data for compact digital cameras, mirrorless interchangeable-lens reflex cameras, and digital single-lens reflex cameras 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 compact digital cameras, mirrorless interchangeable-lens reflex cameras, and digital single-lens reflex cameras are taken from the "BCN Ranking" and the brochures.
- III. The numbers of the observations for compact digital cameras, mirrorless interchangeable-lens reflex cameras, and digital single-lens reflex cameras are 66, 81 and 48 respectively. The data periods used to estimate the hedonic regression models are from 2015/Q2 to 2016/Q3 for compact digital cameras, and from 2014/Q4 to 2016/Q3 for both mirrorless interchangeable-lens reflex cameras and digital single-lens reflex cameras. These models are adopted from November 2016 for the quality adjustment.

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<sup>1</sup> For more details, see the [Outline of the Corporate Goods Price Index \(CGPI, 2010 base\)](#) on the Bank's website.

<sup>2</sup> The Bank adopts three hedonic regression models for compact digital cameras, mirrorless interchangeable-lens reflex cameras, and digital single-lens reflex cameras.

## Estimation Result for Compact Digital Cameras

Estimated Model	2015/Q2-2016/Q3	(Ref.) 2014/Q4-2016/Q1
	Double Box-Cox Model	Double Box-Cox Model
Box-Cox Parameter of Dependent Variable	-0.077	0.278
Intercept	-54.213 ***	-21,204.316 **
Optical Zoom (times)	0.029 ***	2.283 ***
Box-Cox Parameter	0.441	0.270
Shooting Capability (Battery Performance, shots)	--	39,531.120 **
Box-Cox Parameter		-1.858
Maximum ISO Sensitivity (including Expanded Sensitivity)	0.738 ***	8.611E-04 ***
Box-Cox Parameter	-0.275	0.898
F-Number (Wide-Angle)	-0.026 ***	-69.227 ***
Box-Cox Parameter	2.747	-1.630
Maximum Number of Recording Pixels (Movie)	21.419 ***	1.648E-07 ***
Box-Cox Parameter	-0.363	1.115
<b>Dummy Variables</b>		
Image Sensor Size		
not less than 1 inches and less than APS-C	0.151 ***	7.067 ***
APS-C	0.537 ***	24.423 ***
Full Frame	0.661 ***	27.342 ***
LCD Size		
not less than 3.2 inches	0.205 ***	12.696 ***
Touch Screen Display	--	3.688 **
Waterproof	0.180 ***	9.939 ***
Wireless Fidelity	0.179 ***	5.471 ***
Electronic Viewfinder	0.102 **	2.751 *
Producer		
Producer A	0.261 ***	32.971 ***
Producer B	--	26.199 ***
Producer C	--	18.399 ***
Producer D	0.110 **	8.738 ***
Producer E	--	-5.618 ***
Period		
2015/Q1	--	-1.662
2015/Q2	--	-3.639 *
2015/Q3	0.057	0.603
2015/Q4	0.074 *	0.864
2016/Q1	0.009	-2.729
2016/Q2	-0.010	--
2016/Q3	0.068	--
R <sup>2</sup>	0.959	0.969
Adjusted R <sup>2</sup>	0.943	0.959
Standard Error of Regression	0.092	3.935
Mean of Dependent Variable	7.284	66.268
Number of Observations	66	90

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

Estimation Result for Mirrorless Interchangeable-Lens Reflex Cameras

	2014/Q4-2016/Q3	(Ref.)2013/Q4-2015/Q3
Estimated Model	Double Box-Cox Model	Semi Box-Cox Model
Box-Cox Parameter of Dependent Variable	-0.013	-0.366
Intercept	5.328 ***	2.669 ***
Image Sensor Size (mm <sup>2</sup> )	--	3.160.E-05 ***
Optical Zoom of Kit Lens (max, times)	--	6.210.E-04 ***
AF Sensor Point (points)	--	2.990.E-05 ***
Maximum ISO Sensitivity (Except for Expanded Sensitivity)	0.553 ***	--
Box-Cox Parameter	-0.042	
Longest Focal Length / Shortest Focal Length of Kit Lens	0.121 ***	--
Box-Cox Parameter	0.060	
Dummy Variables		
Electronic Viewfinder	0.253 ***	5.002E-03 ***
Maximum Shutter Speed not more than 1/8,000 second	0.290 ***	5.564E-03 ***
Touch Screen Display	--	2.093E-03 ***
Including Two Kit Lens	--	3.036E-03 ***
Image Sensor Size		
APS-C	0.343 ***	--
Full Frame	1.138 ***	--
AF Sensor Point not less than 300 points	0.349 ***	--
Producer		
Producer A	1.060 ***	0.015 ***
Producer B	-0.425 ***	-0.010 ***
Producer C	--	-5.113E-03 ***
Period		
2014/Q1	--	3.947E-03 ***
2014/Q2	--	2.117E-03
2014/Q3	--	1.062E-03
2014/Q4	--	-2.929E-03 **
2015/Q1	0.191 ***	-3.786E-03 ***
2015/Q2	0.190 ***	-3.425E-03 **
2015/Q3	0.299 ***	6.450E-04
2015/Q4	0.024	--
2016/Q1	0.470 ***	--
2016/Q2	0.289 ***	--
2016/Q3	0.335 ***	--
R <sup>2</sup>	0.920	0.856
Adjusted R <sup>2</sup>	0.900	0.826
Standard Error of Regression	0.143	2.955E-03
Mean of Dependent Variable	10.594	2.688
Number of Observations	81	100

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

### Estimation Result for Digital Single-Lens Reflex Cameras

Estimated Model	2014/Q4-2016/Q3	(Ref.)2013/Q4-2015/Q3
	Double Box-Cox Model	Double Box-Cox Model
Box-Cox Parameter of Dependent Variable	0.526	0.156
Intercept	-924.378 ***	21.864 ***
AF Sensor Point (points)	2.114 ***	0.021 ***
Box-Cox Parameter	1.133	1.378
Shooting Capability (Battery Performance, shots)	0.817 **	6.720E-07 ***
Box-Cox Parameter	0.657	2.082
Maximum ISO Sensitivity (Except for Expanded Sensitivity)	370.808 ***	0.643 **
Box-Cox Parameter	-0.253	-0.065
Optical Zoom of Kit Lens (max, times)	--	0.271 ***
Box-Cox Parameter		0.314
Longest Focal Length / Shortest Focal Length of Kit Lens	82.174 ***	--
Box-Cox Parameter	-0.256	
Dummy Variables		
Full Frame Sensor	623.406 ***	5.769 ***
Maximum Shutter Speed not more than 1/8,000 second	--	1.773 ***
Including Two Kit Lens	--	0.551 *
Continuous Shooting Speed not less than 5 shots/second	--	2.062 ***
Double Slot	187.782 ***	--
Lens Kit's F Number (Wide-Angle) not more than 2.8	136.851 ***	--
Producer		
Producer A	238.491 ***	2.704 ***
Producer B	157.338 ***	1.558 ***
Period		
2014/Q1	--	-0.044
2014/Q2	--	0.148
2014/Q3	--	-0.360
2014/Q4	--	0.843
2015/Q1	27.522	0.215
2015/Q2	-49.104	0.409
2015/Q3	--	--
2015/Q4	--	--
2016/Q1	55.840	--
2016/Q2	-185.695 ***	--
2016/Q3	4.484	--
R <sup>2</sup>	0.991	0.959
Adjusted R <sup>2</sup>	0.988	0.947
Standard Error of Regression	46.838	0.803
Mean of Dependent Variable	1,057.257	33.689
Number of Observations	48	69

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