Quality Adjustment

20-22 SEPTEMBER 2021

TURKSTAT

Methods For Quality Adjustment in CPI

Although almost all quality adjustment is made by imputation or by use of overlapping prices, The following methods are also usefull for quality adjustment.

- Imputation (by elem. aggregate index or by other comparable prices/indices)
- Direct comparison (no quality difference)
- Link to show no price change (quality change = price change)
- Overlapping prices (quality diff. = price diff.)
- Monthly re sampling and chaining (MRC)
- Judgemental adjustment (price collectors, experts, etc.)
- Option pricing
- Production cost method
- Hedonic regression
- Imputation

Actually, no single method is appropriate in all cases and under all conditions. A mix of the Methods may be used according to the type of outlet and market conditions.

Methods For Quality Adjustment in CPI

if quality change is not removed, it will be reflected as a price change

if quality is increasing (decreasing), but not removed from the index, it will overstate (understate) price change

- Sampled products permanently disappear and are replaced
- Attempt to obtain product with the same characteristics so that we can measure pure price change in our price index
- Must make a determination if replacement product has a different level of quality
- If it does, an adjustment in price is needed which reflects the amount of the quality difference

Methods For Quality Adjustment in CPI

Direct estimation methods

- Price of characteristic can be determined from products already available in the market

- Data collector or analyst knowledge of products

- Information provided by the product's producer

- Hedonic regression models

Methods For Quality Adjustment in CPI

Indirect estimation methods

- overlap price available

- Imputing the price change using all other varieties in the industry / item index (stratum relative)

- Imputing the price change using only very similar products / varieties within the industry / item index (targeted/class mean)

Methods For Quality Adjustment in CPI

Hedonic Method;

This method uses a regression model. The model eliminates price differences created by quality changes.

Methods For Quality Adjustment in CPI

Option Pricing

If the quality change can be defined as an option of a product and the price of the option can be determined then the option price method can be used. For example, we assume that a new car is produced with some new specifications (airbag, cd player etc.). The cost of the new specification (option) is evaluted.

Depending on the case, full or 50% of the option price can be substructed from the collected price.

Example for Indirect QA (Overlap Pricing)

Variety	Price Index Month 1	Average Price in Month 1	Average Price in Month 2	Month 2 Price Relative	Price Index Month 2
Prod 1	125.0	150	160	1.067	133.3
Prod 2	150.0	225	250	1.111	166.7
Prod 3	125.0	140	-	-	
Sub 1		(160)	180	1.125	140.6
All items	132.83			1.10062	146.9

Product 3 is no longer sold; Substitute 1 is the replacement. Index would rise 15%

with no QA $[(160\times250\times180)^{\frac{1}{3}} /(150\times225\times140)^{\frac{1}{3}}]=1.1517$

The value of the quality difference is estimated to be 20 in the previous period.
The prices used for computing the index for Month 2 would be 160 and 180.
The price index reflects a pure price change of only 10% (not 15%)

$[(160\times250\times180)^{\frac{1}{3}} /(150\times225\times160)^{\frac{1}{3}} =1.1006.]$

Example for Indirect QA (Overlap Pricing)

Variety	Price Index Month 1	Average Price in Month 1	Average Price in Month 2	Month 2 Price Relative	Price Index Month 2
Prod 1	125.0	150	160	1.067	133.3
Prod 2	150.0	225	250	1.111	166.7
Prod 3	125.0	140	-	-	140.6
Sub 1		160	180	1.125	
All items	132.83			1.102	146.9

Product 3 and Substitute 1 are available in the overlapping period (Month 1).
The price change for Substitute 1 is used in the index for Month 2.
The quality difference of 20, observed as the difference in market prices, is excluded and the index increases by 10% (not 15%)

Example for Indirect QA (Overall mean imputation)

Variety	Price Index Month 1	Average Price in Month 1	Average Price in Month 2	Month 2 Price Relative	Price Index Month 2
Prod 1	125.0	150	160	1.067	133.3
Prod 2	150.0	225	250	1.111	166.7
Prod 3	125.0	140	(*152*)	1.091	136.4
Sub 1		-	180		
All items	132.83			1.089	144.74

No overlap price is available for Substitute 1 in Month 1
An estimate is made for Product 3's price in Month 2 using the average change for other similar products between Month 1 and Month 2 $(160 \times 250)^{\frac{1}{2}} / (150 \times 225)^{\frac{1}{2}} = 1.08867$. The quality difference of 28, observed as the difference between the imputed price of Prod 3 and market price of Sub 1, is excluded and the index increases by about 9% (not 15%)

Example for Indirect QA (Class mean imputation)

Variety	Price Index Month 1	Average Price in Month 1	Average Price in Month 2	Month 2 Price Relative	Price Index Month 2
Prod 1	125.0	150	160	1.067	133.3
Prod 2	150.0	225	250	1.111	166.7
Prod 3	125.0	140	(*156*)	1.111	138.9
Sub 1		-	180		
All items	132.83			1.097	145.71

No overlap price is available for Substitute 1 in Month 1

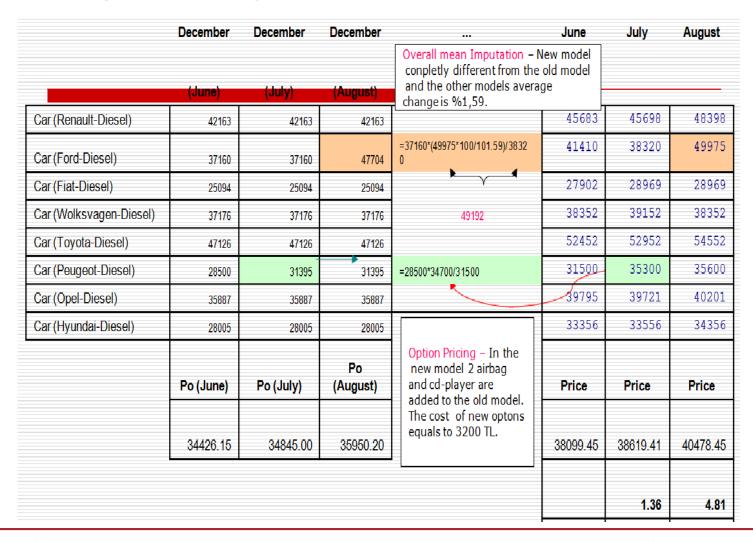An estimate is made for Product 3's price in Month 2 using the price trend in a closely related product (Prod 2) between Month 1 and Month 2 (11.1%)

The quality difference of 24, observed as the difference between the imputed price of Prod 3 and market price of Sub 1, is excluded and the index increases by 9.7% (not 15%)

$[(160 \times 250 \times 156)^{\frac{1}{3}} / (150 \times 225 \times 140)^{\frac{1}{3}} = 1.0971.]$

Example of Quality Adjustment for Car in Turkish CPI

	December	December	December	...	June	July	August
	(June)	(July)	(August)				
Car (Renault-Diesel)	42163	42163	42163		45683	45698	48398
Car (Ford-Diesel)	37160	37160	47704	=37160*(49975*100/101.59)/38320	41410	38320	49975
Car (Fiat-Diesel)	25094	25094	25094		27902	28969	28969
Car (Wolksvagen-Diesel)	37176	37176	37176	49192	38352	39152	38352
Car (Toyota-Diesel)	47126	47126	47126		52452	52952	54552
Car (Peugeot-Diesel)	28500	31395	31395	=28500*34700/31500	31500	35300	35600
Car (Opel-Diesel)	35887	35887	35887		39795	39721	40201
Car (Hyundai-Diesel)	28005	28005	28005		33356	33556	34356
	Po (June)	Po (July)	Po (August)		Price	Price	Price
	34426.15	34845.00	35950.20		38099.45	38619.41	40478.45
						1.36	4.81

Overall mean Imputation – New model conpletly different from the old model and the other models average change is %1,59.

Option Pricing – In the new model 2 airbag and cd-player are added to the old model. The cost of new optons equals to 3200 TL.

Example of Quality Adjustment for Notebook in Turkish CPI

			December	December	....	June	July
			(June)	(July)			
A	Computer (notebook)	Brand A	2020.42	2020.42		2107.59	2107.59
B	Computer (notebook)	Brand B	1395	1395		1053	1109
C	Computer (notebook)	Brand A	1433.84	1433.84	Class Mean Imputation	1308.99	1337.86
D	Computer (notebook)	Brand A	1527.77	1327	=1527.77*(1556.2*100/101.1)/1771.54	1771.54	1556.2
E	Computer (notebook)	Brand B	1370.03	1370.03		1132.96	1119.66
F	Computer (notebook)	Brand C	1332.59	1164	=1332.59*(1077.61*100/101.55)/1215.36	1215.36	1077.61
					Overal Mean Imputation		
			Po (June)	Po (July)		Price	Price
			1497.3852	1430.0137		1385.9159	1343.1471
							-3.09
						Index	Index
						92.56	93.93
							1.48

Thank you…