

## ANNEX IV: QUARANTA EDITING PROCEDURE

- IV.1. Eurostat and the OECD use the Quaranta editing procedure<sup>1</sup> to validate the prices that participating countries report for consumer products, government services and capital goods. The procedure is both an editing tool and an analytical tool. As an editing tool it identifies outliers that need to be checked among the prices reported by countries. As an analytical tool it provides information that can be used to assess the reliability of completed price surveys and to assist the planning of future price surveys. In short, the Quaranta editing procedure plays a key role in improving the quality of Eurostat-OECD comparisons.
- IV.2. The procedure has been in place since the early 1990s when it was used to edit the prices collected for consumer goods and services - the purpose for which it was originally intended. In the meantime, the procedure has evolved and its application broadened to other price surveys such as those covering equipment goods and construction projects. The Quaranta editing procedure described in this Annex is the standard version currently employed. The description focuses on the validation of prices for consumer products as this remains the procedure's principal application.
- IV.3. The validation of the prices collected for consumer goods and services is carried out price survey by price survey in two stages. The first stage involves the price input and output sheets and the intra-country editing of individual price observations by product. The second stage involves the Quaranta editing procedure and the inter-country validation of average survey prices by basic heading. The first stage is described in Chapter 4. The second stage is described in the following paragraphs.
- IV.4. The Quaranta editing procedure is designed to screen average survey prices for possible errors and to assess the reliability of the PPPs they provide. It does this by comparing the prices for the same product in different countries and by analysing the dispersion of price ratios across countries and across products. As participating countries report prices in national currencies, average survey prices can be compared only if they are expressed in a common unit of currency. Both exchange rates and PPPs are used in the Quaranta editing procedure to convert average survey prices to a common currency.
- IV.5. Once converted to a common currency, the average survey prices of different countries for the same product can be compared with each other and outliers identified according to predetermined criteria. But prices, even when expressed in the same currency, cannot be compared directly across products. On the other hand, the price ratios of countries pricing a product can be compared with the corresponding price ratios for other products providing they have first been "standardised". Standardised price ratios for a product are the ratios between the individual average survey prices of the countries pricing the product and the geometric mean of the average survey prices of all the countries pricing the product when the average survey prices are expressed in a common currency. The measures of price dispersion used in the Quaranta editing procedure are calculated with standardised price ratios based on average survey prices that have been converted to a common currency with PPPs.
- IV.6. Central to the Quaranta editing procedure is the "Quaranta table" and central to the Quaranta table is the basic heading. Inter-country validation of average survey prices takes place at the basic heading level. When a price survey is to be edited, a Quaranta table is prepared for each basic heading covered by the survey. A Quaranta table consists of two tables: a basic heading table and a product table. For any given basic heading, the Quaranta table will have only one basic heading table, but usually it will have a number of product tables – one for each product specified for the basic heading.
- IV.7. The inter-country validation of prices collected for consumer goods and services is done first within the country groups and then between the country groups. The preparation of Quaranta tables for the intra-group validation of price surveys covering consumer products is the responsibility of the group leaders. Box IV.1 contains an example of such a Quaranta table. The example is incomplete because it shows product tables for only two of the eight products specified for the basic heading.
- IV.8. From the survey identifier on the first line in the Box, it can be seen that the table refers to the price survey that was conducted in the first half of 2003 – which was *Food, drinks and tobacco* – and to the prices collected by the Central group. It can also be seen that it is the final version of the table – that is, the version sent to Eurostat after the iterative verification process between group leader and group members had been completed. The numbers in italics and square brackets – that is, the numbers from [1] to [28] - have been added to the table for ease of reference. They, and the acronyms employed in the table, are explained in Box IV.2. Numbers [1] to [12] cover the basic heading table and numbers [13] to [28] cover the product table.

## Box IV.1: An example of a Quaranta table

EUROSTAT- PPP: QUARANTA TABLES

SURVEY: 2003-I Central group (final version)

Date: 08.01.2004

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[1] 11.01.11.1 Rice

[2] Av. Weight: 59

[3] No. of it.: 8

[4] EKS method; Selected options: limits for XR-, PPP-indices = 80%, 125%, with \*, without L/P limits

[5] Var. Coef. (%): 19.7

[6]	[7] XR NC/EURO	[8] PPP NC/CUP	[9] PLI (%) PPP/XR	[10] Weight/ 100000	[11] No. of Items	[12] Var. Coef.	[6]	[7] XR NC/EURO	[8] PPP NC/CUP	[9] PLI (%) PPP/XR	[10] Weight/ 100000	[11] No. of Items	[12] Var. Coef.
OS	1.00000	1.01637	101.6	23.8	7: *4	13.8	LUX	1.00000	1.29062	129.1	74.0	6: *3	22.3
BE	1.00000	1.40005	140.0	34.6	8: *6	22.7	NL	1.00000	1.04821	104.8	40.6	7: *4	24.5
CH	1.54110	1.64876	107.0	58.3	5: *5	16.9	PL	4.35350	2.63721	60.6	47.5	5: *3	13.7
CZE	31.3910	18.9608	60.4	63.9	7: *4	25.7	SVK	41.0920	24.8722	60.5	149.5	7: *5	18.3
DE	1.00000	1.68260	168.3	13.8	7: *7	19.3	SVN	232.959	230.491	98.9	95.3	7: *3	13.4
HUN	245.180	199.895	81.5	91.1	7: *3	21.5	DE2	1.00000	1.61527	161.5	13.8	7: *7	16.3

1 [13] 11.01.11.1aa = CNS – Rice, long grain, 500 – 1000 g, specified brand, reference quantity = 1000 g [14] Var. Co.: 16.6

[15]	[16] NC-price	[17] *	[18] Qts.	[19] Var. Co.	[20] Wn	[21] EURO-pr.	[22] EURO-In.	[23] Wn	[24] CUP-price	[25] CUP-In.	[26] Wn
						[27] GM=> 2.74			[28] GM=> 2.64		
OS	3.04	*	4	5.1		3.04	111		2.99	114	
BE	3.01	*	13	16.8		3.01	110		2.15	82	
CH	4.58	*	9	21.2		2.97	109		2.78	106	
CZE	52.80		5	4.4		1.84	67	<	3.05	116	
DE	3.18	*	12	14.2		3.18	116		1.89	72	<
HUN	533.20		5	8.6		2.17	79	<	2.67	102	
LUX	3.46	*	5	9.1		3.46	126	>	2.68	102	
NL	2.63	*	9	14.2		2.63	96		2.51	96	
SVK	82.08		10	7.7		2.00	73	<	3.30	126	>
SVN	720.08		5	7.5		3.09	113		3.12	119	
DE2	3.33	*	8	8.9		3.33	122		2.06	79	<

2 [13] 11.01.11.1ac = CN – Rice, long grain, 500 – 1000 g, well-known brand, reference quantity = 1000 g [14] Var. Co.: 15.0

[15]	[16] NC-price	[17] *	[18] Qts.	[19] Var. Co.	[20] Wn	[21] EURO-pr.	[22] EURO-In.	[23] Wn	[24] CUP-price	[25] CUP-In.	[26] Wn
						[27] GM=> 1.69			[28] GM=> 1.71		
OS	1.76	*	3	2.7		1.76	104		1.73	101	
BE	2.75	*	9	12.4		2.75	162	>	1.96	115	
CZE	24.53	*	4	14.6		0.78	46	<	1.29	76	<
DE	3.39	*	7	19.1		3.39	200	>	2.02	118	
HUN	318.50	*	2	25.0		1.30	77	<	1.59	93	
LUX	1.66	*	8	35.9	>	1.66	98		1.29	76	<
NL	1.86		5	30.1		1.86	110		1.77	104	
PL	4.63	*	6	15.3		1.06	63	<	1.76	103	
SVK	50.10	*	7	10.4		1.22	72	<	2.01	118	
SVN	356.67	*	14	24.7		1.53	90		1.55	91	
DE2	3.25	*	10	10.2		3.25	192	>	2.01	118	

Note: In Germany, both the present capital, Berlin, and the former capital, Bonn, are surveyed. DE is Berlin and DE2 is Bonn. Their prices are validated separately and then combined as unweighted arithmetic means. The asterisks from Berlin determine representativity.

**Box IV.2: Reading the Quaranta table in Box IV.1**

Basic heading table	
[1]	The basic heading covered by the table.
[2]	<b>Av. Weight</b> or average weight: The average expenditure weight for the group of countries covered by the Quaranta table. The unweighted arithmetic mean of the national weights in column [10]. Like the national weights it is scaled to 100,000.
[3]	<b>No. of It.</b> or number of items: The number of products specified for the basic heading. The number of product tables comprising the Quaranta table.
[4]	Identifies the options selected when preparing the Quaranta table – namely: the method used to calculate the PPPs for the basic heading PPPs in column [8]; and the range in which the EURO-indices in column [22] and the CUP-indices in column [25] should lie if they are not to be flagged as outliers in column [23] or column [26]. In this case, the EKS method, with representativity (*), without limits on the Laspeyres-Paasche spread, has been used to calculate the PPPs; and the range in which the EURO-indices and CUP-indices should lie is 80 to 125. Selected options can be changed as required.
[5]	<b>Var. Coef.</b> or variation coefficient: The unweighted arithmetic mean of the variation coefficients of the products at [14]. The average variation of the standardised price ratios of the products priced for the basic heading.
[6]	Abbreviated names of the countries covered by the Quaranta table.
[7]	<b>XR NC/EURO:</b> The market exchange rates (XR) of the countries expressed as the number of units of national currency (NC) per euro. The exchange rate is 1.00000 for countries in the Euro area.
[8]	<b>PPP NC/CUP:</b> The PPPs for the basic heading calculated as specified in [4] – that is, the EKS method - and expressed as the number of units of national currency (NC) per conventional unit for expressing parities (CUP). The CUP is obtained by first standardising the EKS PPPs and then multiplying them by a coefficient to scale them to the euro. The scaling coefficient is defined as the unweighted geometric mean of the NC/EURO exchange rates in column [7]. The prices used to calculate the PPPs are the average survey prices in national currencies that countries report for the products they priced for the basic heading – that is, the NC-prices in column [16].
[9]	<b>PLI (%) PPP/XR</b> or price level indices. The PPPs in column [8] expressed as a percentage of the exchange rates in column [7].
[10]	<b>Weight/100000:</b> National expenditure weights scaled to 100,000. That part of a country's household individual consumption expenditure that is spent on the basic heading when both expenditures are expressed in national currency and valued at national price levels. Household individual consumption expenditure is defined by the domestic concept, before adjusting for net purchases abroad.
[11]	<b>No. of items:</b> Number of products that are priced by each country and the number of products priced by each country that are representative – that is, the number of products assigned an asterisk (*).
[12]	<b>Var. Coef.</b> or variation coefficient: The standard deviation expressed as a percentage of the arithmetic mean of the indices of PPP converted prices – that is, the CUP-indices in column [25] - for all products priced by the country irrespective of whether they are representative or unrepresentative. CUP-indices of products priced by only one country are not included. <b>P.T.O. &gt;&gt;&gt;</b>

IV.9. The basic heading table gives summary information for the basic heading. The information relates either to the basic heading as a whole – from [1] to [5] – or to each country covered by the basic heading – from [6] to [12]. The product table shows for each product the average survey prices reported by countries in national currencies [16], the average survey prices converted to a common currency with exchange rates [21], the average survey prices converted to a common currency with the PPPs for the basic heading [24], the standardised price ratios based on the exchange rate converted prices [22] and the standardised price ratios based on the PPP converted prices [25]. Outliers among the standardised price ratios are identified in [23] and [26]. Values that are below the predetermined range of acceptability are flagged by <, values that above are flagged by >.<sup>2</sup>

IV.10. The PPPs in the Quaranta table are calculated from the average survey prices that are being validated.<sup>3</sup> This means that verification starts with PPPs calculated from prices that have still to be edited. These opening PPPs are likely to be unreliable and the flagging of outliers among the PPP converted prices is likely to be unreliable as well. This is one of the reasons that standardised price ratios based on exchange rate converted prices are included in the Quaranta table. As PPPs are calculated because exchange rate converted prices do not reflect the price levels of countries, it appears paradoxical to use them to edit prices with which PPPs are to be calculated. But experience shows that exchange rate converted prices provide, at least at the beginning of the validation process, a better “feel” for the reliability of the prices collected. Experience also shows that many of the prices initially identified as outliers among the exchange rate converted prices are found to be incorrect.

IV.11. Intra-group validation is an iterative process with an evolving set of Quaranta tables going backwards and forwards between the group leader and the other group members. The whole process can involve several iterations or rounds before being completed. After each round, new Quaranta tables based on revised price data are prepared. As incorrect prices are removed or corrected, the PPPs will become more reliable and so too will the flagging of outliers among PPP converted prices. As the editing progresses, the focus on outliers shifts from those among the exchange rate converted prices to those among the PPP converted prices. The goal of the exercise is to remove, or at least reduce, the outliers among the PPP converted prices. Providing this is achieved, outliers remaining among exchange rate converted prices can be ignored.

**Box IV.2 Reading the Quaranta table in Box IV.1, contd.**

Product table	
[13]	Code, name, and summary definition of the product covered in the subsequent product table.
[14]	<b>Var. Co.</b> or variation coefficient: The standard deviation expressed as a percentage of the arithmetic mean of the indices of PPP converted prices for a product – that is, the CUP-indices in column [25].
[15]	Abbreviated names of the countries pricing the product.
[16]	<b>NC-price:</b> Average survey price in national currency (NC).
[17]	Representativity indicator. Generally, representativity is marked by an asterisk (*), but in the case of rents numerical weights (percentages) are shown.
[18]	<b>Qts.</b> or quotations: The number of price observations on which the average survey prices - the NC-prices - in column [16] are based.
[19]	<b>Var. Co.</b> or variation coefficient: The standard deviation expressed as a percentage of the arithmetic mean of the price observations underlying the average survey price in column [16].
[20]	<b>Wn</b> or warning: Variation coefficients in column [19] that have a value which is greater than the selected crucial value of 33 per cent are flagged by > .
[21]	<b>EURO-pr.</b> or EURO-prices: The prices in national currency – the NC-prices – in column [16] converted to euros with the exchange rates in column [7].
[22]	<b>EURO-In.</b> or EURO-indices: Indices based on the exchange rate converted prices – the EURO-prices – in column [21]. The EURO-prices expressed as a percentage of their geometric mean at [27]. Referred to in the text as “standardised price ratios based on exchange rate converted prices”.
[23]	<b>Wn</b> or warning: Flags the indices of exchange rate converted prices – the EURO-indices – in column [22] that have a value which falls outside the selected range of 80 to 125 [4]. Values that are below 80 are flagged by < , values above 125 are flagged by > .
[24]	<b>CUP-price(s):</b> The prices in national currency – the NC-prices – in column [16] converted to the conventional unit in which to express parities (CUP) with the PPPs in column [8].
[25]	<b>CUP-In.</b> or CUP-indices: Indices based on the PPP converted prices – the CUP-prices – in column [24]. The CUP-prices expressed as a percentage of their geometric mean at [28]. Referred to in the text as “standardised price ratios based on PPP converted prices”.
[26]	<b>Wn</b> or warning: Flags the indices of PPP converted prices – the CUP-indices – in column [25] that have a value which falls outside the selected range of 80 to 125 [4]. Values that are below 80 are flagged by < , values above 125 are flagged by > .
[27]	<b>GM</b> or geometric mean of the exchange rate converted prices – the EURO-prices – in column [21]. The use of a geometric mean here and in [28] insures invariance with respect to choice of numeraire.
[28]	<b>GM</b> or geometric mean of the PPP converted prices – the CUP-prices – in column [24]. It will be the same as [27] when all countries covered by the Quaranta table have priced the product.

- IV.12. It is important to remember during each round of inter-country validation that average survey prices flagged as outliers in the Quaranta table are only possible errors. They are not errors by definition, no matter how well established are the criteria used to identify them. They cannot be removed automatically, they have to be referred back to the countries reporting them for verification. Participating countries are required to investigate the average survey prices returned to them as outliers and to confirm whether they correct or incorrect. When prices are found to be incorrect, participating countries are expected to correct them, otherwise they are suppressed.
- IV.13. Strictly speaking, an outlier that is correct should be retained. Even so, such an outlier can create “noise” which impacts not only on the basic heading PPP for the participating country reporting the outlier but also on the basic heading PPPs for the other participating countries. If the outlier refers to a representative product, the effect of the noise can be reduced, at least for the reporting country, by suppressing the representativity indicator. The other option is to suppress the outlier. Neither of these actions would be justified if, within the context of the basic heading, the product is important to the reporting country or if most of the other countries pricing the product have reported it as unrepresentative (which may explain why it is an outlier in the first place). But, if the outlier is unrepresentative, removing it is probably warranted. Whatever action is taken, it has to be decided jointly by the participating country and the group leader<sup>4</sup> on a case by case basis.
- IV.14. Inter-country validation within country groups is followed by inter-country validation between country groups. Again the Quaranta editing procedure is applied. Quaranta tables that cover all countries in the country groups are prepared by Eurostat. These are sent to countries and the process of iterative verification starts afresh. Validation is done in two steps. First, the average survey prices are edited. Then, once validated, they are edited again, but this time after they have been converted to national annual prices with the spatial and temporal adjustment factors that participating countries provide for this purpose.
- IV.15. The two steps are necessary partly for logistic reasons, but chiefly so that countries are able to recognise their average survey prices immediately - which they may not be able to do after the prices have been converted to national annual averages. This is an important consideration because with the introduction of new countries much in the Quaranta table changes – namely: the PPPs [8], the price level indices [9], the PPP converted prices [24], the

standardised price ratios based on PPPs [25], and their associated variation coefficients [5], [12] and [14]. New outliers among the PPP converted prices will also be flagged [26].

- IV.16. Validation during the first step focuses on overlap products. Here, the main problem encountered tends to be country groups interpreting generic product specifications differently so that, while prices within groups are comparable, prices between groups are not. In such cases, the product is split between country groups and the overlap is lost. Validation during the second step is generally a formality, but an important one nonetheless. When signing off from the validation process, participating countries are accepting responsibility for their national annual prices.
- IV.17. A Quaranta table also contains four variation coefficients. Two in the product table – [14] and [19] – and two in the basic heading table – [5] and [12]. They serve different uses not all of which are immediately relevant to validation. Three of them – [14], [12] and [5] – can all be expected to become smaller as editing progresses and the number of outliers is reduced. In this respect, they provide a means of assessing the effectiveness of validation at the product, country and basic heading levels.
- IV.18. The first variation coefficient is at [14].<sup>5</sup> It is product specific. It refers to the product covered in the product table immediately below it. It measures the variation in the average survey prices for a product after they have been converted to a common currency with the PPPs for the basic heading. It is the most important of the variation coefficients for validation purposes. A product with a high variation coefficient – above 33 per cent is the current Eurostat-OECD crucial value – should be considered suspect and possibly not comparable between countries. Such products are candidates for splitting or for deletion and should be carefully investigated by participating countries.
- IV.19. The second variation coefficient is in column [19].<sup>6</sup> It is country and product specific. It measures the variation among the price observations on which the average survey price in column [16] is based. It is taken directly from the price input and output sheets where it was used in the identification of outliers during intra-country validation. It serves primarily as an aide-mémoire. Values above 33 per cent are flagged in column [20].
- IV.20. The third variation coefficient is at [5]. It is basic heading specific. It is the average product variation coefficient for the basic heading. It provides a measure of the homogeneity of the price structures of the countries covered by the basic heading and of the reliability of the PPPs calculated for the basic heading. The closer its value is to zero the greater is the homogeneity of the price structures and the reliability of the PPPs. As a summary measure of price variation among products within the basic heading, it can be used, together with the basic heading weight [2], in the planning of the survey the next time it comes around in the survey cycle – for example, when allocating the number of products to be sampled to basic headings.
- IV.21. The fourth variation coefficient is in column [12]. It is country and basic heading specific. It measures the variation in a country's price levels among the products it priced for a basic heading. The lower the value, the more uniform are the country's price levels within the basic heading. It provides a rough estimate of the reliability of a country's PPP for the basic heading. Together with the country's basic heading weight [10], it can assist countries to decide how many products they need to price to obtain reliable PPPs for the basic heading the next time it is to be surveyed.

<sup>1</sup> The procedure is named after its originator, Vincenzo Quaranta of INSTAT, who first proposed it to the Eurostat Working Party on Price Statistics in January 1990. It was subsequently described in "A data quality control approach in price surveys for PPP estimates", V. Quaranta, *Improving the Quality of Price Indices: CPI and PPP*, (proceedings of an international seminar held in Florence, December 1995), Eurostat and University of Florence, Luxembourg, 1996.

<sup>2</sup> The intervals of the range are not equal because it is the relative deviations from a geometric mean that are being measured.

<sup>3</sup> Eurostat and the OECD use the EKS method with representativity to calculate PPPs for a basic heading. If the price of a product is to be included in the calculation, at least two countries should have priced it and at least one of these countries should have assigned it an asterisk (\*) – the representativity indicator currently used by Eurostat and the OECD. A full description of the EKS method can be found in Chapter 7 and Annex V.

<sup>4</sup> Or Eurostat in the case of inter-country validation involving all participating countries.

<sup>5</sup> Theoretically, this variation coefficient should be calculated using logarithms because the CUP-indices are based on the geometric mean of the CUP-prices. It is calculated using the arithmetic mean and standard deviation of the CUP-indices for practical reasons.

<sup>6</sup> When participating countries report average survey prices and not individual price observations, as they do for rents, compensation of employees, equipment goods and construction projects, this coefficient of variation does not appear in the Quaranta table.