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Methodological choices when using multilateral methods: window length, seasonality and aggregation structure

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Abstract

Multilateral methods are increasingly being used to derive consumer price indices from transactions data. Eurostat released two guidance publications in 2022 on which the present paper is based. It discusses three key choices to be made when using multilateral methods: 1) the window length over which the multilateral method is compiled and the splicing method used; 2) the compilation methodology for categories that include seasonal products; 3) the aggregation structure and the methodology for integrating diverse data sources in the compilation. With splicing, one cannot avoid chain drift entirely; hence the drift must be reduced as much as possible. Individual seasonal products do not need to be explicitly identified in the data but in order to have a good coverage of two successive in-season periods, it is important that the time window is wide enough. The advantage of applying a multilateral method up to a more aggregated level is the ability to cope with a dynamic universe of individual products. Keeping the variable weights as high as possible in the index hierarchy allows changes in the importance of products and/or outlets over time to be captured.

Keywords: Transaction Data, Multilateral Methods, Harmonised Index of Consumer Prices

JEL classification: C43, E31

1. INTRODUCTION

Unlike web-scraped data or price data compiled by field price collection, transaction data contain both the prices and quantities actually sold. Multilateral methods are a specific type of index compilation methods that can be applied to transaction data. The Harmonised Index of Consumer Prices (HICP) Implementing Regulation¹ supports the use of multilateral methods for the compilation of elementary price indices.

Transaction data are typically characterised as being ‘dynamic’. New products continuously enter the market while obsolete products previously available are removed from the assortments. With standard bilateral price index methods, prices of products in the current period are compared to the corresponding prices in some past base period. However, it has been found that chain-linking bilateral price indices can be subject to ‘chain-drift’, especially if products are explicitly weighted.

Multilateral methods have been found to be a solution to the problems encountered with bilateral methods. They take into account all the products that are available in the periods under consideration. They allow to explicitly weight each product according to its importance in each period. Finally, they aim to avoid the chain-drift problems encountered with chained bilateral indices.

Eurostat published the Guide on Multilateral Methods in the HICP (Guide) (Eurostat (2022a) and the Progress Report - Task Force Multilateral Methods 2022 (Report) (Eurostat (2022b) to support countries in understanding and implementing multilateral methods in the context of the HICP. Both documents have been drafted with the support of the HICP Task Force Multilateral Methods composed of experts from 12 countries (Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, the Netherlands, Poland, Sweden, Slovenia, Norway), from the European Central Bank and from Eurostat. This paper summarizes the key findings of the two documents on different technical choices that have to be made.

The remainder of the paper is organised as follows. Section 2 examines on how the time window over which the index formula is compiled should be defined. It further deals with the splicing technique to be used for combining the respective index series. Section 3 deals with the technical requirements that are needed for an accurate measurement of the prices of seasonal products while Sections 4 and 5 elaborate on more practical questions of application and integration of multilateral methods into index compilation. Section 6 concludes.

⁽¹⁾ In particular, see Article 12 of Regulation (EU) 2020/1148.

2. TIME WINDOWS AND SPLICING METHODS

This section examines the question of the length of the time window over which the multilateral index is applied. There are trade-offs to consider in this context. For instance, shorter time windows could lead to unstable results and may not solve the chain drift problem. The longer the time window, the more data from the past will impact the current month compilations. It also depends on the product type. For seasonal products, the window should be sufficiently long to cover two successive in-season periods. In practice, the time window should cover at least 13-14 months, if not longer (for example 25 months). For products with short life-cycles (e.g. consumer electronics), a shorter time window may be warranted.

In a statistical production environment, each month, the time window has to be adjusted to include the data from the latest month. There are two main strategies for adjusting the time window:

- **Rolling time windows.** Each month, the time window is shifted forward by one month. The latest month is included whereas the oldest month is removed thus the length of the time window is kept constant.
- **Expanding time windows.** Each month, the time window is extended by one month. The length of the time window increases each month by one month. After one year, the length of the time window could be reset to its initial length. With such a strategy, there is an imbalance in window length and the length at the beginning of the year is very short. The advantage of this strategy is that it can be implemented without the need for long back data.

Every month a new time window is used and indices are calculated for every period. Therefore, splicing techniques must be used which link the latest result onto the previous avoiding revisions of already published indices. The multilateral index is transitive with respect to a given time window. However, transitivity is not satisfied anymore for the indices that are published. Therefore, some degree of chain drift cannot be fully excluded for the published (spliced) indices. Nevertheless, splicing is the only option available to avoid revisions of already published figures.

Technically, the splicing of two series operates via a link period. There are different options for the selection of the link month when compiling the results in a given month. Chessa (2019) pointed out that the splicing methods can either use the recalculated or the published indices to link in the new index series².

The formulas of the different techniques are provided in table 1 where the current month is denoted by t and the window length is denoted by T . The methods are also illustrated with a numerical example in Annex 1.

⁽²⁾ Except for the movement splicing and the fixed base, which has the index published in the previous period as the only link option.

Table 1 – Brief description and formulas of the different splicing techniques

		Link onto the published series:	Link onto the previously calculated series:
		$I_{pub}^{0,t} =$	
Movement splice	The period t-1 is used as the link period	$I_{pub}^{0,t-1} * I_{[t-T+1,t]}^{t-1,t}$	
Window splice	The period t-T+1 is used as the link period	$I_{pub}^{0,t-1} * I_{pub}^{t-1,t-T+1} * I_{[t-T+1,t]}^{t-T+1,t} =$ $= I_{pub}^{0,t-T+1} * I_{[t-T+1,t]}^{t-T+1,t}$	$I_{pub}^{0,t-1} * I_{[t-T,t-1]}^{t-1,t-T+1} * I_{[t-T+1,t]}^{t-T+1,t}$
Half splice	The period t-(T+1)/2+1 is used as the link period	$I_{pub}^{0,t-1} * I_{pub}^{t-1,t-\frac{T+1}{2}+1} * I_{[t-T+1,t]}^{t-\frac{T+1}{2}+1,t} =$ $= I_{pub}^{0,t-\frac{T+1}{2}+1} * I_{[t-T+1,t]}^{t-\frac{T+1}{2}+1,t}$	$I_{pub}^{0,t-1} * I_{[t-T,t-1]}^{t-1,t-\frac{T+1}{2}+1} * I_{[t-T+1,t]}^{t-\frac{T+1}{2}+1,t}$
Mean splice	All the overlap periods are used as link periods	$I_{pub}^{0,t-1} * \prod_{k=t-T+1}^{t-1} (I_{pub}^{t-1,k} * I_{[t-T+1,t]}^{k,t})^{\frac{1}{T-1}} =$ $= \prod_{k=t-T+1}^{t-1} (I_{pub}^{0,k} * I_{[t-T+1,t]}^{k,t})^{\frac{1}{T-1}}$	$I_{pub}^{0,t-1} * \prod_{k=t-T+1}^{t-1} (I_{[t-T,t-1]}^{t-1,k} * I_{[t-T+1,t]}^{k,t})^{\frac{1}{T-1}}$
Fixed base	The previous December is used as the link period	$I_{pub}^{0,t-1} * I_{pub}^{t-1,Dec(t)} * I_{[t-T+1,t]}^{Dec(t),t} =$ $= I_{pub}^{0,Dec(t)} * I_{[t-T+1,t]}^{Dec(t),t}$	

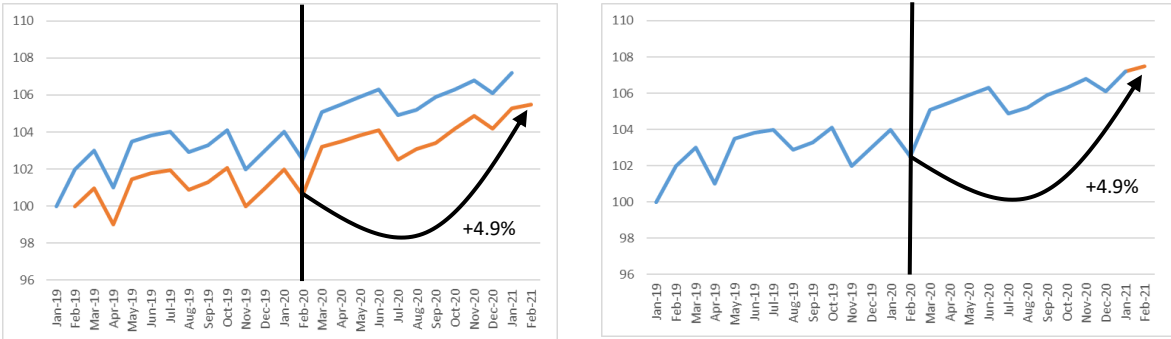
The performance of a splicing method can be tested empirically by comparing the resulting index to the index compiled over a full-time window. For example, consider data that span over several years. A multilateral index can be calculated over this entire time period. This index serves as a fully transitive benchmark. With the same data, a real time index can be calculated using any of the splicing techniques discussed above. The difference between these two indices can help to evaluate the performance of the splicing method. Note however that the ‘benchmark’ index may also be slightly impacted by a very long-time window as the result in a given month can be influenced by very distant data points.

The different splicing methods all have their advantages and disadvantages. Fixed base splicing is more consistent with a bilateral index where the December month of the previous year acts as a price reference period. However, such a strategy is heavily dependent on a specific month (December month of the previous year).

Movement splice is the method that can be most easily understood and explained. It is consistent with the month-on-month movements obtained with the multilateral index. However, some extent of chain drift cannot be excluded with this method. The same holds for window or half splice that may all be subject to chain drift when linking is performed onto previously calculated series. Mean splice may be a more robust alternative as it is based on all possible links. However, it is still possible that chain drift of movement or window splice propagates to the mean splice.

An alternative strategy would be to link onto previously published series. Consider for example a 25 month rolling time window. The splicing is conducted using the half splice on published series method. Under this method, the annual rate of changes of the published indices correspond to annual rate of change of the latest calculated multilateral index³. This is a useful property as annual rates are a key indicator in the context of the HICP. We will refer to this splicing method as 25-HASP (see Chessa (2021)). In Figure 1 the annual rate of change of the multilateral index compiled for the period February 2019 to February 2021 is exactly the same (4.9%) as the annual rate calculated over the long term series obtained with the half splice method on published indices.

Figure 1 - ‘half splice on published indices’ method over a 25-month rolling time window:



Index compiled over Jan19 to Jan21(blue) and over periods Feb19 to Feb 21 (orange).

Spliced (published) index from Jan19 to Feb21

SOURCE: EUROSTAT calculations

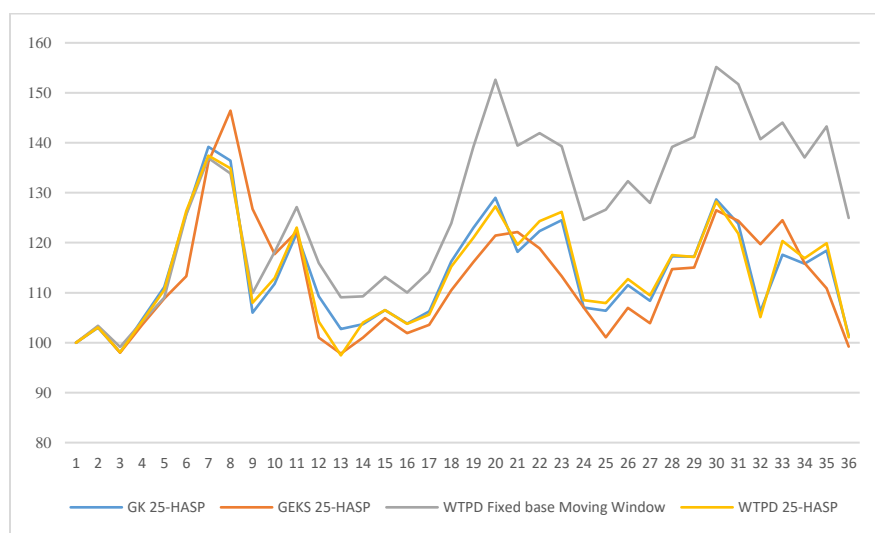
(³) This can also be achieved by using window splice on published series over a 13-month rolling time window.

3. SEASONAL PRODUCTS

A seasonal product⁴ is an individual product that is available for purchase or purchased in significant amounts only part of a year in a recurring pattern. In any given month, the product is considered to be either in-season or out-of-season.

In principle, multilateral methods can be applied to seasonal products. However, because of a high variability in prices and quantities and a large and recurrent share in missing prices during the out-of-season periods, the different multilateral methods are likely to give more diverse results as shown in Figure 2.

Figure 2 – Example dataset with 12 seasonal products using different multilateral methods.



A data set with seasonal products and the corresponding multilateral indices can be found in this [file](#) (Example provided by STATEC for the Guide).

Conceptually, multilateral methods can be seen as an example of a ‘seasonal weight method’⁵. When an individual product is out-of-season, its weight is zero. When a product is in-season, its weight corresponds to the actually observed quantities. The HICP Methodological Manual (Eurostat (2018)), section 7.1.5, gives an overview of this method under the term ‘class-confined seasonal weights’.

The window length should be set so that it can include the last month of the previous in-season period and the first month of the new in-season period. This is important so that any price change between the previous and the current in-season periods is captured. If that is not the case, the first time that a seasonal product reappears, there is no match with the previous season and the price change is lost. That is why fixed base expanding time window strategies (see section 2) tend to perform less good with seasonal

⁽⁴⁾ Article 2(22) of Regulation (EU) 2020/1148: ‘seasonal product’ means an individual product that is available for purchase or purchased in significant amounts only part of a year in a recurring pattern. In any given month, the product is considered to be either in-season or out-of-season. The in-season period may vary from one year to another

⁽⁵⁾ Article 2(27) of Regulation (EU) 2020/1148: ‘seasonal weights method’ means a treatment of seasonal products in which weights for out-of-season seasonal products are zero or set to zero.

products. The in-season period may vary from one year to another, thus in order to capture products that are on the market only for one month per year it is important to have windows of at least 13 months, or longer.

The choice of the splicing method is critical when dealing with seasonal products. Although largely an empirical matter, the traditional splicing onto previously calculated series often tend to deviate (drift away) from a benchmark index calculated without splicing. There is an issue with the fixed base splicing. With December being the ‘link’ month, the long-term trend of the index is determined to a large extent by those seasonal products that are available in December. A 25-HASP may be a good compromise because it ensures consistent annual rates and the window is sufficiently large to include all seasonal products. The CPI Manual (IMF et al (2020)), paragraph 10.103, highlights the benefits of using a larger window in the context of seasonal products. At the same time the multilateral index ties together all months of the time period, as opposed to over the year indices that only compare this month to the same month one year ago.

Draft chapter 9 of the CPI Theory publication⁶ discusses the treatment of seasonal products. In that chapter, a new multilateral method, called ‘similarity linking’, is presented as one of the preferred options in order to derive monthly index series in the context of seasonal products. The similarity linking method is a multilateral method that is based on an underlying bilateral price index such as the Fisher price index. The idea of this method is to link the Fisher price index to the previous period which is most ‘similar’ to the current period. In the draft CPI Theory publication, it is proposed to use the ‘Predicted Share Price Dissimilarity’ in order to measure the distance between the data of two periods.

Eurostat (2022b) provides an initial analysis of advantages and disadvantages of this method in relation to other multilateral methods. One of the main advantages is that there is no need to select a window length or extension method, while one of the disadvantages is that the results depend on the choice of dissimilarity measure. The method shows pronounced differences in index behaviour compared to other methods.

4. AGGREGATION

It is important to identify the ‘elementary aggregate’ in the aggregation structure. Conceptually, according to the HICP legal framework, the elementary aggregate⁷ corresponds to the lowest level of a Laspeyres-type index.

The level at which the elementary aggregate is defined is crucial because it correspond to the level where the use of variable weights is changed to the use of annually fixed Laspeyres-type weights. In all cases, fixed weights must be applied at least at the ECOICOP subclass level.

Within an elementary aggregate, there can be one, or sometimes several elementary price indices⁸. An elementary price index is a price index that could be obtained with a multilateral method (or any other

⁽⁶⁾ <https://www.imf.org/en/Data/Statistics/cpi-manual>

⁽⁷⁾ Article 2(13) of Regulation (EU) 2020/1148: ‘elementary aggregate’ means the smallest aggregate used in a Laspeyres-type index.

⁽⁸⁾ Article 2(14) of Regulation (EU) 2020/1148: ‘elementary price index’ means an index for an elementary aggregate or an index for a stratum within an elementary aggregate.

suitable bilateral method). The multilateral method is applied at the level where the prices of the individual products⁹ are first combined obtaining the homogeneous product.

The ECOICOP subclass (5-digit) is the lowest harmonised level used in HICP compilation. The subclass may be further split up according to some classification used at the national level. For each (national) COICOP category, there are usually several retail chains which are explicitly weighted. Within each retail chain, some chain-specific classification could be used to define even finer product categories. Finally, it may be possible to further stratify by outlet. Some options are shown in Table 2.

Table 2: Level of aggregation and aggregation methods (EA = elementary aggregate)

Level	Option 1	Option 2	Option 3	Option 4
ECOICOP (or some national refinement of ECOICOP)	Laspeyres-type	Laspeyres-type	Laspeyres-type	Laspeyres-type
Retail chain	Laspeyres-type	Laspeyres-type	Laspeyres-type (= EA)	Laspeyres-type (= EA)
Product category	Laspeyres-type	Laspeyres-type (= EA)		Fixed base Törnqvist
Outlet	Laspeyres-type (= EA)			
Individual product	Multilateral	Multilateral	Multilateral	Multilateral
Transacted product	Unit value	Unit value	Unit value	Unit value

The aggregations start from the single items that were actually sold (transacted product). In option 1, the elementary aggregate is defined rather tightly. It covers the transactions of a detailed product category in a specific outlet. In option 3, the elementary aggregate is defined rather broadly. It covers the transactions of a given COICOP category (e.g. ECOICOP subclass, or sub-subclass of a nationally defined COICOP) in a given retail chain.

The advantage of option 1 is that it ensures a closer consistency with a Laspeyres-type index. Also, the impact of a multilateral method (compared for example to a fixed weight method) is reduced if the multilateral method is only applied at a very detailed level. The disadvantage of option 1 compared to option 3 is that openings or closure of outlets and new or obsolete product categories are more difficult to handle. In option 3, new outlets are incorporated implicitly in the unit value calculations. Moreover, there can be changes every month in market shares of product categories or outlets. Such changes will not be captured in option 1 but they will be reflected in option 3. Finally, it is possible that pushing the elementary aggregate level downwards in the index hierarchy will have an upward impact on results.

Option 2 is an example of an intermediate solution which skips the outlet level and directly aggregates the individual products up to the level of a retail chain specific product category.

Option 4 is a more advanced solution. The elementary aggregate level is defined in the same way as in option 3. However, each elementary aggregate consists of several elementary price indices. In fact, a multilateral method is used to come up with price indices by product category. These elementary indices are then aggregated using for instance a Törnqvist index. Hence the aggregation at the product category level is still based on variable weights. It is only at the next level where fixed weights are used and the

⁽⁹⁾ Article 2(6) of Regulation (EU) 2020/1148: ‘individual product’ means a product-offer or a homogeneous product.

Laspeyres principle is applied. The result of option 4 is likely to be close to the result obtained with option 3. It has however the advantage that explicit sub-indices are compiled for each product category, which can facilitate the analysis and validation of the data.

5. INTEGRATING DIVERSE DATA SOURCES

One also needs to decide on the level where the data from different sources (scanner data, web scraped data, field price collection) could be combined. For instance, the ECOICOP subclass level (or any other level below the subclass) could be stratified by data source. Each data source corresponds to a stratum of the subclass to which a weight must be assigned and for which a price index is compiled. Fixed weights must be used at the level where different data sources are combined because only fixed weights are available for the stratum that represents the traditionally collected prices.

A typical aggregation structure can be represented as follows. The European Classification of Individual Consumption according to Purpose (ECOICOP) subclass (5-digit) is the lowest harmonised level of the HICP. This is the level at which indices are published in Eurostat’s database. Very often, the subclass is further split up according to some product classification used at the national level. The lowest level of this product classification is sometimes called the ‘elementary product group’.

If there are several regions in a country, the elementary product group could be sub-divided by region. The regional aggregates could be further divided according to outlet or outlet-type representing the different data sources. In our context, the definition of the sub-divisions is related to the different data sources that would have to be combined. For each sub-division, a separate price index is obtained from one specific data source with a specific index compilation method.

An example of such a subdivision can be found in Table 3. In this example, the multilateral indices are calculated by region and by retailer. In addition, prices are obtained with web scraping, using a specific index compilation method. Finally, some prices continue to be collected and processed in the traditional way, representing the other retailers.

Table 3: Sub-division of a product group by data source and by region

	Scanner data (retailer A)	Scanner data (retailer B)	Web (retailer C)	Field price collection (other retailers)
Region 1	Multilateral method	Multilateral method	Index method adapted to web scraped data	Traditional price collection and index compilation
Region 2	Multilateral method	Multilateral method		Traditional price collection and index compilation

Expenditure shares must be derived for the different sub-divisions below the elementary product group. Very often perfect expenditure data may not be available below the level of an elementary product group and approximations must be made. Possible data sources for the weights could be:

- Scanner data, for the aggregates covered by this data source.
- Turnover data from structural business survey, from retail trade statistics, or from the business register.
- Household budget survey, for the regional dimension, and possibly for the outlet-type dimension.

Given the imperfections in the source data, some assumptions must usually be made in practice to derive the expenditure shares. Sometimes the same proportions are used for all elementary product groups (for example the same outlets turnover shares are used for all products). The sum of the lower level expenditures could also be compared with the expenditure for the elementary product group. If the difference is very large, the least reliable estimates could be reviewed and adjusted to make the difference smaller and thus the estimates more coherent.

The index of the elementary product group is a multi-source price index that combines price indices based on different methodologies. Let us suppose that an expenditure share and a price index are now available for each data source aggregate. The price index of the elementary product group is then obtained by combining the price indices that are appropriately weighted.

There are two views that can be taken:

- The different sub-divisions below the level of elementary product group are elementary aggregates. We will use the term ‘elementary aggregate’ to designate the lowest level of a Laspeyres-type index¹⁰.
- The elementary product group is an ‘elementary aggregate’. The different sub-divisions below the level of an elementary product group are then the strata of the elementary aggregate. A stratum¹¹ is any sub-division of the elementary aggregate for which an elementary price index¹² is available.

This distinction is important to discuss the aggregation methods. Whatever view is taken, we consider here only index formulas with fixed weights. This is because it is likely that for data sources other than scanner data, only lagged expenditure data are available.

The different sub-divisions can be elementary aggregates, and thus the standard Laspeyres-type aggregation applies. This does not preclude the possibility that other weights or finer sub-divisions are used within the elementary aggregate. For example, the aggregate ‘scanner data-retailer A’ may itself be stratified by type of outlet, and a multilateral index is calculated for each type of outlet. Monthly expenditure data may be available for these outlet types. It may be possible to aggregate the multilateral indices up to the level of the scanner data aggregate using an index formula that uses monthly weights (for example a superlative index formula).

The different sub-divisions can also be strata of an elementary aggregate. When this is the case there are different options for aggregation.

- One possibility is to use a weighted arithmetic average to combine the stratum indices. The stratum weights are obtained by price-updating the expenditure shares of the strata from the weight reference period to the price reference period (Lowe index):

(10) As defined in Article 2(13) of implementing Regulation (EU) 2020/1148: ‘elementary aggregate’ means the smallest aggregate used in a Laspeyres-type index’.

(11) The smallest stratum is sometimes called a ‘micro-aggregate’ (see example 2 from Sweden in the Annex).

(12) As defined in Article 2(14) of implementing Regulation (EU) 2020/1148: ‘elementary price index’ means an index for an elementary aggregate or an index for a stratum within an elementary aggregate’.

$$I_{EA}^{t,0} = \frac{\sum_s p_s^t q_s^b}{\sum_s p_s^0 q_s^b} = \sum_s w_s I_s^{t,0}$$

where:

$w_s = \frac{(p_s^b q_s^b) * I_s^{b,0}}{\sum_s (p_s^b q_s^b) * I_s^{b,0}}$ is the weight for stratum s

$p_s^b q_s^b$ is the expenditure of stratum s for period b

$I_s^{t,0} = \frac{p_s^t}{p_s^0}$ is the elementary price index of stratum s in period t compared to the price reference period 0

$I_{EA}^{t,0}$ is the price index of the elementary aggregate in period t compared to the price reference period 0.

- A geometric weighted average could be used instead to combine the stratum indices. There would be no need to price-update and the stratum weights would be equal to the expenditure shares (Geometric Young index):

$$I_{EA}^{t,0} = \prod_s \left(\frac{p_s^t}{p_s^0} \right)^{\frac{(p_s^b q_s^b)}{\sum_s (p_s^b q_s^b)}} = \prod_s (I_s^{t,0})^{w_s}$$

where:

$w_s = \frac{(p_s^b q_s^b)}{\sum_s (p_s^b q_s^b)}$ is the weight for stratum s

$p_s^b q_s^b$ is the expenditure of stratum s for period b

$I_s^{t,0} = \frac{p_s^t}{p_s^0}$ is the elementary price index of stratum s in period t compared to the price reference period

$I_{EA}^{t,0}$ is the price index of the elementary aggregate in period t compared to the price reference period 0,

The geometric formulation could be considered if there is some substitution between the strata. More concretely, this could be considered for aggregating price indices for outlets of the same type within the same region. The geometric variant would be consistent with a Jevons index that aggregates price observations across outlets. Otherwise, the arithmetic formulation could be considered. The arithmetic variant would be consistent with the higher-level Laspeyres-type aggregation. Transitivity and time reversibility are satisfied for both the arithmetic variant (assuming fixed stratum quantities during the year) and the geometric variant (assuming fixed stratum expenditure shares during the year)¹³. The index for the elementary aggregate differs if either the arithmetic or geometric variant is applied¹⁴.

(13) These index formulas are thus compliant with Article 12(2) of implementing Regulation (EU) 2020/1148: ‘An index formula that is consistent with those described in paragraph 1 shall be used to obtain a price index for an elementary aggregate from two or more elementary price indices’. Transitivity and time reversibility are the properties mentioned in paragraph 1 of that article. Note that these properties are only satisfied within a year and not across several years as the stratum weights are usually updated each year.

(14) For a discussion on the Geometric Young index, see Armknecht and Silver (2014). ,

6. CONCLUSIONS

When using multilateral index number methods, decisions must be made regarding the window length over which the multilateral method is compiled and the way that successive multilateral indices are linked without revising already published indices. With splicing one cannot avoid chain drift entirely, hence the drift must be reduced as much as possible. The validity of a splicing method should be empirically validated. Considerations should be given to the ‘half splice on published indices’ method over a 25-month rolling time window (25-HASP).

Individual seasonal products do not need to be explicitly identified in the data but the compilation methodology for categories that include seasonal products should be carefully examined. In order to have a good coverage of two successive in-season periods, it is important to have time windows longer than 13 months. The impact of splicing should be closely examined with seasonal products, as some splicing methods may produce indices that are biased compared with (i.e. deviate systematically from) benchmark indices compiled without splicing.

Benchmark indices without splicing should be compiled to validate the options taken with regards to the window length, the splicing method in particular but not exclusively on categories with seasonal products.

The advantage of applying a multilateral method up to a more aggregated level is the ability to cope with a dynamic universe of individual products. Keeping the weights variable as high as possible in the index hierarchy allows capturing changes in the importance of products and/or outlets over time. The use of tightly defined elementary aggregates introduces more stability in the index. Such a strategy facilitates the analysis of results and ensures a closer consistency with a Laspeyres-type index but captures less well a dynamic universe. The index structure below the subclass level and the elementary aggregate weights should be reviewed and updated at least once per year.

ANNEX

We describe the different splicing options using a rolling time window of 13 months, but the methods can be adapted to other time windows. In this example, there are three compilation rounds:

- The multilateral index compiled in period 13 covers periods 1 to 13.
- The multilateral index compiled in period 14 covers periods 2 to 14. The multilateral index compiled in period 15 covers periods 3 to 15.

Movement splice

Link onto the published series:

$$I_{pub}^{0,t} = I_{pub}^{0,t-1} * I_{[t-T+1,t]}^{t-1,t}$$

Table 4: Illustration of the movement splice

Period	1	2	3	4	5	...	11	12	13	14	15
1 st compilation round in period 13	100.0	100.7	100.6	101.6	102.7	...	104.3	106.0	103.8		
2 nd compilation round in period 14		100.0	100.2	101.1	102.2	...	103.8	105.5	103.3	104.6	
3 rd compilation round in period 15			100.0	101.0	102.0	...	103.5	105.3	103.2	104.4	104.1
Published index (Movement splice - Link onto published)	100.0	100.7	100.6	101.6	102.7	...	104.3	106.0	103.8	105.1	104.8

*The splicing starts in period 14. The published indices for periods 1 to 13 are obtained at the first compilation round. The published index in period 14 is obtained by applying the change between period 13 and period 14 indices of the second compilation round to the published index of period 13 (103.8*104.6/103.3=105.1). The published index in period 15 is obtained by applying the change between period 14 and period 15 indices of the third compilation round to the published index of period 14 (105.1*104.1/104.4 =104.8).*

Window splice

Link onto the previously calculated series:

$$I_{pub}^{0,t} = I_{pub}^{0,t-1} * I_{[t-T,t-1]}^{t-1,t-T+1} * I_{[t-T+1,t]}^{t-T+1,t}$$

Link onto the published series:

$$I_{pub}^{0,t} = I_{pub}^{0,t-1} * I_{pub}^{t-1,t-T+1} * I_{[t-T+1,t]}^{t-T+1,t} = I_{pub}^{0,t-T+1} * I_{[t-T+1,t]}^{t-T+1,t}$$

Table 5: Illustration of the window splice

Period	1	2	3	4	5	...	11	12	13	14	15
1 st compilation round in period 13	100.0	100.7	100.6	101.6	102.7	...	104.3	106.0	103.8		
2 nd compilation round in period 14		100.0	100.2	101.1	102.2	...	103.8	105.5	103.3	104.6	
3 rd compilation round in period 15			100.0	101.0	102.0	...	103.5	105.3	103.2	104.4	104.1
Published index (Window splice - Link onto previous)	100.0	100.7	100.6	101.6	102.7	...	104.3	106.0	103.8	105.3	105.0
<i>The splicing starts in period 14. The published indices for periods 1 to 13 are obtained at the first compilation round. The published index in period 14 is obtained by applying the change between period 13 and period 2 indices of the first compilation round and the change between period 2 and period 14 indices of the second compilation round to the published index of period 13 (103.8*(100.7/103.8)*(104.6/100.0)=105.3). The published index in period 15 is obtained by applying the change between period 14 and period 3 indices of the second compilation round and the change between period 3 and period 15 indices of the third compilation round to the published index of period 14 (105.3*(100.2/104.6)*(104.1/100)=105.0).</i>											
Published index (Window splice – Link onto published)	100.0	100.7	100.6	101.6	102.7	...	104.3	106.0	103.8	105.3	104.7
<i>The splicing starts in period 14. The published indices for periods 1 to 13 are obtained at the first compilation round. The published index in period 14 is obtained by applying the change between period 2 and period 14 of the second compilation round to the published index of period 2 (100.7*(104.6/100.0)=105.3). The published index in period 15 is obtained by applying the change between period 3 and period 14 of the third compilation round to the published index of period 3 (100.6*(104.1/100)=104.7).</i>											

Half splice

Link onto the previously calculated series:

$$I_{pub}^{0,t} = I_{pub}^{0,t-1} * I_{[t-T,t-1]}^{t-1,t-\frac{T+1}{2}+1} * I_{[t-T+1,t]}^{t-\frac{T+1}{2}+1,t}$$

Link onto the published series:

$$I_{pub}^{0,t} = I_{pub}^{0,t-1} * I_{pub}^{t-1,t-\frac{T+1}{2}+1} * I_{[t-T+1,t]}^{t-\frac{T+1}{2}+1,t} = I_{pub}^{0,t-\frac{T+1}{2}+1} * I_{[t-T+1,t]}^{t-\frac{T+1}{2}+1,t}$$

Table 6: Illustration of the half splice

Period	1	2	3	...	7	8	9	...	13	14	15
1 st compilation round in period 13	100.0	100.7	100.6	...	104.3	102.9	104.2	...	103.8		
2 nd compilation round in period 14		100.0	100.2	...	103.8	102.5	103.7	...	103.3	104.6	
3 rd compilation round in period 15			100.0	...	103.7	102.1	103.6	...	103.2	104.4	104.1
Published index (Half splice - Link onto previous)	100.0	100.7	100.6	...	104.3	102.9	104.2	...	103.8	105.0	104.6
<p><i>The splicing starts in period 14. The published indices for periods 1 to 13 are obtained at the first compilation round. The published index in period 14 is obtained by applying the change between period 13 and period 8 indices of the first compilation round and the change between period 8 and period 14 indices of the second compilation round to the published index of period 13 (103.8*(102.9/103.8)*(104.6/102.5)=105.0). The published index in period 15 is obtained by applying the change between period 14 and period 9 indices of the second compilation round and the change between period 9 and period 15 indices of the third compilation round to the published index of period 14 (105.0*(103.7/104.6)*(104.1/103.6)=104.6).</i></p>											
Published index (Half splice – Link onto published)	100.0	100.7	100.6	...	104.3	102.9	104.2	...	103.8	105.0	104.7
<p><i>The splicing starts in period 14. The published indices for periods 1 to 13 are obtained at the first compilation round. The published index in period 14 is obtained by applying the change between period 8 and period 14 of the second compilation round to the published index of period 8 (102.9*(104.6/102.5)=105.0). The published index in period 15 is obtained by applying the change between period 9 and period 15 of the third compilation round to the published index of period (104.2*(104.1/103.6)=104.7).</i></p>											

Mean splice

Link onto the previously calculated series:

$$I_{pub}^{0,t} = I_{pub}^{0,t-1} * \prod_{k=t-T+1}^{t-1} (I_{[t-T,t-1]}^{t-1,k} * I_{[t-T+1,t]}^{k,t})^{\frac{1}{T-1}}$$

Link onto the published series:

$$I_{pub}^{0,t} = I_{pub}^{0,t-1} * \prod_{k=t-T+1}^{t-1} (I_{pub}^{t-1,k} * I_{[t-T+1,t]}^{k,t})^{\frac{1}{T-1}} = \prod_{k=t-T+1}^{t-1} (I_{pub}^{0,k} * I_{[t-T+1,t]}^{k,t})^{\frac{1}{T-1}}$$

Table 7: Illustration of the mean splice

Period	1	2	3	4	5	...	11	12	13	14	15
1 st compilation round in period 13	100.0	100.7	100.6	101.6	102.7	...	104.3	106.0	103.8		
2 nd compilation round in period 14		100.0	100.2	101.1	102.2	...	103.8	105.5	103.3	104.6	
3 rd compilation round in period 15			100.0	101.0	102.0	...	103.5	105.3	103.2	104.4	104.1
Published index (Mean splice - Link onto previous)	100.0	100.7	100.6	101.6	102.7	...	104.3	106.0	103.8	105.1	104.8
<p><i>The splicing starts in period 14. The published indices for periods 1 to 13 are obtained at the first compilation round. The published index in period 14 is obtained by applying the geometric average of the changes (k=2,...,13) between period 13 and period k indices of the first compilation round and the changes between period k and period 14 indices of the second compilation round to the published index of period 13</i> $(103.8 * [(100.7/103.8)(104.6/100.0) * \dots * (103.8/103.8) * (104.6/103.3)]^{1/12} = 103.8 * 1.012702 = 105.1)$. <i>The published index in period 15 is obtained by applying the geometric average of the changes (k=3,...,14) between period 14 and period k indices of the second compilation round and the changes between period k and period 15 indices of the third compilation round to the published index of period 14</i> $(105.1 * [(100.2/104.6)(104.1/100.0) * \dots * (104.6/104.6) * (104.1/104.4)]^{1/12} = 105.1 * 0.996914 = 104.8)$.</p>											
Published index (Mean splice – Link onto published)	100.0	100.7	100.6	101.6	102.7	...	104.3	106.0	103.8	105.1	104.8
<p><i>The splicing starts in period 14. The published indices for periods 1 to 13 are obtained at the first compilation round. The published index in period 14 is obtained as a geometric average of the changes between period k and period 14 of the second compilation round to the published index of period k (k=2,...,13):</i> $([(100.7) * (104.6/100.0) * \dots * (103.8) * (104.6/103.3)]^{1/12} = 105.1)$. <i>The published index in period 15 is obtained as a geometric average of the changes (k=3,...,14) between period k and period 15 of the third compilation round to the published index of period k (k=3,...,14)</i> $(105.1 * [(100.6/105.1)(104.1/100.0) * \dots * (105.1/105.1) * (104.1/104.4)]^{1/12} = 105.1 * 0.9969 = 105.1 * 0.996745 = 104.8)$.</p>											

Fixed base (December of the previous year)

Link onto the published series:

$$I_{pub}^{0,t} = I_{pub}^{0,t-1} * I_{pub}^{t-1,Dec(t)} * I_{[t-T+1,t]}^{Dec(t),t} = I_{pub}^{0,Dec(t)} * I_{[t-T+1,t]}^{Dec(t),t}$$

Table 8: Illustration of the fixed base splicing

Period	1	2	3	4	5	...	11	12 (Base period)	13	14	15
1st compilation round in period 13	100.0	100.7	100.6	101.6	102.7	...	104.3	106.0	103.8		
2nd compilation round in period 14		100.0	100.2	101.1	102.2	...	103.8	105.5	103.3	104.6	
3rd compilation round in period 15			100.0	101.0	102.0	...	103.5	105.3	103.2	104.4	104.1
Published index (Fixed base – Link onto published)	100.0	100.7	100.6	101.6	102.7	...	104.3	106.0	103.8	105.1	104.8
<p><i>The splicing starts in period 14. The published indices for periods 1 to 13 are obtained at the first compilation round. The published index in period 14 is obtained by applying the change between period 12 and period 14 of the second compilation round to the published index of period 12 ($106.0 \times (104.6/105.5) = 105.1$). The published index in period 15 is obtained by applying the change between period 12 and period 15 of the third compilation round to the published index of period 12 ($106.0 \times (104.1/105.3) = 104.8$).</i></p>											

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