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Alignment of Methodology and Scope between Services Producer Price Indices (SPPIs) and Consumer Price Indices (CPIs): Developing a framework for using CPIs in SPPI calculation

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D. Blank – Destatis (Germany)

M. Santiago - BLS (USA)

N. Elversoe – Statistics Denmark

R. Draper - SCB (Sweden)

R. Vaizner – CBS (Israel)

A. Bertin, S. E. Maillefert, J. M. Fournier – INSEE (France),

*The views expressed by the authors do not necessarily represent the positions of their institutions.
Any errors and omissions are only the responsibility of the authors.*

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1 INTRODUCTION

For over 30 years, the Voorburg Group has worked towards expanding Producer Price Index (PPI) coverage to services by establishing and maintaining an internationally comparable methodology for measuring output and producer price indices for the service industries. As many countries continue to expand their coverage of services PPIs, and as members of the European Union (EU) are formally adopting a business-to-all basis¹, there has been discussion among Voorburg group members about utilizing selected Consumer Price Index (CPI) based indices to represent PPIs². CPI usage, when appropriate, has the potential to simultaneously reduce costs and the level of burden on both statistical institutions and respondents, while also providing a swift route to higher levels of PPI coverage.

PPIs and CPIs have some inherent differences that must be explored and considered to ensure that CPIs are used in the appropriate circumstances and manner. First of all is the price definition. A PPI measures changes in the **price received by a domestic company** for providing goods or services whereas CPI captures changes in the **price paid by the resident consumer** for a good or a service. Thus, the indices will differ regarding the valuation principle.

The second main difference rests on imported and exported services. The PPI measures changes in the prices received for products **provided by domestic companies**, which excludes imported products and includes exported products. Whereas the CPI measures changes in the prices for **all products available to a consumer**, and which includes imported products and excludes exported products. The presence of imports or exports will impact the indices only if the prices of imported or exported services change at a different rate than the equivalent domestic services.

Other methodological issues and practical concerns that must be addressed are the differences in nomenclature and classification systems and differences in the weighting of products within the index structures.

Using CPIs as a proxy³ for PPIs may be a viable proposal but must be adapted to each national situation. It is not necessarily suitable for industries with a low percentage of sales to consumers where lack of price correlation can pose a risk. Furthermore, CPI data needs to be adjusted to take account of the explicit fees, implicit fees, and the imported and exported services. And even when all these boxes are checked, there are still some issues with differences in nomenclature that must be considered on a case-by-case basis.

¹ European Business Statistics (EBS), formerly Framework Regulation Integrating Business Statistics (FRIBS), is a common legal framework for business statistics adhered to by EU member states and formerly mandates production of SPPIs on a business-to-all basis (Eurostat, 2021). Eurostat (2021). [European Business Statistics Manual](#) - 2021 Edition, Page 247

² Official presentations have been made by R.Draper and M.Fridén (Statistics Sweden, 2019) at the 34th Voorburg Group meeting, K.Pegler and C.Taylor (ONS, 2014) at the 29th Voorburg Group meeting. Voorburg Group members also gave input regarding this topic via the second edition of the Eurostat-OECD Methodological Guide for Developing Producer Price Indices for Services (2014)

³ In statistics, a proxy or proxy variable is generally defined as a variable that is not in itself directly relevant, but that serves in place of an unobservable or immeasurable variable. Upton, G., Cook, I. (2002) Oxford Dictionary of Statistics. OUP ISBN 978-0-19-954145-4. In terms of the use of a CPI as a proxy for a PPI, this paper takes a different stance in that the proxy is chosen not because something is necessarily unobservable or immeasurable but rather the CPI proxy presents a strategically viable alternative that is either a partial or full match to the PPI it is representing.

2 SCOPE OF SPPIs

The Eurostat-OECD Methodological Guide for Developing Producer Price Indices for Services states that the scope of SPPIs should cover services provided for all uses, including both intermediate and domestic final consumption as well as exports. Additionally, since prices, and price movements, can vary depending on the purchaser, separate SPPIs should be available for each of these end use categories. The guide also states that SPPIs should measure change in the prices of products, rather than industries since the output of industries in most countries can typically be broken down into various products, and CPIs and other price indices also measure change in the prices of products rather than industries. Furthermore, SPPIs should represent all output as defined in national accounts.⁴

The IMF's Producer Price Index Manual: Theory and Practice states that PPIs can cover all domestic production, including exports, or be limited to production for domestic markets only. The manual also states that PPIs can be compiled and classified by industry or product. These are decisions that must be made by each statistical agency to define the scope and coverage of the PPI. When the main purpose of the PPI is as a deflator of national accounts, broad coverage of economic activity is needed. Statistical agencies must consider relative shares of different activities in national economies when determining the scope and coverage of their PPI.⁵ The use of product or industry SPPIs, and how that affects the use of CPIs as a proxy for SPPIs is discussed in more detail in section 6.2.

3 CALCULATION OF SPPIs

There are (at least) two ways for calculating business to all SPPIs.

One method is a single business to all SPPI (BtoAll) that covers output prices to all end users in a single estimation. This method might be used when service output and its prices for different end users are very similar or cannot be separated in practice.

Conversely, a BtoAll SPPI can be created as an aggregation of SPPIs computed by destination, by "horizontal aggregation" (at each classification level) of BtoB, BtoC, and BtoX, as defined below.

- **Domestic Business-to-Business SPPIs (BtoB) measure transaction price changes for services sold by national producers to national businesses;** they cover domestic production sold to legal entities established in the national territory (including the general government sector, affiliates of foreign groups, etc.).
- **Domestic Business-to Consumer SPPIs (BtoC) measure transaction price changes for services sold by national producers to households in the national territory;** CPIs can be the main source for these indices.
- **Domestic Business to Export SPPIs (BtoX) measure transaction price changes for services sold by producers established in the national territory to foreign markets.** These transaction prices have to be converted to national currency and therefore include exchange rate effects.

⁴ OECD/Eurostat (2014), [Eurostat-OECD Methodological Guide for Developing Producer Price Indices for Services: Second Edition](#), Page 20

⁵ International Monetary Fund (2004), [Producer Price Index Manual: Theory and Practice](#), Page 33

This approach requires the ability to track price changes across different types of customers, which is costly in the terms of surveys. It also requires the availability of inputs to be able to aggregate the results of indices by customer category in accordance with the relative weight of these different markets in total production.

4 CPI AS A PROXY FOR B2C OR B2ALL – BASIC PRINCIPLES

When using CPI data to compile SPPIs, CPI data can be used either exclusively, where only CPI data are used or in tandem with other producer price data not covered by the CPI, especially those relating to business users.

4.1 CURRENT GUIDANCE

According to the Eurostat-OECD Methodological Guide for Developing Producer Price Indices for Services, there is potential overlap between SPPIs and CPIs when it comes to the pricing of services delivered to households. The guide does not provide any rules for how to use CPIs when compiling SPPIs since there is so much variation in the service products and data sources between countries. However, it does state that if a country is using CPI information to obtain prices for services acquired by households, SPPI data collection would only be needed for business-to-business and export transactions if those segments are significant.⁶ This implies that using CPIs as a proxy for SPPIs, with no further data collection needed, would be possible for industries without significant business-to-business or export transactions.

Furthermore, the guide explicitly addresses using price data collected for the CPI as a special case of direct use of prices of repeated services when this method is used for calculating SPPIs. This situation arises in particular for service industries where the vast share of output goes to final demand, such as passenger transportation, food and accommodation, or finance and insurance. In other words, when services that are predominantly but not exclusively destined for household consumption, the use of CPI data can help to remove or minimize the requirement for data collection.⁷

The IMF manual does not address the use of CPIs as a proxy for PPIs.

4.2 VALUATION PRINCIPLE: BASIC PRICES VS. PRODUCER PRICES VS. PURCHASER PRICES

When using CPI data as a proxy for SPPIs, attention must be paid to the principles underlying the methodology of SPPI development.

The System of National Accounts (SNA) defines two kinds of prices to measure output, namely, basic prices and producers' prices⁸:

- a. The *basic price* is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable, and plus any subsidy receivable, by the producer as a consequence of its production or sale. It excludes any transport charges invoiced separately by the producer. Basic prices exclude any taxes on products the producer receives from the purchaser and passes on to government but include any subsidies the producer receives from government and uses to lower the prices charged to purchasers.

⁶ OECD/Eurostat (2014), [Eurostat-OECD Methodological Guide for Developing Producer Price Indices for Services: Second Edition](#), Page 23

⁷ OECD/Eurostat (2014), [Eurostat-OECD Methodological Guide for Developing Producer Price Indices for Services: Second Edition](#), Page 44

⁸ *System of National Accounts (2008)*, Page 101

- b. The producer's price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output minus any VAT, or similar deductible tax, invoiced to the purchaser. It excludes any transport charges invoiced separately by the producer.

Both producers' and basic prices are actual transaction prices that can be directly observed and recorded. Basic prices are often reported in statistical inquiries and some official "producer price" indices actually refer to basic prices rather than to producers' prices as defined here.

SNA also defines the concept of purchaser's price which corresponds to the amount paid by the purchaser, excluding any VAT or similar tax deductible by the purchaser, in order to take delivery of a unit of a good or service at the time and place required by the purchaser. The purchaser's price of a good includes any transport charges paid separately by the purchaser to take delivery at the required time and place.

When a purchaser buys directly from the producer, the purchaser's price may exceed the producer's price by:

- a. The value of any non-deductible VAT, payable by the purchaser;
- b. The value of any transport charges on a good paid separately by the purchaser and not included in the producer's price; and
- c. If purchasers buy output not from the producer directly but from a wholesaler or retailer, it is necessary to include their margins in the difference between basic and purchasers' prices also.

Figure below⁹ gives an overview of the official differences between basic, producer and purchasers' prices:

Basic prices (PPI)
+
Taxes on products excluding invoiced VAT
-
Subsidies on products
=
Producers' prices
+
VAT not deductible by the purchaser
+
Separately invoiced transport charges
+
Wholesalers' and retailers' margins
=
Purchasers' prices (CPI)

CPIs aim to measure transactions in purchasers' prices; SPPIs aim to measure transactions in basic prices.

If CPI data is used in the compilation of SPPIs it must at least be adjusted from valuation at purchasers' prices to basic prices by deducting any taxes, as basic prices are better aligned to the remuneration that producers actually receive to compensate them for expenditures on goods and services used as intermediate inputs, for labor costs, and as a return to capital. Explicit fees that are added to the price at the point of sale, such as value added tax and excise duties, are typically calculated as a percentage of the price and therefore easy to remove from the CPI data. The more difficult taxes and fees to remove are the implicit fees (taxes on products other than VAT, freight, and insurance). These fees are more difficult both to identify and to quantify, however they

⁹ [System of National Accounts \(2008\)](#), Page 103 (§ 6.69)

should still be removed when using CPIs in SPPI development as they are not part of the price received by the producer. Additionally, adjustments should be made for subsidies on products and services which are not included in CPIs. For example, in France, the prices charged for canteen services in school universities or even companies are largely subsidized. Prices paid by consumers are often lower than the prices received by the producers who provided the service.

Second, when CPI data are used as a full proxy for the SPPI, special attention needs to be given to the potential for prices charged to businesses to display different trends to those charged to household consumers. The assumption that prices for business users and households move in a similar trend, with a similar composition of consumption, should be tested.¹⁰ However, testing this assumption is difficult for national statistical offices when the goal is to use CPIs for estimating SPPIs that they do not calculate.

4.3 INTERNATIONAL TRADE OF SERVICES: IMPORTS/EXPORTS

As stated previously, SPPI measures changes in the prices received for all services provided by domestic companies (including exports) while CPI measures changes in the prices for all services available to a consumer, and this will include imported services.

These differences of scope related to international trade of services will impact the indices only if the prices of imported or exported services change at a different rate than the equivalent domestically produced or domestically consumed services, respectively. Particularly for countries that are affected by exchange rates fluctuations, the prices of imports and exports can change at a different rate than domestic services.

One way to understand the differences in scopes between CPIs and the SPPIs due to international trade of services is to look at the relative shares of domestic production and imports in the total final consumption by services categories. A high proportion of imports suggests different developments between the CPI and the SPPI. Similarly, a high share of exports in domestic production of services suggests potentially different developments between CPIs and the SPPIs (see section 5).

4.4 PRICE DEVELOPMENT MATCHING

Some countries currently use CPIs as part of their B2All SPPI calculations. For example, Hungary produces B2All SPPIs for air passenger transport, post and telecommunications services as a weighted average of CPIs with B2B SPPIs.¹¹ In Sweden, 17% of SPPIs are derived from CPIs. CPIs are the primary source of prices in section I – Accommodations and food services, section R – Arts, entertainment and recreation services, and section S – Other services.¹² In France, 19% of SPPIs are derived from consumer price indices.¹³ For further information on the French experience, see section 6.3 Practical Examples.

However, there is little published on the practical implications of using CPIs as a proxy for SPPIs. The UK Office for National Statistics (ONS) has done some analysis on using CPIs as a proxy for PPIs in the manufacturing sector.¹⁴ ONS mapped the COICOP classification to the UK Standard Industrial Classification, created an estimate of PPIs derived from CPIs, and compared the estimated PPI to the actual PPI. Their comparison clearly showed the need to monitor and adjust for the effect of changes to explicit taxes, and recommended further analysis on

¹⁰ OECD/Eurostat (2014), [Eurostat-OECD Methodological Guide for Developing Producer Price Indices for Services: Second Edition](#), Page 45

¹¹ Holocsy, [CPI Use in PPI Context](#), Hungarian Central Statistical Office, 2014

¹² Draper and Fridén, [SPP by customer sector – “the Swedish experience”](#), Statistics Sweden, 2019

¹³ OECD/Eurostat (2014), [Eurostat-OECD Methodological Guide for Developing Producer Price Indices for Services: Second Edition](#), Page 24

¹⁴ Pegler and Taylor, [CPI Use in PPI Context](#), Office for National Statistics, UK, 2014

the importance of removing implicit fees. ONS also investigated whether the presence of imports caused significant difference between the estimated PPIs and actual PPIs. Their analysis suggested a positive, but weak, relationship between the difference in their estimated PPIs and actual PPIs and the prevalence of imported goods that was largely the result of a few industries. The use of CPIs as a proxy for the BtoC portion of PPIs appeared viable, though probably not suitable for all industries. In particular, CPIs are not recommended to be used in areas where there is a large amount of imported supply or where implicit fees are important and difficult to identify or quantify. Additionally, as discussed earlier, CPI data would need to be adjusted for taxes and subsidies.

5 SUPPLY AND USE TABLES

“Traditionally, the main use of SUTs has been to improve GDP estimates by balancing records of the supply of goods and services with those of the demand for them, thus capitalizing on and confronting disparate sources of data—business surveys, household surveys, labour force surveys, administrative tax records, imputations, and so on. But their potential goes well beyond this¹⁵, as SUTs provide a bird’s-eye view of the structure of the economy—who makes what, how and for whom.” (OECD, 2017)

Simple schematic of supply-use tables

Supply

Products	Industries			Imports	Trade and transport margins	Taxes less subsidies on products	Total
	Agriculture	Industry	Services activities				
Agricultural products	Output by product and by industry at basic prices			Imports by product	Trade and transport margins by product	Taxes less subsidies on products by product	Total supply by product at purchasers' prices
Industrial products							
Services							
Total	Total output at basic prices by industry			Total imports	Total trade and transport margins	Total taxes less subsidies on products	Total Supply at purchasers' prices

Use

Products	Industries			Final uses			Total
	Agriculture	Industry	Services activities	Final consumption	Gross capital formation	Exports	
Agricultural products	Intermediate consumption by product and by industry			Final uses by product and by category			Total use by product at purchasers' prices
Industrial products							
Services							
Value added	Value added by component and by industry, at basic prices						Value added
Total	Total output at basic prices by industry			Total final uses by category			

¹⁵ In recent years, SUTs have become the key accounting tool used to generate national input-output tables, and have become essential to the construction of datasets such as those used for Trade in Value Added (TiVA) estimates and related applications, such as CO2 footprints and jobs embodied in trade. And their potential goes beyond even these high-profile applications. SUTs can, for example, help simulate and estimate the economic impact of potential price shocks, or develop productivity estimates taking account of labour, capital and intermediate inputs. Moreover, they provide the basis for simple descriptive statistics that are not typically available or collected. <http://oecdinsights.org/2017/06/05/statistical-insights-what-role-for-supply-use-tables/>

SUTs provide an objective and practical basis to determine whether a CPI for a given product would constitute a good proxy for a product or industry PPI. There are a number of factors that can be derived from SUTs to support the feasibility of a CPI's fitness-for-purpose as a proxy.

Commonly available information

- Household consumption share of total use
- Export share of total use
- Import share of total supply

Less commonly available information

- Household consumption share of total domestic production

The first practical step is to calculate the *household consumption share of total use* on a per product basis (or the lowest level of available data). This gives the price statistician a mapping of where to focus other analysis, for example, classification assessments (see section 6.1). The second practical step that the SUTs allow for is calculating the prevalence of exports and imports, which can interfere with the feasibility of the CPI as a proxy (see section 4.3). These objective measures of CPI suitability give the price statistician a sound basis from which to make decisions from, yet some exceptions may exist. A further qualitative assessment may be made to delve into homogeneity and heterogeneity of products and price change in cases where household consumption is low and/or international trade is high.

As suggested, it is preferred to make this analysis on the lowest classification level possible, or in the case of lack of detail it should only be made for industries and services that are relatively homogeneous. In certain rare cases it can be argued that the CPI is an exact match to the PPI counterpart and the term proxy becomes redundant. For example, if 100% of the revenue comes from household consumption and international trade is non-existent.

Ideally, the price statistician will utilize a supply-use table already valued in basic prices but if not then explicit and implicit taxes will need to be considered (see section 4.2).

A quick checklist to consider when using SUTs for finding and utilizing CPIs as PPI Proxies:

- How detailed are your Supply-and-Use-tables, industry, service, 6-digit level?
- How homogenous are the given industry or service at the level of detail available to you?
- Is there a share of household consumption for a given service or industry that is deemed to be too high a risk for use as a broad-based proxy?
- How big are the export and import share of the revenue data in the SUT for the given industry or service?

The following table depicts an assessment that can be completed utilizing the most recently available SUTs. Ideally the analysis will be conducted at the lowest classification level possible deemed of a high enough quality of data. On the use side the price statistician needs to allocate use data to appropriate segments (consumer; business; government and export). On the supply side, by design, import data is presented as total import to all segments, however, national accounts may have unpublished data at a finer level enabling a segment based assessment to be conducted for import data too.

SUPPLY	
Imports	I2ALL
USE¹⁶	
Total Intermediate Use	B2B
Household final consumption expenditure	B2C
Government final consumption expenditure	B2G or B2B
Gross fixed capital formation	B2B
Exports	B2E

Once allocated on a per classification basis a percentage share can be generated to ascertain the suitability of a CPI proxy as a replacement for PPI direct collection of prices.

As an example, we have extracted some data from the OECD website and made an overview table for a selection of counties (See appendix B). The tables used to create this table are the supply and use tables:

- [43. Use at basic prices](#)
- [30. Supply at basic prices and its transformation into purchasers' prices](#)

It is important again to note that this analysis is a starting point to assessing the feasibility of a CPI as a proxy for PPI. After a sufficient good/service/industry have been identified, there are other qualitative assessments on a case-by-case basis that should be considered, which have been described throughout this paper.

6 OTHER METHODOLOGICAL ISSUES AND PRACTICAL CONSIDERATIONS

6.1 NOMENCLATURE: COICOP/ISIC/CPA

Another methodological problem arises when one wishes to estimate SPPIs by CPIs. The nomenclatures used by these two categories of indices are different. This can have an impact on definition or scope of the two categories of indices.

CPIs are (generally) calculated according to the Classification of Individual Consumption by Purpose (COICOP), a nomenclature of consumption functions. As an international standard classification, COICOP is the primary tool for collecting and presenting internationally comparable statistics on individual household consumption according to purpose. Only its four levels of aggregation (5 digits code) are internationally standardized. This nomenclature could combine goods and services or several services purchased by consumers from retailers.

At the state level, national statistical offices have mostly developed more detailed levels of the COICOP nomenclature to better monitor consumer prices. In EU, Member States use and disseminate CPIs based on a harmonized specific COICOP.

SPPIs should be representative of all the different service activities. The International Standard Industrial Classification for all industries (ISIC) is the international reference classification of economic activities. It essentially aims to provide a set of categories of activity used to compile production statistics based on these

¹⁶ BtoB can be further split by industry based dimensions and by outputs utilized by government entities (BtoG), however, such splitting is currently outside the bounds of mainstream application.

activities. Besides, ISIC covers production activities, falling within the scope of the System of National Accounts. Only, its first four levels of aggregation (coded with 4 digits) are internationally standardized.

Take, for example, the product regular vehicle inspections. Here, the index structure may further distinguish by region and by type of vehicles for which these tests are performed. In the CPI, trucks probably have a very small share of vehicle inspections, while motorcycles probably play little role in the SPPIs. The different shares of vehicle tests could have an impact on the overall price development of the product. In principle, this is true for many products that play a role in both index types.

As SPPIs should reflect the evolution of prices of specific services sold by companies, it is only possible to use CPIs at a very detailed level of activity, which are at the intersection of two sets of services definitions, from two heterogeneous nomenclatures.

To illustrate this point, we have attempted to map the COICOP nomenclature (2018) to the European CPA product nomenclature (derived from the ISIC nomenclature). It takes up the work carried out by Eurostat to provide the Member States of European Union with a harmonized table of mapping consumption functions and products decomposition of the SUT, at more detailed levels (COICOP 2018 defined at the 4-digit level of detail - 6-digit level of detail of the CPA nomenclature).

This exercise is limited to the elements required by the European EBS regulation covering only the products of CPA sections H, I, J, L, M and N (excluding group 70.1 and divisions 72 and 75). This set of products corresponds to market services only, excluding financial activities (section K of CPA). For the latter, output and price measures are mainly conventions specific to National Accounts rules (FISIM, production of non-life or life insurance services production). National Accounts use probably only banking and financial investment fees, as measured by CPIs.

A file attached to this document attempts to define concordance between SPPIs and CPIs¹⁷. This work was carried out on the basis of a concordance table, at detailed levels, between CPA 2.1 and COICOP 2018 disseminated by Eurostat¹⁸. Analyzing the headings of different items of the two nomenclatures as well as the elements explicitly included or excluded in each of them. From 129 categories tested, only 77 showed varying degrees of concordance.

Thus, we can define, in a relatively subjective way, five categories of concordance between the categories as defined by COICOP and those as defined by CPA:

- 1) **Match** - when the definitions of the two classifications are relatively close (8 CPA categories out of 129), especially for transport of passengers, services relating to dwellings, videogames, etc.;
- 2) **Proxy** - when the definitions of the two classifications partially overlapped (22 CPA categories out of 129);
- 3) **Proxy by aggregation of several CPIs** - with the question of the weightings of these CPIs which have to be used in order to estimate the evolution of a SPPi (20 CPA categories out of 129);

¹⁷ see An_attempt_to_define_concordance_between_CPIs_and_SPPIs.xls

¹⁸ https://ec.europa.eu/eurostat/ramon/rerelations/index.cfm?TargetUrl=LST_REL&StrLanguageCode=EN&IntCurrentPage=5

- 4) **Weak Proxy**, when the definitions of the two classifications are far from being close (16 CPA categories out of 129); and finally
- 5) **Weak Proxy by aggregation of several CPIs**, with only 11 CPA categories covered.

The varying degrees of concordance shows that some limitations may need to be considered when using CPIs to represent SPPIs.

6.2 PRODUCTS VS. INDUSTRIES

The Eurostat-OECD methodological guide for developing producer price indices for services defines industry based and product based indices as follows:

Industry based indices are created from a sample of business enterprises classified under that industry. All of the output of these sampled units is represented, even secondary activity output that is classified under other industries in the international classification systems, and aggregated to form these (4-digit) industry level indices.

Product based indices are created from samples of products. All service product output (obtained from lists of producers of each product) is eligible for selection, regardless of the classification of the business enterprises that produce it. Price movements for products are generally aggregated to form product Group or product Class level indices

For both index types, prices and price changes of products are observed. The differences lie, on the one hand, in the population from which the sample of providers and the sample of price observations are drawn and, on the other hand, in the weighting of the individual services.

How does the population of providers of certain services affect the index development? Is the price development different for providers for whom the services in question represent their economic focus than for companies that provide this service as a by-product? In open markets with a large number of providers, it can be assumed that the economic focus of the provider plays only a minor role compared with other factors such as the economic importance of the provider, its reputation or regional circumstances. One could assume that the price development of a product category is closely linked to the price development of these products at the market leaders - regardless of whether these market leaders have their focus in the corresponding economic sector.

The second crucial difference between product-based and industry-based indices - the weighting of the individual services - probably has a stronger influence on the index trend. On the one hand, an industry-based index is composed of the price trends of main and by-products. On the other hand, within the main products one may have a different internal weighting depending on whether one considers only the suppliers of the respective industry or all suppliers.

This, of course, depends heavily on how much is known about the revenue significance of the services in the various groups of providers. Often, no clearly distinguishable data on the sales significance of individual services are available for either type of index. If we consider only the section of an industry-based index that reflects the price development of the main products, its inner weighing is subject to similar uncertainties as those of a product-based index. The smaller one chooses the product section, the more similar the price developments in the chosen product section are likely to be.

The output of industries in most countries can typically be broken down into various products, and so measures of industry output in volume terms can be easily derived. Regardless of the type of index published by the statistical offices, these indices can be broken down to products too.

The part of a product index that is most observable, and probably the most secure, is the sub-index for which prices are collected from companies for which the products in question correspond to their economic focus. The same applies to industry-based indices. The sub-index that is easiest to collect and probably best secured is the price development of the main products of the industry.

Based on the previous considerations on the influences of the economic focus of companies on price developments, it seems reasonable to estimate index components by price developments for the corresponding products in other economic sectors. That is, missing parts of an industry-based index can be estimated by product indices from other sources, and missing parts of a product-based index can be estimated by product components of an industry-based index.

CPIs and other price indices also measure change in the prices of products rather than industries. This approach provides greater scope for combining various price index data at an aggregate level for use in, for example, balancing supply and use tables in the national accounts and in macroeconomic analysis.

6.3 PRACTICAL EXAMPLE – CPIs USED AS BTOC SPPIS BY INSEE

As already mentioned, the French SPPIs are calculated by decomposing indices according to the different types of users: domestic market of companies (BtoB), household consumers (BtoC) and non-domestic markets (BtoX).

The consumer price indices (CPIs) are naturally the main source for the basic prices for services sold directly to households in France even if they are compiled and published including VAT, that is to say at “market prices”. They are thus recompiled at “basic prices”, if applicable, by being “fiscally adjusted” when they are also used as BtoC SPPIs.

Furthermore, because the consumer prices are computed by “basic headings” (articulated with the combined nomenclature COICOP) and not by “class of product” (the 4-digit level of the “Classification des Produits Française - CPF” broadly equivalent to the CPA classification), a concordance table between these two concepts (CPIs and SPPIs), hence between CPA and COICOP has been defined. This concordance table is similar to the concordance table defined in part 6.1 above.

Thus, it is mainly consumer price indices for passenger transport, food and accommodation or communication services that are used, sometimes to estimate different SPPIs (see appendix A).

7 CONCLUSION

The CPI represents a viable opportunity to increase and/or replace coverage in the production of SPPIs. Conceptual differences between the PPI and CPI, which are consistent with the primary uses of the two measures, need to be carefully considered in order to ensure accurate and a theoretically and practically sound suite of price indicators. The different uses result in differences such as valuation principle, scope and coverage, aggregation and classification and other differences such as timing and frequency of the series. This paper has discussed a number of these important aspects to consider while also providing some practical guidance.

- 1) **Valuation principle** – the PPI measures changes in the prices received by the company for the provision of good or services and is defined in basic prices. It should include subsidies on products and taxes on production while excluding taxes on products, subsidies on production, retail and wholesale margins and

ancillary aspects of the transaction that are separately invoiced (e.g. insurance charges). In contrast, the CPI measures changes in the prices paid by the consumer. The price is the total amount the purchaser pays, excluding any deductible VAT or similar deductible tax, in order to take delivery of a unit of a good or service at the time and place required by the purchaser; the purchaser's price of a good or service includes any ancillary charges paid separately by the purchaser to take delivery at the required time and place. Thus, the indices will differ with regard to the inclusion and/or exclusion of certain taxes, subsidies and ancillary charges.

- 2) **International trade in services** – The SPPI measures changes in the price received for services provided by domestic companies to the domestic market and to export. The CPI measures changes in the prices for all services available for the consumer, including imported services and excluding exported services. For industries that contain a large portion of imported services, it is potentially less appropriate to use the CPI as proxy for the SPPI and it may be necessary to remove the prices of imported services from the CPI. The imported services impact the indices only if their prices change at a different rate than the equivalent domestic services.
- 3) **Classification** – the compilation of the SPPI and the CPI are based on different classification structures. The PPI is compiled according to industry or product classification (ISIC/CPA) and the CPI is compiled according to the classification of individual consumption (COICOP). Therefore, the CPIs must be mapped onto the classification used to compile the SPPI's. When there is not much overlap between the two different nomenclatures, the CPI proxies must be matched at the very specific and detailed level.
- 4) **Products vs. industries** – The SPPI can be industry based or product based. For both index types, prices of products are observed; the differences are in the sample design and in the weighting of the services. The outputs of industries can be separated into various products. The CPI also measures changes in the prices of products.
- 5) **Supply and Use Tables (SUTs)** – SUTs provide a basis to determine which industries or products are suited to the use of CPIs as proxies, because they contain information about the share of final consumption of total use, as well as the share of export, import, and intermediate consumption for each service industry at a detailed level.

To summarize, this paper describes the differences and similarities between the two indices to enable the price statistician to make a more informed assessment of the risks involved in using CPIs as proxies for SPPIs. Beyond these aspects there are of course other operational differences in the practical application of quality adjustment and imputation methods, different methods of measuring intermediate services, such as banking and insurance services, and coverage of personal consumption components that are not directly paid by the consumer but by a third party. This paper sets the foundations from which more studies and analysis on the implication of using CPIs as a proxy for SPPIs can be done in the future.

8 APPENDICES

8.1 APPENDIX A: FRENCH CPIs USED DIRECTLY FOR SPPIS – B2C

COICOP 2018	COICOP HEADING	SPPIS
03.1.4.2	Repair, tailoring and hire of clothing (S)	95.29 | Repair services of other personal and household goods
03.2.2.0	Cleaning, repair, and hire of footwear (S)	95.23 | Repair services of footwear and leather goods
04.1.1.0	Actual rentals paid by tenants for main residence (S)	68.20 | Rental and operating services of own or leased real estate
04.4.4.1	Maintenance charges in multi-occupied buildings (S)	81.10 | Combined facilities support services
04.4.4.1	Maintenance charges in multi-occupied buildings (S)	81.22 | Other building and industrial cleaning services
05.1.2.0	Repair, installation and hire of furniture, furnishings and loose carpets (S)	95.24 | Repair services of furniture and home furnishings
05.3.3.0	Repair, installation and hire of household appliances (S)	95.22 | Repair services of household appliances and home and garden equipment
07.2.4.4	Hire of personal transport equipment without driver (S)	77.11 | Rental and leasing services of cars and light motor vehicles
07.2.4.1	Services for parking (S)	68.20 | Rental and operating services of own or leased real estate
07.2.4.1	Services for parking (S)	52.21.24 | Parking lot services
07.2.4.2	Toll facilities (S)	52.21.22 | Highway operation services
07.3.1.1	Passenger transport by train (S)	49.10 | Passenger rail transport services, interurban
07.3.2.1	Passenger transport by bus and coach (S)	49.39 | Other passenger land transport services n.e.c.
07.3.2.1	Passenger transport by bus and coach (S)	49.31 | Urban and suburban passenger land transport services
07.3.2.2	Passenger transport by taxi and hired car with driver (S)	49.32 | Taxi operation services
07.3.3	Passenger transport by air	51.10 | Passenger air transport services
07.3.4.0	Passenger transport by sea and inland waterway (S)	50.10 | Sea and coastal passenger water transport services
07.3.4.0	Passenger transport by sea and inland waterway (S)	50.30 | Inland passenger water transport services
07.3.5.0	Combined passenger transport (S)	49.31 | Urban and suburban passenger land transport services
07.3.6.0	Other purchased transport services (S)	49.42 | Removal services
07.4.1	Postal and courier services (S)	53.10 | Postal services under universal service obligation

COICOP 2018	COICOP HEADING	SPPIs
08.3.1.0	Fixed communication services (S)	61.10 | Wired telecommunications services
08.3.2.0	Mobile communication services (S)	61.20 | Wireless telecommunications services
09.4.2.1	Hire, maintenance and repair of camper vans and caravans (S)	59.14 | Motion picture projection services
09.4.1.0	Hire and repair of photographic and cinematographic equipment and optical instruments (S)	74.20 | Photographic services
11.1.1.1	Restaurants, cafés and the like – with full service (S)	55.90 | Other accommodation services
11.1.1.1	Restaurants, cafés and the like – with full service (S)	56.30 | Beverage serving services
11.1.1.1	Restaurants, cafés and the like – with full service (S)	56.10 | Restaurant and mobile food serving services
11.1.1.2	Restaurants, cafés and the like – with limited service (S)	56.10 | Restaurant and mobile food serving services
11.1.1.2	Restaurants, cafés and the like – with limited service (S)	56.29 | Other food serving services
11.1.2.1	Canteens, cafeterias of universities, schools, and kindergartens (S)	56.29 | Other food serving services
11.1.2.9	Other canteens, cafeterias and refectories (S)	56.29 | Other food serving services
11.2.0.1	Hotels, motels, inns and similar accommodation services (S)	55.10 | Hotel and similar accommodation services
11.2.0.2	Holiday centres, camping sites, youth hostels and similar accommodation services (S)	55.20 | Holiday and other short stay accommodation services
11.2.0.3	Accommodation services of boarding schools and other educational establishments (S)	55.30 | Camping ground, recreational and vacation camp services

Highlighted in blue: CPIs used for several SPPIs - BtoC.

Highlighted in yellow: SPPIs - BtoC calculated partially with the corresponding CPIs.

8.2 APPENDIX B: SUPPLY AND USE TABLE EXAMPLE ANALYSIS

The following example is a heat map analysis providing a visualization of where potential gains from CPI may be found.

Product (use)	Australia B2C	Australia B2E	Australia Import	Austria B2C	Austria B2E	Austria Import	Denmark B2C	Denmark B2E	Denmark Import	France B2C	France B2E	France Import
Total product at purchaser's prices	27%	9%	...	22%	20%	...	20%	23%	...	24%	13%	...
Total product at basic prices (bp)	26%	9%	10%	20%	21%	20%	17%	24%	21%	23%	14%	21%
Products of agriculture, forestry and fishing, bp	12%	17%	2%	20%	8%	31%	11%	34%	25%	19%	14%	15%
Products of agriculture, hunting and related services, bp	11%	17%	2%	22%	10%	33%	12%	34%	23%	19%	15%	14%
Products of forestry, logging and related services, bp	2%	10%	3%	14%	2%	24%	5%	8%	8%	22%	3%	4%
Fish and aquaculture products, support serv. to fishing, bp	32%	17%	3%	43%	3%	56%	4%	46%	45%	21%	14%	41%
Mining and quarrying, bp	2%	59%	7%	0%	7%	78%	4%	33%	30%	0%	5%	89%
Coal and lignite, bp	0%	92%	0%	...	...	...	...	...	...	...	...	...
Crude petroleum and natural gas, bp	10%	51%	20%	...	...	...	...	...	...	...	...	...
Metal ores, bp	0%	63%	6%	...	...	...	...	...	...	...	...	...
Other mining and quarrying products, bp	0%	16%	10%	...	...	...	...	...	...	...	...	...
Mining support services, bp	0%	1%	2%	...	...	...	...	...	...	...	...	...
Manufactured products, bp	26%	15%	42%	11%	42%	42%	10%	41%	44%	18%	31%	38%
Food, beverages and tobacco products, bp	47%	22%	20%	36%	35%	29%	21%	42%	32%	48%	17%	19%
Food products, bp	43%	23%	18%	...	...	...	...	...	...	...	...	...
Beverages, bp	66%	17%	27%	...	...	...	...	...	...	...	...	...
Textiles, wearing apparel, leather and related products, bp	58%	9%	81%	48%	32%	72%	25%	58%	83%	30%	37%	69%
Textiles, bp	34%	5%	58%	...	...	...	...	...	...	...	...	...
Wearing apparel, bp	79%	5%	95%	...	...	...	...	...	...	...	...	...
Leather and related products, bp	40%	22%	77%	...	...	...	...	...	...	...	...	...
Wood & prod. of wood & cork, exc. furniture, of straw & plaiting mat., bp	1%	7%	15%	2%	38%	17%	4%	18%	42%	5%	12%	26%
Paper and paper products, bp	24%	9%	32%	3%	49%	31%	6%	30%	53%	13%	22%	36%
Printing and recording services, bp	4%	2%	2%	0%	21%	5%	0%	10%	13%	0%	1%	0%
Coke and refined petroleum products, bp	26%	6%	50%	25%	21%	57%	11%	26%	65%	36%	15%	37%
Chemicals and chemical products, bp	21%	17%	48%	5%	46%	50%	4%	43%	58%	6%	40%	40%
Basic pharmaceutical products and pharmaceutical preparations, bp	34%	9%	57%	12%	44%	61%	4%	75%	26%	13%	42%	50%
Rubber and plastic products, bp	16%	5%	48%	5%	42%	47%	3%	34%	51%	6%	25%	37%
Other non-metallic mineral products, bp	5%	2%	18%	3%	28%	29%	6%	22%	31%	7%	13%	24%
Basic metals, bp	0%	67%	15%	0%	42%	36%	0%	32%	72%	0%	35%	42%
Fabricated metal products, except machinery and equipment, bp	6%	3%	26%	2%	37%	33%	2%	26%	32%	4%	14%	22%
Computer, electronic and optical products, bp	27%	8%	81%	11%	44%	61%	12%	43%	66%	14%	38%	65%
Electrical equipment, bp	25%	4%	73%	6%	52%	47%	9%	40%	59%	12%	37%	55%
Machinery and equipment n.e.c., bp	5%	7%	67%	1%	52%	42%	0%	51%	34%	1%	43%	52%
Motor vehicles, trailers and semi-trailers, bp	42%	5%	74%	10%	51%	51%	28%	24%	87%	30%	39%	47%
Other transport equipment, bp	6%	10%	39%	6%	63%	36%	8%	38%	83%	2%	57%	32%
Furniture and other manufactured goods, bp	41%	12%	57%	29%	34%	46%	11%	62%	38%	32%	27%	60%
Furniture, bp	43%	2%	52%	...	...	...	...	...	...	...	...	...
Other manufactured goods, bp	40%	20%	61%	...	...	...	...	...	...	...	...	...
Repair and installation services of machinery and equipment, bp	5%	0%	0%	0%	13%	17%	4%	6%	4%	1%	9%	7%
Electricity, gas, steam and air conditioning, bp	22%	0%	0%	15%	5%	5%	48%	10%	6%	31%	3%	0%
Water supply, sewerage, waste management and remediation services, bp	30%	0%	0%	1%	9%	17%	42%	7%	8%	24%	8%	4%
Natural water, water treatment and supply services, bp	48%	0%	0%	0%	0%	0%	64%	0%	0%	39%	0%	0%
Sewerage services, sewage sludge, waste collection & management serv., bp	4%	0%	0%	1%	10%	19%	39%	9%	9%	20%	10%	5%
Waste collection, treatment & disposal serv., materials recovery serv., bp	4%	0%	0%	...	...	...	...	...	...	...	...	...
Constructions and construction works, bp	0%	0%	2%	1%	1%	1%	1%	11%	7%	6%	0%	0%
Buildings and building construction works, bp	0%	0%	0%	...	...	...	...	...	...	...	...	...
Constructions and construction works for civil engineering, bp	0%	0%	7%	...	...	...	...	...	...	...	...	...
Specialised construction works, bp	0%	0%	0%	...	...	...	...	...	...	...	...	...
Wholesale&retail trade serv., repair serv. of motor vehicles & cycles, bp	56%	7%	0%	45%	18%	2%	34%	28%	3%	43%	18%	2%
Wholesale and retail trade and repair serv. of motor vehicles & cycles, bp	58%	0%	0%	50%	10%	1%	57%	6%	4%	58%	8%	0%
Wholesale trade services, except of motor vehicles and motorcycles, bp	31%	12%	0%	17%	32%	3%	14%	41%	3%	15%	29%	4%
Retail trade services, except of motor vehicles and motorcycles, bp	88%	1%	0%	89%	0%	0%	82%	0%	0%	83%	4%	0%
Transportation and storage services, bp	25%	16%	8%	17%	27%	25%	4%	45%	32%	19%	19%	15%
Land transport services and transport services via pipelines, bp	24%	25%	2%	21%	31%	26%	15%	19%	16%	23%	14%	14%
Water transport services, bp	36%	13%	3%	2%	34%	93%	1%	92%	6%	4%	90%	9%
Air transport services, bp	...	...	30%	37%	22%	24%	3%	46%	41%	38%	34%	22%
Warehousing and support services for transportation, bp	3%	4%	2%	7%	23%	19%	1%	8%	73%	10%	8%	14%
Postal and courier services, bp	...	...	2%	9%	19%	10%	2%	8%	2%	12%	11%	10%
Accommodation and food services, bp	71%	12%	14%	77%	9%	6%	68%	2%	0%	71%	0%	0%
Accommodation services, bp	46%	32%	41%	...	...	...	...	...	...	...	...	...
Food and beverage serving services, bp	78%	6%	7%	...	...	...	...	...	...	...	...	...
Information and communication services, bp	17%	4%	7%	13%	18%	18%	14%	13%	18%	17%	9%	9%
Publishing services, bp	32%	10%	31%	29%	17%	35%	20%	19%	31%	32%	6%	8%
Audiovisual and broadcasting services, bp	16%	2%	12%	13%	10%	24%	16%	4%	9%	9%	10%	9%
Motion picture, video & TV programme production serv., etc., bp	15%	3%	24%	...	...	...	...	...	...	...	...	...
Programming and broadcasting services, bp	18%	2%	0%	...	...	...	...	...	...	...	...	...
Telecommunications services, bp	32%	3%	3%	36%	9%	9%	40%	7%	10%	37%	7%	7%
Computer programming, consultancy and related serv., Information serv., bp	6%	3%	3%	0%	23%	16%	1%	14%	17%	1%	11%	10%
Computer programming, consultancy and related services, bp	0%	4%	3%	...	...	...	...	...	...	...	...	...
Information services, bp	17%	2%	2%	...	...	...	...	...	...	...	...	...
Financial and insurance services, bp	35%	2%	2%	25%	11%	8%	36%	5%	4%	24%	6%	3%
Financial services, except insurance and pension funding, bp	29%	2%	1%	14%	13%	9%	32%	5%	3%	11%	9%	4%
Insurance, reinsurance & pension funding services, exc. compulsory S.S., bp	83%	1%	1%	58%	11%	9%	66%	5%	6%	66%	4%	2%
Services auxiliary to financial services and insurance services, bp	6%	2%	2%	9%	3%	2%	15%	6%	7%	0%	0%	0%
Real estate services, bp	64%	1%	0%	62%	0%	0%	73%	0%	0%	73%	0%	0%
Imputed rents of owner-occupied dwellings, bp	98%	1%	0%	100%	0%	0%	100%	0%	0%	100%	0%	0%
Real estate services excluding imputed rents, bp	0%	0%	0%	32%	0%	1%	52%	0%	0%	39%	0%	0%
Professional, scientific and technical services, bp	3%	4%	4%	1%	16%	12%	1%	14%	13%	3%	10%	10%
Legal, accounting, head offices services, management consultancy serv., bp	...	...	...	2%	13%	11%	0%	12%	10%	3%	7%	6%
Architectural, engineering, tech. testing and analysis services, bp	...	...	...	0%	21%	11%	0%	24%	14%	1%	15%	17%
Scientific research and development services, bp	...	...	...	0%	18%	7%	0%	10%	12%	0%	10%	12%
Advertising and market research services, bp	...	...	...	0%	15%	27%	0%	11%	26%	0%	15%	21%
Other professional, scientific, technical and veterinary services, bp	...	...	...	15%	11%	8%	8%	3%	3%	24%	0%	0%
Administrative and support services, bp	5%	3%	5%	16%	6%	7%	15%	11%	19%	4%	18%	17%
Rental and leasing services, bp	4%	4%	10%	13%	12%	10%	26%	4%	3%	5%	20%	23%
Employment services, bp	5%	3%	3%	0%	2%	5%	1%	2%	2%	1%	0%	0%
Travel agency, tour operator & other reservation services & related, bp	...	...	0%	82%	4%	4%	43%	1%	50%	33%	0%	0%
Security & investigation serv., serv. to buildings & other bus. support, bp	6%	0%	...	12%	3%	5%	3%	21%	19%	2%	24%	19%
Public administration and defence services, compulsory S.S. services, bp	1%	0%	0%	0%	1%	0%	1%	1%	1%	0%	0%	0%
Education services, bp	40%	11%	0%	9%	0%	1%	7%	0%	1%	6%	0%	0%
Human health and social work services, bp	35%	0%	1%	19%	1%	2%	11%	0%	0%	22%	0%	0%
Human health services, bp	36%	0%	1%	17%	1%	1%	11%	0%	1%	18%	1%	1%
Residential care services, social work services without accommodation, bp	34%	0%	0%	26%	0%	4%	11%	0%	0%	29%	0%	0%
Arts, entertainment and recreation services, bp	57%	4%	5%	60%	6%	6%	45%	1%	6%	34%	3%	1%
Creative, arts, entmnt, library, museum, other cult. serv., gambling, bp	60%	3%	6%	55%	8%	9%	46%	1%	9%	38%	5%	3%
Creative, arts and entertainment services, bp	17%	3%	4%	...	...	...	...	...	...	...	...	...
Gambling and betting services, bp	92%	4%	7%	...	...	...	...	...	...	...	...	...
Sporting services and amusement and recreation services, bp	54%	4%	5%	71%	2%	1%	42%	1%	0%	29%	0%	0%
Other services, bp	83%	1%	1%	40%	0%	1%	30%	1%	10%	37%	6%	5%
Services furnished by membership organisations, bp	...	...	...	3%	0%	0%	12%	1%	0%	0%	0%	0%
Repair services of computers and personal and household goods, bp	...	...	...	27%	1%	2%	100%	0%	0%	44%	0%	0%
Other personal services, bp	83%	1%	1%	84%	0%	1%	54%	0%	27%	64%	14%	12%
Services of HH as employers, undif. G&S prod. by HH for own use, bp	...	...	...	100%	0%	0%	6%	0%	0%	88%	0%	0%
Services provided by extraterritorial organisations and bodies, bp	...	...	...	...	...	...	...	...	...	...	...	...
Taxes less subsidies on products	58%	0%	...	65%	1%	...	59%	0%	...	58%	0%	...

Product (use)	Australia B2C	Australia B2E	Australia Import	Austria B2C	Austria B2E	Austria Import	Denmark B2C	Denmark B2E	Denmark Import	France B2C	France B2E	France Import
Electricity, gas, steam and air conditioning, bp	22%	0%	0%	15%	5%	5%	48%	10%	8%	31%	3%	0%
Water supply, sewerage, waste management and remediation services, bp	30%	0%	0%	1%	9%	17%	42%	7%	8%	24%	8%	4%
Natural water, water treatment and supply services, bp	48%	0%	0%	0%	0%	0%	64%	0%	0%	38%	0%	0%
Sewerage services, sewage sludge, waste collection & management serv., bp	4%	0%	0%	1%	10%	19%	39%	9%	9%	20%	10%	5%
Waste collection, treatment & disposal serv., materials recovery serv., bp	4%	0%	0%	---	---	---	---	---	---	---	---	---

The price statistician can review each output on a classification-by-classification basis to determine the appropriateness of a CPI replacement. This example shows that in the case of *Electricity, gas, steam and air conditioning* the potential impacts of price change and/or coverage divergence of exports and imports are minimal and the potential coverage gain within each respective output considerable. This is a win-win scenario for the use of a CPI replacement. For the remaining utilities, *water supply, sewerage, waste management and remediation services* the same hypothesis can be made for Australia, Denmark and France. In the example of Austria, an alternative market structure is being utilized where services are being imported to a much higher degree and transactions that are direct to consumer are minimal. This highlights the importance of assessing the applicability of CPI as a replacement both on a classification basis and based on the national setting being put into focus.

8.3 APPENDIX C: RESULTS FROM THE 2021 VOORBURG GROUP ALTERNATIVE DATA SURVEY

Results to be added from the alternative data survey.