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Quality Change for Services Producer Price Indexes

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1.0 INTRODUCTION

This paper discusses issues related to quality adjustment for output producer price indexes for services and highlights recent debate on this topic by the Voorburg Group on Services Statistics. At the heart of the debate are questions pertaining to the appropriate basis for quality adjusting Service Producer Price Indexes and the implications of these adjustments on economic measures, particularly SNA estimates. Recent Voorburg Group discussions on quality change have focussed primarily on Advertising services, Air Transport services and Distributive Trade services. These discussions are the basis of this paper.

In order to properly frame the discussion, some basic information on Producer Price Indexes, the Voorburg Group, and recent Voorburg Group discussions is presented first in Section 1.0. Sections 2.0 and 3.0 focus on Advertising services and Air Transport services respectively, while the Distributive Trades issues are summarized in Section 4.0. In Section 5.0, the three specific cases are further discussed in a general context, highlighting the conceptual questions raised by the three specific cases.

The Voorburg Group seeks to obtain further opinions and guidance from the community of price index experts on these issues and intends to table these recommendations at its next annual meeting in October 2012.

Background on Producer Price Indexes

Price indexes are important economic statistics that serve many purposes. They are first and foremost indicators of macroeconomic performance and of the purchasing power of money in various economic transactions. As well, they are also used to deflate nominal measures of goods and services produced, consumed and traded to provide measures of volumes which are critical in the compilation of the System of National Accounts. They are also used directly and indirectly in the administration of monetary and fiscal policy of the government[1]. Common price indexes include Consumer Price Indexes (CPI), Import and Export Price Indexes and Producer Price Indexes (PPI).

Producer price indexes are generally divided into two broad categories: Input PPIs which measure changes in the price of goods and services consumed by businesses as they enter the production process and Output PPIs which measure changes in the price of goods and services produced by businesses as they leave the place of production (i.e. the factory gate). Input prices are generally referred to as *purchaser* prices while output prices are to as *basic* or *producer* prices (using SNA terminology). The essential difference between input and output PPIs is that an input PPI measures the price pressures faced by producers for goods and services they consumes when producing their output. It should be noted however that other costs such as capital and labour costs factor into the final price producers choose for their output. As such, output prices are considered a more direct measure of inflation. It should also be noted that output prices themselves can also be an input further along in the production process, and as such they represent a measure of potential inflation in further stages of production.[2]

[1] PPI manual, Chapter 1.9
[2] PPI manual, Chapter 2.42

PPIs have many uses including:

- Short-term indicator of inflationary trends;
- National accounts deflators;
- Indexation in legal contracts in both the public and private sectors, particularly for more detailed PPI components;
- Required by international organizations such as Eurostat, the OECD, IMF, and European Central Bank (ECB) for economic monitoring and comparison;
- Current cost accounting;
- Compilation of other inflation measure such as the Final Expenditure Price Index; and
- Analytical tool for business/researchers. [3]

Although these uses of PPIs are all important in their own right, PPIs have a critical role to play in the compilation of National Accounts estimates as they are used to deflate output data and produce volume estimates. In the absence of input price indexes or final expenditure price indexes, output PPIs are sometimes used as proxy indexes to deflate inputs and some final expenditure series.

The discussion in this paper focuses on output PPIs for services otherwise known as Services Producer Price Indexes (SPPI).

The Voorburg Group on Services Statistics

The mandate of the Voorburg Group on Services Statistics is to develop internationally comparable methodologies for measuring the deflated constant dollar outputs of the service industries. To achieve this mandate, the Group has focussed its efforts on three main themes: classification (industry and product), nominal turnover or output measures, and price indexes[4] emphasizing harmonized approaches and best practices among countries. As such, the development of SPPIs has been one of the primary concerns of the Group.

As opposed to the Ottawa Group which is focussed on applied research mainly (though not exclusively) in the area of Consumer Price Indexes, the work on SPPIs by the Voorburg Group has concentrated primarily on practical considerations and implementation challenges rather than on conceptual and methodological issues. Given that both city groups cover prices subject matter, however, the Voorburg Group has always supported closer ties with the Ottawa group.[5] In particular, the Voorburg Group could benefit from the theoretical and conceptual expertise of the Ottawa Group particularly in the area of quality adjustment. That said, due to operational and practical considerations, coordination between both city groups has been difficult and limited.

In recent years, coinciding with significant development of Services Producer Price Indexes (SPPI) in many E.U. and non-E.U. countries, the group has devoted considerable attention to the development of SPPIs and progress has been considerable. In fact, material developed under the guise of the Voorburg Group is now a key source of information for the joint OECD-Eurostat Task Force currently working on the Revision to the Methodological Guide for Developing Producer Price Indices for Services.

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[3] PPI manual, Chapter 2.51
[4] Ducharme, 2004. p. 10.
[5] Ibid, p. 11.

Voorburg Group discussions on quality change

The Voorburg Group agenda over the last 3 years has covered, among others, the Air Transport, Advertising and Distributive Trades services industries. Although good progress has been made with respect to developing best practices for the measurement of output (turnover) for these industries, discussions pertaining to the development of SPPIs have moved at a slower pace largely due to inconclusive discussions on quality adjustment. One of the specific recommendations arising from the last meeting was that the Ottawa Group (or some other forum of international price experts) should be consulted on the outstanding issues pertaining to quality change.

With respect to Air Transport and Advertising Services, the specific issue being debated was whether or not consumer utility should be considered when quality-adjusting **producer** prices. One view, the "production-cost" view, supported by most Voorburg members, was that quality change should be considered only to the extent that these changes affect the production function of the service provider. In this view, changes that don't affect the production process would be excluded. As well, the particular elements that may affect the quality of a particular service may be different from the optic of the producer vs. the consumer. The counter-argument, the "user-value" view, is that consumer utility should always be considered when adjusting for quality change. The argument is particularly compelling when a service being produced is being consumed entirely as personal expenditure (final consumption). In this case, intuitively, an SPPI and the corresponding CPI should give the same result; the supply price should be equivalent to the demand price (excluding value added taxes).

Answering this question is by no means straight forward. As was evident at the Voorburg meetings, there are two basic views on how to approach quality adjustment. Although these approaches are fundamentally different from each other, they both have merit depending on the potential uses of the price indexes being calculated.

It should be noted that this question can be generalized to cover all SPPI indexes and not just Advertising and Air Transportation services.[6]

For Distributive Trades services, the price concept recommended is a margin price, which is estimated as the difference between the selling and acquisition prices. This treatment is conceptually consistent with the definition of wholesale and retail margins in the System of National Accounts. The issue raised at Voorburg is whether or not the underlying good is part of the distributive trade service and whether or not changes in the quality of the good sold should be included when quality adjusting the distributive trade service. Again, Voorburg members expressed two opposing views. In one view, the output of wholesalers and retailers is defined very narrowly as a distributive service only. Accordingly, based on the narrow definition of the service, quality changes would apply only to the service portion and not the underlying good. Quality adjusting both the good and the service would lead to a double counting of the quality adjustment in the System of National Accounts since the good portion would have already been quality adjusted within the specific PPI for that good. In the other view, the quality of the underlying good must also be controlled for. Quality change is seen as multiplicative rather than additive, and should be considered at each stage of the value chain (from producer to final consumer).[7] It

[6] Session notes, Voorburg 2011, "VG 2011- Notes – Quality Adjustment Session"
[7] Session notes, Voorburg 2011, "VG 2011- Notes – Cross-Cutting Issues Part 1"

should be noted that currently this is still a conceptual discussion as practical and implementable methods for quality adjusting margin prices have not been discussed in great detail.

2.0 ADVERTISING SERVICES

At the 2011 meeting of the Voorburg Group, the issue of quality adjustment for advertising services was discussed. A paper written by SPPI practitioners from the U.K. and Germany explored the impact that audience size has on the price of services offered by media agencies and media marketers. More specifically, the paper addressed whether or not audience size was an appropriate measure to be used for quality-adjustment in advertising services.[8]

Summary of paper and Voorburg discussion

The advertising industry is characterized by two main business models. Under the broker model, the agent operates between the seller and customer and buys media space on behalf of the client. In the reseller model, the agency is primarily engaged in the purchase and resale of media space (agency takes ownership of media space). The firms in the industry typically use one of the following pricing mechanisms: pricing mechanisms based on working time such as commissions and contract fees, pricing mechanisms based on expected audience size, and pricing mechanisms based on achieved audience size.[9]

The authors recommend that using audience size for quality adjusting advertising services is only appropriate where media space characteristics play an important role in the industry's business models. In other words, if changes in a characteristic (audience size) affect the production or delivery of the services, then a quality adjustment is warranted. In this view, the cost of providing the service is the proper basis for making quality adjustments. This conclusion is founded primarily on the premise that the fixed-input output price index (FIOPI) is the conceptual basis for an SPPI. FIOPIs are constructed on the assumption that inputs and technology are fixed and as such, the characteristics of the production function are the appropriate basis for quality adjustment of an output price index.

The recommendations in the paper are supported by simplified numerical examples[10] some of which are represented here. In the first example, presented in Table 1, a reseller buys and resells media space with a pricing mechanism based on ***expected*** audience size. In Q1, the price per slot is £1000 based on an expected audience size of 1 million viewers. In Q2 the price per slot increases to £1500 based on the same expected audience size of 1 million viewers; however, the achieved audience size actually increases to 1.5 million viewers. Under this particular pricing mechanism, output prices are set based on the expected audience size and achieved audience size does not factor into production or consumption decisions. As such, quality adjustment based on audience size is not required. The price increase between Q1 and Q2 is taken as a pure price movement and output in constant prices is unaffected between Q1 and Q2.

[8] Jenkins, Pegler, von Borstel, 2011
[9] Jenkins, Pegler, von Borstel, 2011, p. 3-4.
[10] Jenkins, Pegler, von Borstel, 2011.

Table 1: Expected audience size example

	Price £	Quantity	Turnover	Expected Audience	Achieved Audience	Price per *expected viewer*	Price index	Output (constant prices)
Q 1	1000	10	10,000	1 million	1 million	0.001	100	100
Q 2	1500	10	15,000	1 million	1.5 million	0.0015	*150*	*100*

The second example, presented in Table 2, considers a case where a reseller or broker uses a pricing mechanism based on achieved audience size. In this case, the reseller sells a portfolio of different media slots to achieve a specified audience size. In Q1 the reseller sells a portfolio of ten slots at £1000 each to achieve an audience size of 1 million viewers. In Q2, using better portfolio management techniques, the reseller manages to achieve an audience of 1.5 million viewers and increases the price to £1500 per slot. Changing the mix within the portfolio (inputs) has resulted in increased viewership and a corresponding price increase. In this case, because of the link between the price of the service and the achieved audience size, the price per expected viewer can be used to quality adjust the index. The change in quality removes the price effect resulting in an increase of real output.

Table 2: Achieved audience size example

	Price £	Quantity	Turnover	Expected Audience	Achieved Audience	Price per *achieved viewer*	Price index	Output (constant prices)
Q1	1000	10	10,000	1 million	1 million	0.001	100	100
Q2	1500	10	15,000	1 million	1.5 million	0.001	*100*	*150*

The opposing view is that audience size must always be used to adjust quality. This view, consistent with a user-value approach, is based on the premise that higher viewership for an advertisement is always better for the entity consuming the service. In the longer term, achieved and expected audience size should be highly correlated. In fact, expected audience size is really based on historic achieved audience figures and smart consumers will know this and make decisions accordingly.

There is also strong support for this view from the System of National Accounts. The Handbook on Price and Volume Measures in National Accounts, in the case of advertising in newspapers, clearly states that "It is important however to take into account changes in the number of people that see the advert. An advert in a national newspaper (large circulation) is a higher quality product than an advert in a local newspaper (small circulation)."[11] In other words, more viewers are better.

Having debated both perspectives, the Voorburg Group did not achieve a consensus on the issue. Although a majority of participants supported the practice of quality adjusting for changes in the production function, a minority supported considering consumer utility.

[11] Handbook on price and volume measures in National Accounts, p. 109.

3.0 AIR TRANSPORT SERVICES

Although the Advertising and Air Transportation industries are very different industries, in discussing quality change for Air Transport, the Voorburg Group considered many of the same issues. Most notably, are input costs (production function) the appropriate basis for making quality changes to producer price indexes or should quality changes be based on the utility to the consumer?

Summary of paper and Voorburg discussion

In their paper, authors from the U.K. and Austria[12] describe the issues pertaining to quality change for this industry noting that only a few countries have incorporated these methods into the production of the SPPI owing to the complexity of the task.

From a practical standpoint, quality change in this industry is difficult to deal with from a production perspective. Quality change arises when tickets for destinations that are in a sample vary from period to period. These differences, related to the specific conditions for the flight could include, for example, restrictions in baggage weight, the inclusion or exclusion of meals, and flexible ticket options. For the SPPI practitioner, assessing the myriad of options and the quality difference between them is difficult. The overlap method and comparable replacement are common techniques currently used by SPPI practitioners for quality adjusting air transportation services.

As with the discussion regarding Advertising services, the authors emphasize that the conceptual basis for an SPPI is the FIOPI and that constant output from a producer's perspective is defined as the service provided with a fixed production process. As such, quality change should be considered when changes to the production process occur. The paper highlights two examples to illustrate this notion. In the first example, an airline starts charging a 10% baggage levy, where previously the fee for baggage was included in the ticket price. The increase would be shown as a pure price change in this case because the inputs required to provide the service have not changed (no change in the production function). In the second example, the airline has replaced the existing seats in the aircraft with smaller seats thereby increasing the passenger capacity of the aircraft. The airline delivers more passengers per flight, thereby reducing the operating and maintenance costs per passenger. Despite lowering ticket prices for a given destination, the airline sees an increase in turnover. In this case, since the production function has changed, the resulting price change should be adjusted for quality.

The treatment of quality change in these two examples is consistent with the treatment of quality in the SNA where quality differences are generally treated as changes in volumes. In the first example, the pricing mechanism has changed but the production of the service has not. In the SNA this would be reflected as a change in price rather than a change in volume. For the second example, the change would be shown as a change in volume of the service.

Discussion at Voorburg again focussed on the notion of production function vs. consumer utility. The quality adjustment required when the characteristics of a product change could potentially be very different when evaluated from a producer (production function) perspective versus a consumer point of view, leading to potential inconsistencies in the SNA. This problem would be particularly evident for products that are purchased strictly by the household sector. In these cases, deflated output would not be equal to deflated final consumption because these

[12] Jenkins, Puchter, 2011.

variables are deflated using different deflators (SPPI for output and CPI for personal expenditures)

After lengthy discussion regarding these issues, the majority view of the Voorburg Group was that changes in the production function should be the basis for quality adjustment in SPPIs and that changes in consumer utility should not be quality adjusted in SPPIs. That said, the group recommended that other experts in quality adjustment be consulted (including the Ottawa Group).

4.0 DISTRIBUTIVE TRADES

At recent annual meetings, the Voorburg Group has examined issues pertaining to the measurement of turnover and prices for the distributive trade industries. Many issues and questions have been addressed and several papers concerning this industry have been produced. One key question, however, remains disputed among Voorburg participants: When measuring the price change of wholesale or retail margins, should the quality change of the underlying good be taken into account?

Summary of Voorburg discussion

At the heart of this debate is the definition of the price concept used to measure the distributive trade service. The recommended concept for an output price index for this service is the margin price, derived as the difference between the selling price and the price that the service provider paid to replace the good in inventory (operationally, selling and acquisition prices are used). Traders play an essential role in the distribution of goods in the economy and conceptually the trade margin represents the service associated with distributing the products. This definition, consistent with the output concept for distributive trade industries in the SNA, excludes the underlying good. In the SNA, the gross output of the distributive trades industries is a margin derived as the net of sales of goods sold and the cost of goods purchased for resale.

The view supported by the majority of Voorburg participants is that quality changes related to the goods being wholesaled or retailed should not be considered when pricing the service. This view is founded primarily on the definition of the service in question. If the output concept excludes the value of the good, then it follows that the price definition for the same service should also exclude the good. Quality adjustment in this case would be limited to the service portion only and would occur only when changes to service characteristics are observed. The goods themselves are already priced and quality adjusted separately in the PPIs for those goods and adjusting for the quality of the good in the distributive trade service would lead to double counting of the quality adjustment in the SNA. Countries currently producing SPPIs for the distributive trade industries, notably Canada and the U.S., are advocates of this view.

The opposing view discussed at Voorburg suggests that the value of the distributive trade service implicitly includes the value of the good and as such quality adjustment should be extended to both the good and the service. This view suggests that the additivity of goods and services (in the SNA supply-demand framework) does not imply the independence of these.

The Voorburg Group also discussed what the two approaches would mean in terms of productivity. Proponents of the "service only" view emphasized that productivity is a

function of capital and labour and that productivity of traders is not related directly to the utility that consumers derive from products they have purchased. Rather, productivity is affected by the wholesaler's and retailer's use of capital and labour to provide the retail or wholesale services. Proponents of the "goods" view noted that the productivity of a firm is not based solely on its production function but also on the value provided to the consumer. From the consumer's perspective, the utility includes both the good and the service. If a retailer offers a lower quality product from one period to the next but with the same level of service, the overall utility and quality for the consumer has declined and as such adjustments for the quality of the good are required.

Ultimately, the Group decided that National Statistical Offices (NSOs) should work with their national accountants to determine the most appropriate approach for their country. It was also suggested that this issue should be raised with other expert groups on prices (including the Ottawa Group).

5.0 EXPANDING THE CASE FOR THE PRODUCTION FUNCTION VIEW

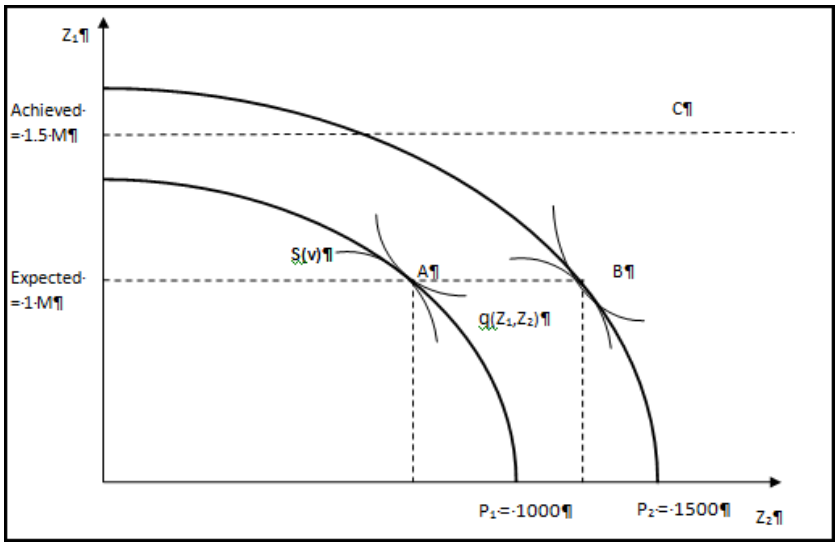
Whether or not consumer utility should be considered when quality-adjusting Services Producer Price Indexes is a question that generates much debate. Based on recent Voorburg discussions, most SPPI compilers believe that consumer utility should not necessarily factor into quality adjustment decisions. The case for the production function approach is supported in the Voorburg papers on quality change for Air Transport and Advertising. Although in many cases, changes in the characteristics of the services produced will generate increased consumer utility, these changes will not imply changes to the production function. The changes are therefore irrelevant from a production perspective and should not lead to quality adjustment. Instead, quality adjustments for services producer price indexes should be linked to changes in the production function owing to the fact that the conceptual basis for the SPPIs is the FIOPI.

Building a case for the production function approach for quality adjustment of services producer price indexes

Using utility and production function diagrams, the advertising examples discussed in Section 2.0 are revisited here. The scenario of expected audience size is represented in Figure 1, which presents the space between two characteristics of a given product, in this case advertising services[13]. The surfaces P_i trace out all potential combinations of two characteristics Z_1 and Z_2 that can be purchased at prices P_1 and P_2. In the example, the characteristic Z_1 represents audience size. The curves Q_i represent indifference curves that map out all combinations of characteristics Z_1 and Z_2 that the consumer is indifferent against purchasing and S_i are production functions mapping out all potential combinations of inputs and technology at prices P_1 and P_2. Any point, to the right and above A (such as B or C) represents a different combination of the characteristics with a greater utility for the consumer. In period 1, delivery of the advertising service occurs at point A, the intersection of the optimal production and utility at price P_1=£1000 with an expected audience size of 1 million viewers.

[13] Diagrams adapted from Triplett (1987) and PPI manual p. 528.

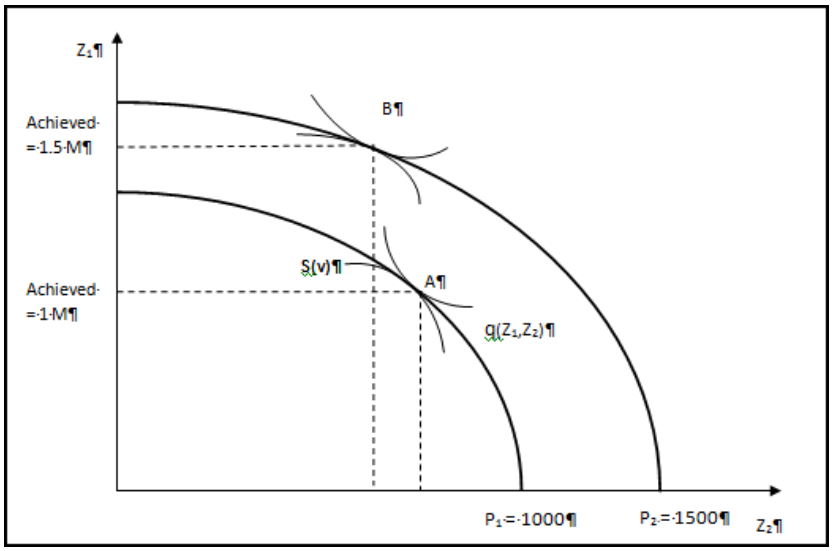
Figure 1: Pricing mechanism based on expected audience size



In period 2, the reseller raises the price per slot to £1500 for the same advertising package where audience size remains at 1 million viewers. The production and the consumption of the advertising service occurs at point B, the intersection of the optimal production and utility at price P_1=£1500. In this scenario, although an audience size of 1.5 million viewers would place consumer utility at any point on line C (a higher utility than at point A or B), production and consumption decisions are made with an expected audience size of 1 million viewers and both occur at point B. It follows that with this particular pricing mechanism, additional viewers do not play a role in either production or consumption decisions and as such, the producer price of the service should not be quality adjusted.

The scenario of achieved audience size is illustrated in Figure 2. In period 1, service delivery occurs at point A with an achieved audience size of 1 million viewers. In period 2, service delivery occurs at point B. Point B is characterized by a higher achieved audience, which is presumably preferred by the user who is willing to pay a higher price for the product. This is reflected by the fact that the utility is greater at B than A. As explained in Section 2.0, changes in quality are the result of changes to the production of the service (improved portfolio management) and as such, the price index measuring the output of service should be adjusted for quality.

Figure 2: Pricing mechanism based on achieved audience size



The potential discrepancy between the producer and consumer valuation of the quality adjustment was briefly discussed in Section 3.0, Air Transport Services. The example of aircraft seats is revisited here to highlight this potential issue. From a producer price perspective, the impact of quality adjustment is described in the Table 3. From 2009 to 2010, as a result of modifications to the aircraft (replacement of seats for smaller seats), the firm lowers the price of the ticket for a given trip by £14. For simplicity, the entire price difference is attributable to the change in quality. The adjustment for quality change results in a flat price index and a 5% growth in volume terms. In other words, the entire movement is attributed to change in volume and not a change in price.

Table 3: Price, volume and turnover, Aircraft seat example

	Observed price (£) SPPI	Quality adjust-ment (£)	Quality Adjusted Price (£)	Price index SPPI	Observed Turnover (£)	Derived (constant period t price) output volume	Change in volume
2009	140		140	*100*	5,000,000	*5,000,000*	-
2010	126	***14***	***140***	*100*	5,250,000	5,250,000	5.0%

Expanding the example further, assume for simplicity that the output is purchased entirely by consumers (final expenditures in the SNA) and that there are no taxes or margins associated with this transaction, making the purchase price and the production price the same. Assume as well that the consumer's valuation of the change in quality from the switch to smaller seats is very different than that of the producers. In a quality adjustment scenario where consumers put a great deal of value on comfort, the switch to smaller seats could lead to price increases on a quality adjusted basis if the quality adjustment from the consumer's perspective is greater than the drop in the price. In other words, to retain their same level of satisfaction, consumers would need to see a greater drop in price than the amount of the actual price decrease. This scenario is outlined in Table 4, where a quality adjustment of £28 is required to bring the consumers to the same level of

satisfaction they had with the large seats. This amounts to a 10% price increase and actually translates to a decrease in volume.

Table 4: Price, volume and expenditures, Aircraft seat example

	Observed price (£) CPI	Quality adjust-ment (£)	Quality Adjusted Price (£)	Price index CPI	Observed Consumer Expenditure (£)	Derived (constant period t price) volume	Change in volume
2009	140		140	*100*	5,000,000	*5,000,000*	-
2010	126	***28***	***154***	*110*	5,250,000	*4,772,727*	-4.5%

The supply-demand identity for a given product or service in the SNA is:

Supply =
output + imports + transport margin + trade margin + taxes - subsidies on the products =
intermediate consumption + final consumption expenditure + gross capital formation + exports =
Demand

In compiling SNA estimates, particularly Input-Output estimates or supply-use estimates, this identity is typically constructed or estimated in nominal terms. The current dollar estimates are then deflated using appropriate deflators for each component of the identity to arrive at a constant dollar estimate. Imbalances of the constant dollar supply and demand identity are typically related to an incorrect current dollar balance or a problem with the deflators.

Under the assumptions in the example noted above, the above identity is reduced to:

output = final consumption expenditure

Although the simplified example is unlikely, the example highlights very clearly the consequences of using different price indexes for deflating different components of the identity. Under the scenario, constant dollar (deflated) output would never equal constant dollar (deflated) expenditures without explicit reconciliation adjustments from the SNA compiler. It should be noted that in reality, there would be margins and taxes associated with production and consumption of the service as well as business intermediate consumption, and imports and exports of the service. As well, other differences in addition to those resulting from quality adjustment would certainly arise due to inherent differences in the way the various indexes are weighted and aggregated. To address these differences, the SNA compiler would "balance" the identity by adjusting one or many of the components based on knowledge of the strengths and weaknesses of the underlying data.

As discussed above, from a practical perspective, SNA compilers can resolve coherence issues resulting from source data and price index differences. The issue, however, is not straightforward from a theoretical perspective, and the question remains as to the most appropriate price index and method for quality adjustment. This question was addressed by Triplett (1983). In the paper, Triplett explores quality adjustment for input price indexes and for output price indexes, concluding that there are two different uses of the data (input measures and output measures), that input and output price indexes imply different theoretical price index treatments.

Triplett shows that the difference in theoretical treatments carries over into the issue of adjusting for quality change.

Triplett discusses the differences between input characteristics and output characteristics noting that, although in most cases output characteristics could also be input characteristics, input characteristics are inputs in the production or utility function of a user while output characteristics are associated with the producing industry's production function, not the using industry. He adds that sometimes things get produced that are not wanted by users and that output is not necessarily there because someone wants it[14]. Triplett concludes that, for this "resource-cost" view, the cost of making a machine is the proper basis for making quality adjustments, not the productivity of using these machines to produce other goods[15]. By extension, we can also say that the cost of producing a service is the proper basis for making quality adjustments from a producer price perspective, not the utility one gets from using the service.

The "resource cost" view is conceptually consistent with the definition of a FIOPI, which is the basis of the SPPI indexes described in this paper. Accordingly, based on Triplett's conclusions, the quality adjustment based on the production function is appropriate for the output price indexes described in this paper.

Quality adjustment for distributive trade (margin) services

Triplett's conclusions can also be extended to the debate about quality adjustment for distributive trade services, the central question being whether or not the underlying product being sold by retailers or wholesalers should also be adjusted for quality change.

It was explained in Section 4.0 that the output of the distributive trade industry is defined as the service of distributing products to consumers and that this service was defined as a margin. The SNA is quite clear that the output of wholesalers and retailers is a service that includes storing, displaying and making products available for sale. The actual goods sold are excluded from the outputs and not recorded as intermediate inputs of the wholesaler or retailer.

> *The recording in the SNA of transactions for wholesalers and retailers does not mirror the way in which those involved view them. The purchases of goods for resale by wholesalers and retailers are not recorded by these units explicitly, and they are viewed as selling, not the goods, but the services of storing and displaying a selection of goods in convenient locations and making them easily available for customers. This partitioning measures output for traders by the value of the margins realized on goods they purchase for resale. (SNA 2008, 3.68)*

In supply-use framework, the net treatment (margin concept) of output means that households consume actual goods (cars, food, etc.) and not distributive trade services. In other words, the consumption of households is articulated by product. With a gross treatment, wholesalers and retailers would output distributive trade services and households would consume these services and not the products themselves. The distributive trade margins (on products) are the bridge between the producer and purchaser valuation of a particular good. They are not true products and consumers do not buy these services directly.

[14] Triplett, 1983, pp. 293-294.
[15] Ibid, p. 304.

It follows that in order to be conceptually consistent with the SNA output concept, producer price indexes that measure the price of distributive trade services should also be based on a margin concept. That said, margins and margin prices are not directly observable and must be estimated using observable data. In the case of margin prices, the price concept is the selling price less the acquisition price for a particular good. This definition has clear implications for quality adjustment. Since the service explicitly excludes the underlying good by definition, the quality adjustment should be restricted to the service portion only. It should be noted that output PPIs for goods are already adjusted for quality change of the underlying products.

Illustrating this approach by way of an example for a particular good is useful. Assume that 10 "widgets" are produced by a manufacturer and sold to a consumer by a wholesaler/retailer. Further assume that the good is entirely consumed by the consumer and that the producer's price for widgets is $10 and the purchaser's price for widgets is $15. For this single product, the value of the transaction (v) is equal to the price per unit of quantity (p) multiplied by the number of units of quantity (q), that is: V = p x q. Using the supply-demand framework described in the previous section, the supply demand balance for the widgets is *output + trade margin = final consumption expenditure.*

Table 5: Supply-demand balance for widgets

	Output	+	Trade Margin	=	Final Consumption
V	100		50		150
P	10 (PPI)		5 (15-10) (Margin Price)		15 (CPI)
Q	10		10		10

The example shows that margins and margin prices are additive not only in terms of value but also in terms of prices. Furthermore, the margins and margin prices are mark-ups on the output and output prices and that they clearly exclude the value of the goods which they are applied to. It follows that adjustments to keep the quality of widgets constant should not be applied to the output producer price index for margins since the value of the widgets is netted out in the calculation of the margin.

6.0 Conclusion

As mentioned in the introduction, the approach for quality adjusting services producer price indexes has been debated extensively over the course of the last 2 or 3 meetings of the Voorburg Group. Although an approach where quality adjustment is based on the production function was favoured by many Voorburg participants, this view was not unanimous. In an effort to resolve the debate, the Voorburg Group requested that other international expert groups in price statistics be consulted and this paper was written primarily for purpose of initiating this dialogue. Although resolution of the debate is unlikely, the paper may stimulate discussion on the topic and stimulate further work on the issue.

The paper summarized the Voorburg Group papers and related discussions and extended the arguments already noted to build a case for quality adjustment based on the production function. The examples cited in this paper and in the original Voorburg papers, as well as the research by Triplett initially seem to suggest that the production function approach is the appropriate method for quality adjusting output price indexes for services. This however, may be an oversimplification of the issues and more research and debate is necessary.

What is clear from the outset, however, is that, as Triplett suggested, the appropriate quality adjustment mechanism will likely depend on the particular uses of the given price index. For example, the appropriate quality adjustment mechanism for services produced and consumed mainly by final consumers should consider consumer utility. On the other hand, if the purpose of the price index is to deflate outputs then quality adjustment based on how the good is produced (production function) might be more appropriate.

What is also clear is that solutions need to be practical and implementable. This was certainly a recurring theme at Voorburg, where practitioners consistently favoured production function based quality adjustment as a practical and implementable alternative.

A dogmatic approach favouring one approach over the other is likely not the best solution. One potential way forward is the development of a taxonomy or framework to articulate the range of services in scope for SPPI development, the uses of these SPPIs and appropriate methods of quality adjustment for each service. In keeping with its mandate to develop internationally comparable methodologies for measuring the deflated constant dollar outputs of the service industries, the Voorburg group will explore the development of this framework as it progresses in developing best practices and compilation methods for producer price indexes for services.

7.0 Bibliography

Ducharme, Louis Marc, 2004. "Strategic Vision of the Voorburg Group on Services Statistics for 2005-2008. www.voorburggroup.org

European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, World Bank, 2009. "System of National Accounts 2008", New York

Eurostat, European Communities. 2001. "Handbook on Price and Volume Measures in National Accounts", Luxemburg.

Gallais, Alain (INSEE) and Loranger André (Statistics Canada), 2010. "Measuring Quality Change in Producer Price Surveys for Rental and Leasing Services". Paper presented at the 25th Voorburg Group Meetings, Vienna Austria.

Garneau, Mary Beth (Statistics Canada), Kaumanns, Sven (Eurostat)
Murphy, Bonnie (United States Bureau of Labor Statistics) and Gallais, Alain (INSEE), 2011. "Issue Paper on: Section G of ISIC (rev 4) Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles". Paper presented at the 26th Voorburg Group Meetings, Newport, U.K.

International Monetary Fund. 2004. "Producer Price Index Manual, Theory and Practice", Washington, D.C.

Jenkins, Christopher (ONS), Pegler, Kat (ONS) and von Borstel, Johanna (Destatis), 2011. "Quality Adjustment Paper on: ISIC 7310, Advertising". Paper presented at the 26th Voorburg Group Meetings, Newport, U.K.

Jenkins, Christopher (ONS) and Puchter, Christian (Statistics Austria), 2011. "Revisited Paper – Adjusting for Quality Change: ISIC 51, Air Transport".

Triplett, Jack. E., 1983, "Concepts of Quality in Input and Output Price Measures. A Resolution of the User-Value Resource-Cost Debate." in *The U.S. National Income and Product Accounts: Selected Topics. Studies in Income and Wealth. Volume 47*, ed. Murray F. Foss. . National Bureau of Economic Research. . (Chicago, London: The University of Chicago Press), pp. 269-311.

Triplett, Jack E., 1987, "Hedonic Functions and Hedonic Indices", in *The New Palgrave: A Dictionary of Economics*, ed. By John Eatwell, Murray Milgate, and Peter Newman, Vol. 2 (London: MacMillan), pp. 630-34.

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