Module 4. Further Concepts and Practical Issues

Aim of this module

The purpose of this module is to describe the problems and practical issues in producing price indexes.

Learning outcomes for this module

On completion of this module, you will be able to:

- explain what is meant by quality change and why it is a problem when compiling price indexes
- describe how prices are adjusted to account for quality change

Module content

- Quality and quality adjustment

Activities in Module 4

- 4.1 Discussion on whether changes in characteristics result in a change of quality

A. Introduction to the Module

4.1 The production and dissemination of price index statistics forms a key part of the function of national statistical offices. As with other statistics, price indexes are subject to a range of sampling and non-sampling errors, which are controlled and where possible minimised by the statisticians involved in their compilation. In addition to these tasks associated with the production of official statistics, price indexes are vulnerable to a range of price-index specific biases. This Module covers the problems, compromises and practical solutions employed by price index practitioners to avoid or mitigate these biases.

B. The concept of quality

B.1 The objective of price indexes

4.2 The objective of ABS price indexes is to measure *pure price change* over time; that is, to measure the extent to which the cost of an identical basket of goods changes over time, not affected by changes in quality or quantity or the terms of sale. This objective is *pricing to constant quality*. It is not a simple objective to achieve because the characteristics of goods being sold in the market place, and their terms of sale, change over time. Frequently the precise commodity priced in one period is no longer available in the next period because either there has been some change in the characteristics of the commodity or else something new has taken its place. For price index purposes it is necessary to devise techniques to identify quality differences and eliminate their effect on prices from the calculations of price change for inclusion in the index.

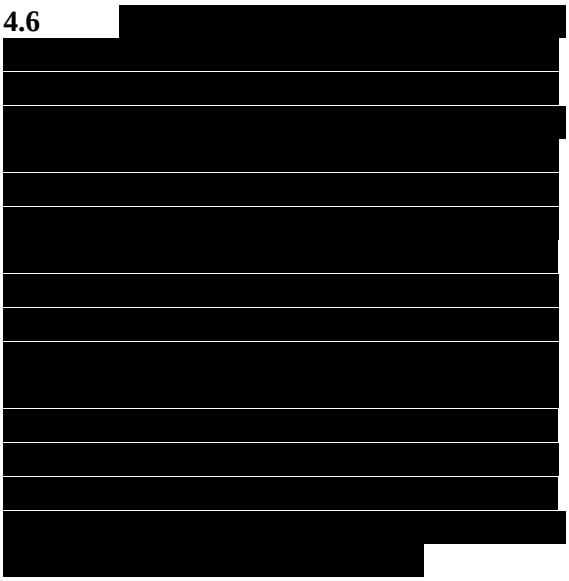
4.3 As a price index must measure pure price change, it must therefore make adjustments for changes in the characteristics (or changes in quality) of individual goods and services. Such adjustments are called *quality adjustments*.

B.2 The evaluation of quality change[39]

4.4 It is useful to try to clarify why one would wish to adjust the observed price change between two items that are similar, but not identical, for differences in their quality. A change in the quality of a good or service occurs when there is a change in some, but not most, of its characteristics.

4.5 ***Quality change for consumer price indexes***: For purposes of the CPI and input price indexes in general), a quality change must be evaluated from the purchaser's perspective (for the CPI, the purchaser is a consumer). The evaluation of the quality change is essentially an estimate of the additional amount that a consumer is willing to pay for the new characteristics possessed by the new quality. This additional amount is not a price increase because it represents the monetary value of the additional satisfaction or utility that is derived from the new quality. Of course, if the old quality is preferred to the new one, consumers would only be willing to buy the new quality if its price were lower.

4.6



4.7 ***Consumers' point of view:*** For purposes of illustration, consider the following hypothetical experiment involving a consumer purchasing a household good. In this

[39] This section adapted from paragraphs 1.230 – 1.234 of *Consumer Price Index Manual: Theory and Practice*, with complimentary material from *Producer Price Index Manual: Theory and Practice*, paragraphs 1.213 – 1.216.

experiment a new quality appears alongside an old one. Assume that the two products are substitutes and that the consumer is familiar with the characteristics of the old and the new qualities. Use P_{OLD} to refer to prices of the old quality and P_{NEW} for the prices of the new quality. Suppose that both qualities are offered to the consumer at the same price, namely the price P_{NEW}^{t} at which the new quality is actually being sold in period *t*. The consumer is asked to choose between the two qualities, and prefers the new quality over the old when offered at this price.

4.8 Suppose next that the price of the old quality is progressively reduced until it reaches $P_{OLD}^{t,*}$, at which point the consumer becomes indifferent between purchasing the old quality at $P_{OLD}^{t,*}$ and the new quality at P_{NEW}^{t}. Any further decrease below $P_{OLD}^{t,*}$ causes the consumer to switch back to the old quality. The difference between P_{NEW}^{t} and $P_{OLD}^{t,*}$ is a measure of the additional value that the consumer places on the new quality as compared with the old quality[40]. It measures the maximum amount that the consumer is willing to pay for the new quality over and above the price of the old quality.

4.9 Let P_{OLD}^{t-1} denote the actual price at which the old quality was sold in period *t-1*. For CPI purposes, the price increase between the two qualities is not the observed difference $P_{NEW}^{t} - P_{OLD}^{t-1}$, but instead $P_{OLD}^{t,*} - P_{OLD}^{t-1}$. The actual price of the new quality in period t needs to be multiplied by the ratio $P_{OLD}^{t,*} / P_{NEW}^{t}$ in order to make the comparison between the prices in periods *t-1* and *t* a comparison between products of equal quality in the eyes of the consumer.

4.10 Two important points need stressing here (and are illustrated in Figure 4.1):

- the hypothetical price for the old quality in period *t* ($P_{OLD}^{t,*}$) is directly comparable with the actual price of the old quality in period *t-1* (P_{OLD}^{t-1}), because both price measures refer to the same identical product; that is, the product is valued using the same characteristics, or the same quality. The difference between these valuations, $P_{OLD}^{t,*} - P_{OLD}^{t-1}$, is a pure price change.

- the difference between the period *t* price of the new quality P_{NEW}^{t} and the hypothetical period *t* price of the old quality $P_{OLD}^{t,*}$ is *not* a price change but an evaluation of the difference in the quality of the two items in period *t* in the eyes of the consumer.

4.11 [redacted]

4.12 ***Practical outcome:*** The key task for the price index practitioner is to identify when quality has changed, to determine an evaluation of the difference in quality, and to use this evaluation to ensure that the price index continues to measure pure price changes.

[40] To be precise, this is the additional value that the consumer places on the new quality in period *t*. The relationship between price and quality can change over time, particularly over the long term. For example, how much would an extra 20 Megabytes of hard-drive capacity be worth to a purchaser of a computer in 2009? Contrast this with how the additional capacity may have been valued in 1989.

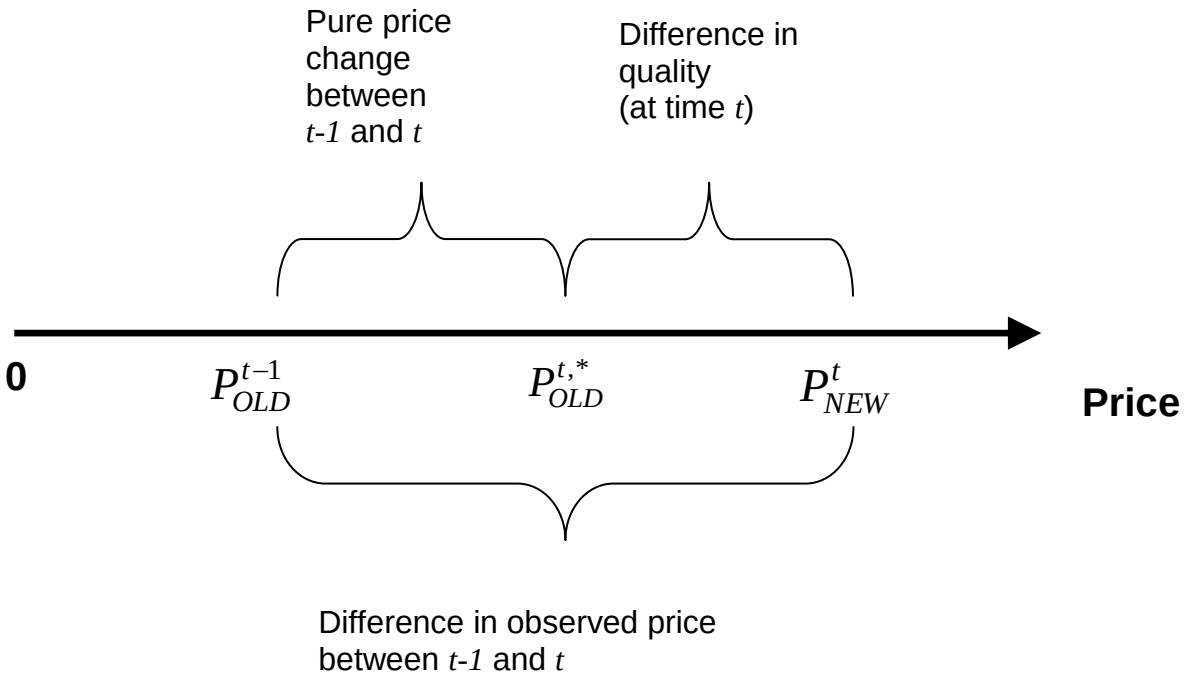


Figure 4.1 - Quality change and pure price change

Example 4.1 Conceptual example of evaluating quality change

Suppose a mainstay of the washing machine market is a model called "Omni-clean". Customers are familiar with its features and its operation. In January the Omni-clean was retailing at \$225.

Assume now that in February the original model "Omni-clean", receives competition from an new machine "Nova-wash", which has a greater variety of pre-set functions, temperatures and spin speeds. These features are also understood by the consumer. In February both machines are priced at \$295. At this price the consumer purchases the newer "Nova-wash".

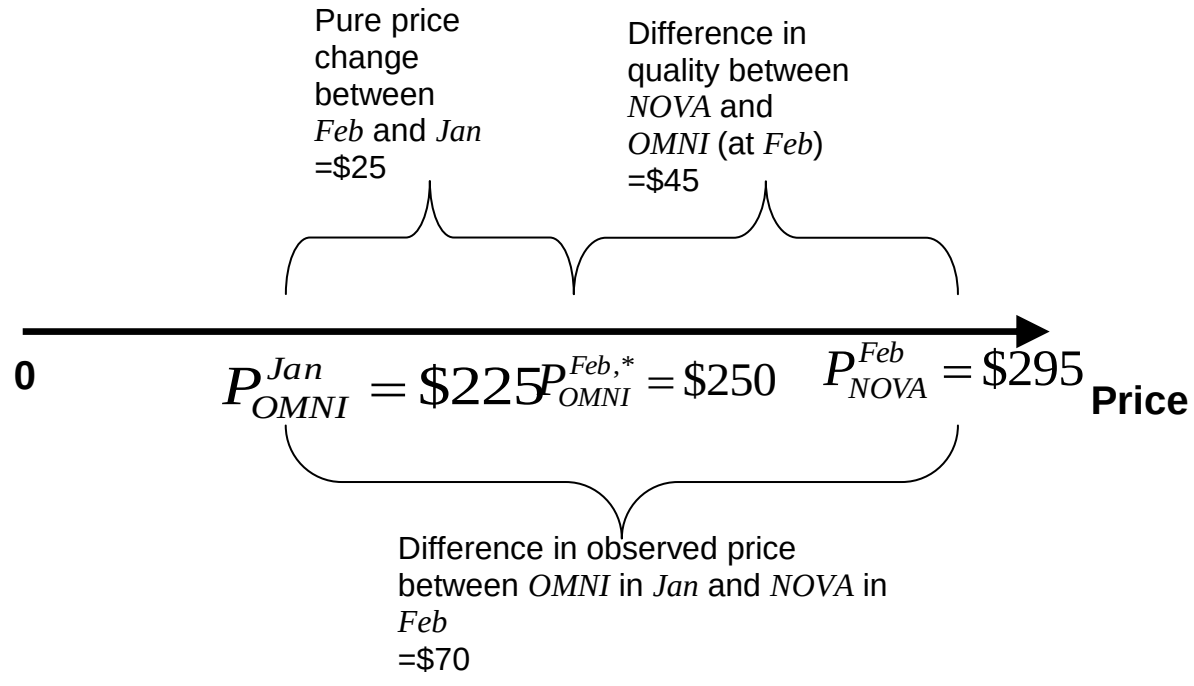
If, in February, the price of the older "Omni-clean" is reduced to \$250, the consumer is happy to purchase either the "Omni-clean" or the "Nova-wash". If the price falls to \$249.99 or below, the consumer purchases the "Omni-clean" over the newer model.

$$\begin{aligned}\text{Observed price difference in February} &= P_{NOVA}^{Feb} - P_{OMNI}^{Jan} \\ &= \$295 - \$225 \\ &= \$70\end{aligned}$$

$$\begin{aligned}\text{Difference in quality as valued by the consumer in February} &= P_{NOVA}^{Feb} - P_{OMNI}^{Feb,*} \\ &= \$295 - \$250 \\ &= \$45\end{aligned}$$

$$\begin{aligned}\text{Pure price change} &= P_{OMNI}^{Feb,*} - P_{OMNI}^{Jan} \\ &= \$250 - \$225 \\ &= \$25\end{aligned}$$

The difference of \$45 is a measure of the additional utility that the consumer places on the quality of the "Nova-wash" as compared with that of the "Omni-clear". In practice, of course, we will never observe the hypothetical price $P_{OMNI}^{Feb,*}$.



B.3 What determines quality?[41]

4.13 The term 'quality' embraces all those characteristics in a good or a service that the purchaser values or from which it derives utility. Thus the problem is to identify those characteristics that households value, to make an estimate of the value of those characteristics and to measure the change in those characteristics embodied in the good or service so that its effect can be removed when calculating price movements. When used in this context, 'quality' encompasses all attributes of a product, including quantity (with quantity here referring to mass, length, volume and other physical dimensions, and number of units sold).

4.14 Most types of goods and services whether simple food items, such as potatoes or high technology products such as computers, are available in the market in many different qualities. For example, physical characteristics may vary (in potatoes they could be red, white, washed, unwashed, loosed, packaged, graded or ungraded etc. - consumers recognise and appreciate the differences and are prepared to pay different prices for the differing products).

4.15 In economic theory it is generally assumed that whenever a difference in price is found between two goods and services, which appear to be physically identical, there must be some other factor, such as location, timing, conditions of sale etc., which is introducing a difference in quality. Otherwise it can be argued that the difference could not persist, as rational purchasers would always buy the lower priced items and no sales would take place at the higher price. The expression *change in quality* is used to cover sets of goods or services whose identifiable characteristics are sufficiently different to make them distinguishable from each other from an economic point of view but which are sufficiently similar to each other to be described by the same generic term such as potato, computer or transportation.

4.16 Some examples of change in quality could be:

- location (such as goods delivered to Sydney vs. Melbourne)
- model options (such as with or without leather interior)
- timing (such as electricity supply: off-peak vs. peak)
- conditions of sale (such as a good sold with after service care), and
- circumstances in which goods or services are supplied or delivered (silver service vs. meals on wheels)
- The same goods or services sold by different kinds of retailers, such as local shops, specialist shops, department stores or supermarkets have to be treated as different qualities.

B.4 Does a difference in price indicate a difference in quality?[42]

4.17 We can readily observe that different prices are observed in markets for identical products sold with the same conditions of sale. There are a number of possible reasons for this. Purchasers may not be well informed about the range of prices on offer and in general will not check every available price for a product every time it is purchased. As prices change, not all suppliers may change their prices at the same time.

4.18 When there is price variation for the same quality of good or service, the price relatives used for index number calculation should be defined as the ratio of the weighted average price of that good or service in the two periods, the weights being the relative quantities sold at each price. Suppose, for example, that a certain quantity of a particular

[41] This section is derived directly from the *System of National Accounts 1993* (SNA93), Section H. "Choice between direct and indirect measurement of prices and volumes" (Paras 16.130. - 16.132.). This particular reference is itself cited heavily in both the CPI and PPI Manuals.

[42] *ibid*

good or service is sold at a lower price to a particular category of purchaser without any difference whatsoever in the nature of the good or service offered, location, timing or conditions of sale, or other factors. A subsequent decrease in the proportion sold at the lower price raises the average price paid by purchasers for quantities of a good or service whose quality is the same and remains unchanged, by assumption. It also raises the average price received by the seller without any change in quality. This must be recorded as a price and not a volume increase.

4.19 Nevertheless, it must be questioned whether the existence of observed price differences always implies corresponding differences in quality. There are strong assumptions underlying the standard argument which are seldom made explicit and are often not satisfied in practice: for example, that purchasers are well informed and that they are free to choose between goods and services offered at different prices.

4.20 In the first place, purchasers may not be properly informed about existing price differences and may therefore inadvertently buy at higher prices. While they may be expected to search out for the lowest prices, costs are incurred in the process. Given the uncertainty and lack of information, the potential costs incurred by searching for outlets in which there is only a possibility that the same goods and services may be sold at lower prices may be greater than the potential savings, so that a rational purchaser may be prepared to accept the risk that he or she may not be buying at the lowest price. Situations in which the individual buyers or sellers negotiate, or bargain over prices, provide further examples in which purchasers may inadvertently buy at a higher price than may be found elsewhere. On the other hand, the difference between the average price of a good purchased in a market or bazaar in which individual purchasers bargain over the price and the price of the same good sold in a different type of retail outlet, such as a department store, should normally be treated as reflecting differences in quality attributable to the differing conditions under which the goods are sold (i.e. the difference in the retail margin).

4.21 Secondly, purchasers may not be free to choose the price at which they purchase because the seller may be in a position to charge different prices to different categories of purchasers for identical goods and services sold under exactly the same circumstances, in other words, to practise price discrimination. Economic theory shows that sellers have an incentive to practise price discrimination as it enables them to increase their revenues and profits.

4.22 However, it is difficult to discriminate when purchasers can retrade amongst themselves, that is, when purchasers buying at the lowest prices can resell the goods to other purchasers. While most goods can be retraded, it is usually impossible to retrade services, and for this reason price discrimination is extensively practised in industries such as transportation, finance, business services, health, education, etc., in most countries. Lower prices are typically charged to purchasers with low incomes, or low average incomes, such as pensioners or students. When governments practise or encourage the practice of price discrimination it is usually justified on welfare grounds, but market producers also have reasons to discriminate in favour of households with low incomes as this may enable them to increase their profits. Thus, when different prices are charged to different consumers it is essential to establish whether or not there are in fact any quality differences associated with the lower prices. For example, if senior citizens, students or schoolchildren are charged lower fares for travelling on planes, trains or buses, at whatever time they choose to travel, this must be treated as pure price discrimination. However, if they are charged lower fares on condition that they travel only at certain times, typically off-peak times, they are being offered lower quality transportation.

4.23 Thirdly, buyers may be unable to buy as much as they would like at a lower price because there is insufficient supply available at that price. This situation typically occurs when there are two parallel markets. There may be a primary, or official, market in which the quantities sold, and the prices at which they are sold, are subject to government or official control, while there may be a secondary market - a free market or unofficial

market - whose existence may or may not be recognised officially. If the quantities available at the price set in the official market are limited there may be excess demand so that supplies have to be allocated by rationing or some form of queuing. As a result, the price on the secondary or unofficial market will tend to be higher. It is also possible, but less likely, that lower prices are charged on the secondary or unofficial market, perhaps because the payment of taxes on products can be evaded in such a market.

4.24 For the three reasons just given, lack of information, price discrimination or the existence of parallel markets, identical goods or services may sometimes be sold to different purchasers at different prices. Thus, the existence of different prices does not always reflect corresponding differences in the qualities of the goods or services sold.

Activity 4.1 Discussion on whether changes in characteristics result in a change of quality

This activity may be done as a group exercise

This activity presents a range of consumer items that are permanently replaced by revised or modified items of the same general type. The objective of the exercise is to decide, for each replacement for each item, whether or not the difference in characteristics between the original item and the replacement would be considered a quality change. This quality change needs to be considered from the point of view of the consumer, so the activity needs to focus on change to utility: does the change in characteristics provide a different (not necessarily improved) sense of satisfaction – or utility – to the consumer?

An important consideration in this exercise is that we are not attempting to value any differences in quality, but instead trying to seek agreement on whether or not quality has actually changed (from the consumers' perspective).

In completing this activity, please decide whether or not the change in characteristics results in a ***increase in quality, a decrease in quality, or whether quality has stayed the same*** - and provide a reason as to your decision.

QUESTION 4.1 (1) COFFEE - AN 80g JAR OF [redacted] INSTANT COFFEE

Replacement item	Quality: Increase, decrease, or the same?	Reason for decision?
An 80g coffee jar is replaced by the same style of coffee but the jar size changes to 100g.		
The flavour is changed to include "a delightful new essence of French vanilla"		
The original cylindrical glass jar is replaced by a hexagonal jar		
The coffee comes with a free mug		
The company repackages the product line with a different colour lid which more readily identifies flavour when stored in the pantry		

Activity 4.1 continues next page

QUESTION 4.1 (2) CHOCOLATE BISCUITS – A 200g PACKET [redacted]

Replacement item	Quality: Increase, decrease, or the same?	Reason for decision?
The packaging changes from one row of twenty two to two rows of eleven		
The cocoa solids content of the chocolate is decreased		
The level of milk fat included is decreased		
The packaging is changed to brown-chocolate-coloured plastic with photo imagery from the current blue-and-gold branding		
The packaging changes from the plastic wrapping to a re-sealable tube		

QUESTION 4.1 (3) CHIPS – A 200g PACKET [redacted] SALT & VINEGAR CRISPS

Replacement item	Quality: Increase, decrease, or the same?	Reason for decision?
The “Salt & Vinegar” flavour is replaced by "*New Extreme Ess n Vee*"		
Existing “Thin sliced“ variety is replaced with a crinkle-cut version		
The single package of crisps is replaced with five individual 40g serves, so that the total weight of the contents of the packages is preserved		
The packaging advertises a competition for the theatrical release of a new release movie		

Activity 4.1 continues next page

QUESTION 4.1 (4) CAR – [redacted]

Replacement item	Quality: Increase, decrease, or the same?	Reason for decision?
The base model is replaced with a type that comes fitted with a [redacted] satellite navigation system		
[redacted] introduces a new alloy in the chassis; the consumer experiences no noticeable change in performance, durability, safety, environmental emissions or fuel economy		
The default paint colour for the [redacted] is changed from white to cream		
The default paint colour for the [redacted] is changed from white to metallic silver [redacted]		
The car retailer switches to [redacted], and replaces the [redacted] with [redacted]		

QUESTION 4.1 (5) CAR RENTAL – ONE WEEK HIRE OF SMALL COMPACT CAR, PICK UP & RETURN

Replacement item	Quality: Increase, decrease, or the same?	Reason for decision?
Air conditioning is now included with all rental vehicles		
The small compact is replaced with a large family sedan		
The "Return" option of the rental agreement is amended to have an optional "or Drop of at Port, Railway or Airport"		
The rental agency switches its fleet from [redacted] to [redacted]		

Activity 4.1 continues next page

QUESTION 4.1 (6) BAKED BEANS – A 415g TIN [redacted]

Replacement item	Quality: Increase, decrease, or the same?	Reason for decision?
The current product is replaced with Reduced Sugar & Salt [redacted]		
The default tin type is replaced with a tin featuring a ring pull device on the lid		
The default tin type is replaced with a non-metal version that can be placed straight in a microwave oven		
The exterior labelling of the tin is revised to include full nutritional information, including a measure of the glycemic index (GI) rating		

QUESTION 4.1 (7) SAND – 3 CUBIC METRES OF SAND, DELIVERED LOOSE

Replacement item	Quality: Increase, decrease, or the same?	Reason for decision?
Bulk delivery of sand is replaced with delivery of equivalent volume in 5 kilogram bags		

QUESTION 4.1 (8) APPLES – A 1 KG OF LOOSE (SELF PACK) [redacted] APPLES

Replacement item	Quality: Increase, decrease, or the same?	Reason for decision?
The self packed apples are replaced with one kilogram bags of [redacted] apples; and through new strict quality control procedures these apples are the same flavour, size, freshness and crispness of the loose apples		

B.5 Pricing to constant quality

4.25 In Module 1 we considered how price indexes could be constructed by observing prices for a fixed set of products over time. We took "fixed" to mean two things:

- the specific goods and services included in the price basket remains the same from period to period; and
- the quantity of those goods and services included in the index remains the same from period to period.

4.26 It is essential that in the compilation of a price index that each item included within the price basket is priced to the same quality that it was in the price reference period. Failure to price to constant quality would result in a price index that measured a price change and a quality change; that is, in addition to a price change the index would also measure the impact of a change in the product being delivered.

Example 4.2 Pricing to constant quality

Internet Trading

With the increase of on-line shopping it is now possible to purchase the exact same product on-line for a cheaper price. Does this represent a price change or a quality change?

Shopping on-line has an increase in the quality of service as shoppers do not need to leave home. However, shopping on-line has a decrease in quality as buyers need access to a computer with the internet, have to wait to get the product delivered and the after sales service is often of a lower quality.

In pricing to constant quality, the prices statistician must account for the difference in the service. The difference between the on-line price and in store price is currently treated a quality difference.

4.27 Pricing to constant quality is not a simple objective to achieve because the characteristics of goods or services being sold in the market place, and their terms of sale, change over time. Frequently the precise commodity priced in one period is no longer available in the next period because either there has been some change in the characteristics of the commodity or something new has taken its place. For price index purposes, it is necessary to devise techniques to identify quality differences and eliminate their effect on prices from the calculations of price change for inclusion in the index.

B.6 Importance of pricing to constant quality

4.28 In Module 1, we saw how price indexes are used in the national accounts to revalue a value estimate from the current period, in the prices of an earlier period. This revalued (or price updated) measure is then used to determine a measure of volume change.

$$V^t = P^t Q^t$$

$$\frac{V^t}{\left(\frac{I^t}{I^{t-1}}\right)} = P^{t-1} Q^t$$

$$\Delta Q^{t-1:t} = \frac{P^{t-1} Q^t}{P^{t-1} Q^{t-1}}$$

where V^t = value at time t

P^t = price at time t

Q^t = quantity (volume) at time t

I^t = price index at time t

(Equation 4.1)

4.29 In this context quality change is a change in volume. Any price index developed for this purpose must exclude the effects of quality change and measure pure price change.

4.30 The System of National Accounts (and its derivatives such as the European System of Accounts), in general, treats differences in quality as differences in volume. Different qualities reflect different use values. Different qualities are, therefore, economically different from each other.

Example 4.3 Importance of pricing to constant quality – hypothetical case study

A specific model of a car (which we denote by *m*) sells for $20,000 in January 2008. The manufacturer receives $30 million in revenue for this car in this period.

It is replaced by a new version of the car in February of 2008, which is otherwise identical to that sold previously, except for the inclusion of an in-car DVD player and GPS system. This new model car (which we denote by *n*) sells for $25,000 in February. Discussions with both the manufacturer and a range of consumer groups show that the new improvements are valued (by consumers) at $4,000 in January. The manufacturer receives $33 million revenue for sales of this car in February.[43]

TABLE 4.1 - HYPOTHETICAL CASE STUDY – QUALITY CHANGE AND CARS

Period	Model of car	Price ($)		Revenue ($)
Jan-2008	*m*	P_m^{Jan}	20,000	30,000,000
Feb-2008	*n*	P_n^{Feb}	25,000	33,000,000

Erroneously ignoring the change in quality

In failing to account for quality change, we are assuming that the two car models are economically identical

$$\frac{V^t}{\left(\frac{I^t}{I^{t-1}}\right)} = P^{t-1}Q^t$$

$$\frac{V^{Feb}}{\left(\frac{P_n^{Feb}}{P_m^{Jan}}\right)} = \frac{33{,}000{,}000}{\left(\frac{25{,}000}{20{,}000}\right)}$$

$$= 26{,}400{,}000$$

$$= P^{Jan}Q^{Feb}$$

$$\Delta Q = \frac{P^{t-1}Q^t}{P^{t-1}Q^{t-1}}$$

$$= \frac{26{,}400{,}000}{30{,}000{,}000}$$

$$= 0.88$$

If we erroneously ignore the change in quality, we would incorrectly calculate that the volume decreased by 12.0%

Example 4.3 continues next page

[43] Slide updated 27/11/2009

Accounting for the change in quality

We know the cars are not identical. There is \$4,000 worth of improvements in model *n* when compared with model *m* (as valued in January). We wish to make price comparisons between the February price for model *n* and the January price for model *m*. This can be achieved by estimating a price for model *n* in January, by considering the model m price in January and then including the cost of the extra components[44].

$$\begin{aligned}\hat{P}_n^{Jan} &= P_m^{Jan} + x \\ &= 20{,}000 + 4{,}000 \\ &= 24{,}000\end{aligned}$$

We then construct a measure of price change between January and February by using this quality adjusted price, and we make the comparison based upon the quality observed in the second period (that is, based on model *n*).

$$\frac{V^t}{\left(\frac{I^t}{I^{t-1}}\right)} = P^{t-1}Q^t$$

$$\begin{aligned}\frac{V^{Feb}}{\left(\frac{P_n^{Feb}}{\hat{P}_n^{Jan}}\right)} &= \frac{33{,}000{,}000}{\left(\frac{25{,}000}{24{,}000}\right)} \\ &= 31{,}680{,}000 \\ &= P^{Jan}Q^{Feb}\end{aligned}$$

$$\begin{aligned}\Delta Q &= \frac{P^{t-1}Q^t}{P^{t-1}Q^{t-1}} \\ &= \frac{31{,}680{,}000}{30{,}000{,}000} \\ &= 1.056\end{aligned}$$

Correctly accounting for the change of quality would more properly indicate that the volume had increased by 5.6%

[44] This is called the "Option Cost" method of quality adjustment and is one of many techniques we might apply. This and other approaches are considered in the remainder of this Module.

B.7 An overview of methods of quality adjustment when matched items are unavailable[45]

4.31 It is apparent from the above that quality adjustments to prices are not a simple matter of applying routine methods to prices in specified product areas. A number of alternative approaches are suggested below. Some will be more appropriate than others for specific product areas. An understanding of the consumer market, technological features of the producing industry, and alternative data sources will all be required for the successful implementation of quality adjustments. Specific attention will need to be devoted to product areas with relatively high weights, where large proportions of items are turned over. Some of the methods are not straightforward and require a level of expertise. Quality adjustment needs to be implemented by developing a gradual approach on a product-by-product basis. Such concerns should not be used as excuses for failing to attempt to estimate quality-adjusted prices. The practice of statistical agencies in dealing with missing items, even if it is to ignore them, implicitly involves a quality adjustment. Such an implicit approach may not be the most appropriate method, and may even be misleading. The extent of quality changes and the pace of technological change require that appropriate methods be used.

4.32 [redacted]

[45] This section relies heavily on the *Producer Price Index manual: Theory and Practice* , Chapter 7, Section C, and the equivalent material in the *Consumer Price Index manual: Theory and Practice* commencing at paragraph 7.33

[redacted]

4.33 When an item is missing in a month for reasons other than being off season or off cycle, the replacement may be of a different quality – like may no longer be compared with like. The three main types[46] of quality adjustment procedures that are employed under these circumstances are then:

- ***Direct comparison (QDC)***, where a decision is reached that no quality change is observed, and therefore no adjustment is made.

- ***Explicit, direct or component-wise methods (QDAP, QCPP QPVC*)**, which assess the value of the quality change between the old (replaced) and the new (replacing) model based on observed changes in characteristics of the models. Pure price change is estimated as the difference in the accordingly adjusted prices.

- ***Implicit, indirect or holistic methods* (QNDC)**, which assess the pure price change between the old (replaced) and the new (replacing) model based on price changes observed for similar models. The difference between the *estimate* of pure price change and the observed price change is considered as change due to quality difference.

B.8 The quality adjustment problem – measure price change from period 0 accounting for change in quality

4.34 In the situation where we have no overlapping sales we are required to make an

[46] [redacted]

explicit quality adjustment to enable comparison of two prices. Regardless of how we assess the actual quality difference, we are presented with a problem: when comparing two prices, which price do we adjust for the change in quality, the current period or the reference period?

4.35 ***Arguments for adjusting the price of the item from the current period:*** We observe a change of quality in the product being priced in the current period. A logical assumption would be to modify the price in the current period so that it reflects the quality of the item priced in the price reference period. That is, "what price would the item have in the current period if it had the same quality as observed in the price reference period?" This would ensure that the current period-previous period comparison is done at a level of constant quality.

4.36 ***Arguments for adjusting the price of the item from the reference period:*** We could similarly make an adjustment to the price of the item observed in the reference period. That is, "what price would the item have been in the price reference period if it had the same quality as observed in the current period?" When applied rigorously this method will give an identical measure of price change as the alternative approach.

4.37 ***So which method should be applied?*** In practice national agencies must take actions that not only give the correct result for any current period measures but also ensure that future re-use of data gives correct results.

4.38 If the current period price is adjusted to reflect the quality of the earlier period, then a similar, reciprocal adjustment must be made next period when comparing prices. That is, the "next period price" will also have to be revalued using the quality of the reference period. And the next period, and so on.

4.39 However, if the reference period price is adjusted (so that it is valued using the quality of the incoming item), then no other changes need be made – this same adjusted reference period price can be reused in future periods without further calculation

4.40 So, for practical expediency, national agencies almost always adopt the approach of

"Adjust the reference period price to reflect the quality observed in the current period"

4.41 When following this practical solution[47], the quality adjustment problem can be seen as "determining the price of the incoming quality in the price reference period", or estimating the value $\hat{p}^0_{NEW}$

B.9 Formulation of the general problem

4.42 A fixed basket price index is constructed measuring price change from period 0 to period *t-1*(which we will label $I^{0:t-1}$). In period *t*, an item from the previous price sample is replaced by a new item. We denote these two items of different quality as *i,OLD* and *i,NEW*. No price for the old item is observed in period *t*, with the price for the replacement item being observed instead $p^t_{i,NEW}$. If this new item (on the new quality) is included in the price sample, the general problem then becomes one of determining a multiplicative factor *g* such that

$$\hat{p}^0_{i,NEW} = g \times p^0_{i,OLD}$$

Equation 4.2

4.43 In this formulation, the multiplicative factor *g* is an estimate of the ratio of the value of the quality difference in the price reference period. An important point of clarification is required here: our *aim* is to determine a value for the difference in the two qualities as at the price reference period. In practice we will rarely have data for this period, and frequently have to make an estimate of the factor g using observations from the current and previous periods.

B.10 Direct comparison

4.44 The method of *Direct Price Comparison* means that the value of the quality difference is assessed as zero; using the

[47] Note that the alternative view was illustrated in Example 4.1

form expressed in Equation 4.2 above, this equates with g=1.

4.45 Direct Price Comparison is also known as "unadjusted price comparison" for "essentially equivalent" or "directly equivalent" product offers. It means that the index computation is made without any quality adjustment. The entire difference between the observed price in the previous period for the old quality $p_{i,OLD}^{t-1}$ and the observed price observed in the current period for the new quality $p_{i,NEW}^{t}$ is due only to *pure price change*.

4.46 The applicability of the method rests on the assumption that quality changes are negligible. The suitability of this assumption will vary by product type and market, and change over time. While there will be frequent individual circumstances where a product replacement is identical in quality to its predecessor, this will in general be an exception to the overall evolution of products in the marketplace (from both the consumer and producer perspectives).[48].

[48] [redacted]

B.11 Explicit methods

4.47 The assumptions needed for explicit methods of quality adjustments concern the way in which various characteristics or features of a model contribute to the quality. Different forms of these assumptions lead to different explicit methods, ranging from an informal ad hoc character for some kinds of judgmental adjustment, to a formally stated mathematical/statistical model for hedonic methods.

4.48 The effort needed for explicit methods increases as more detailed information about characteristics and features of the models has to be collected and evaluated. But those efforts are well rewarded, as quality adjustment by explicit methods gives the opportunity to control, account for, and harmonise what lies behind the adjustments.

4.49 ***Quantity adjustment***

4.50 The method of Quantity Adjustment means that the value of a change in package size, as a proportion of the price, is assessed as the relative change in package size. Quantity adjustment is also called "package size adjustment", although perhaps it should be better considered as a special case of Single-Variable Adjustment[49] (q.v.).

4.51 Quantity adjustment is applicable for adjustment of price per package in cases of modest changes in package size, where the size of the replacing package is between about half and about double of the size of the replaced package.

4.52 The applicability of the method rests on the assumption that the value of the product is proportional to the size of the package (i.e. the quantity of package contents). This assumption is often a source of confusion in application. For consumer price indexes an assessment should be made as to whether or not the new quality – in this case, the new quantity – has the same use as the size of the outgoing product. For example, a 24-can case of lager does not have the same use as a 4-pack of lager, as it allows consumption by more consumers in a similar time frame, or allows a single consumer to store the lager to be consumed over a longer time frame[50].

4.53 Computation for the "quantity adjustment" method utilises a linear relationship between the quantities observed for the old and new qualities. If the quantity changes from u_{OLD} to u_{NEW} (where quantity is measure in the same units such as millilitres or kilograms), the quality adjusted price for the new quality in the price reference period (0) is

$$g = \frac{u_{NEW}}{u_{OLD}}$$

$$\hat{p}^0_{NEW} = g \times p^0_{OLD} = \frac{u^{NEW}}{u^{OLD}} \times p^0_{OLD} \qquad \textbf{Equation 4.3}$$

[49] Single Variable Adjustment may in turn may be seen as a special case of adjustment by Hedonic methods.

[50] [redacted]

Example 4.4 Quantity Adjustment and the [redacted]

In March quarter the mass of a single [redacted] was reduced from 62.5 grams to 58 grams. An example of the resulting "quantity adjustment" quality change is illustrated below

$$u_{OLD} = 62.5 \ grams$$
$$u_{NEW} = 58 \ grams$$
$$g = \frac{u_{NEW}}{u_{OLD}} = \frac{58}{62.5}$$
$$p^0_{OLD} = \$0.40$$
$$\hat{p}^0_{NEW} = g \times p^0_{OLD} = \frac{u_{NEW}}{u_{OLD}} \times p^0_{OLD} = \frac{58}{62.5} \times \$0.40$$
$$\hat{p}^0_{NEW} = \$0.37$$

The fall in quantity for the new, incoming, quality is reflected directly by a fall in the price in the price reference period (the period 0 price drops 7.2% (from \$0.40 to \$0.37) when compared with the old quality, reflecting the change in mass). The linear relationship is illustrated in Figure 4.2.

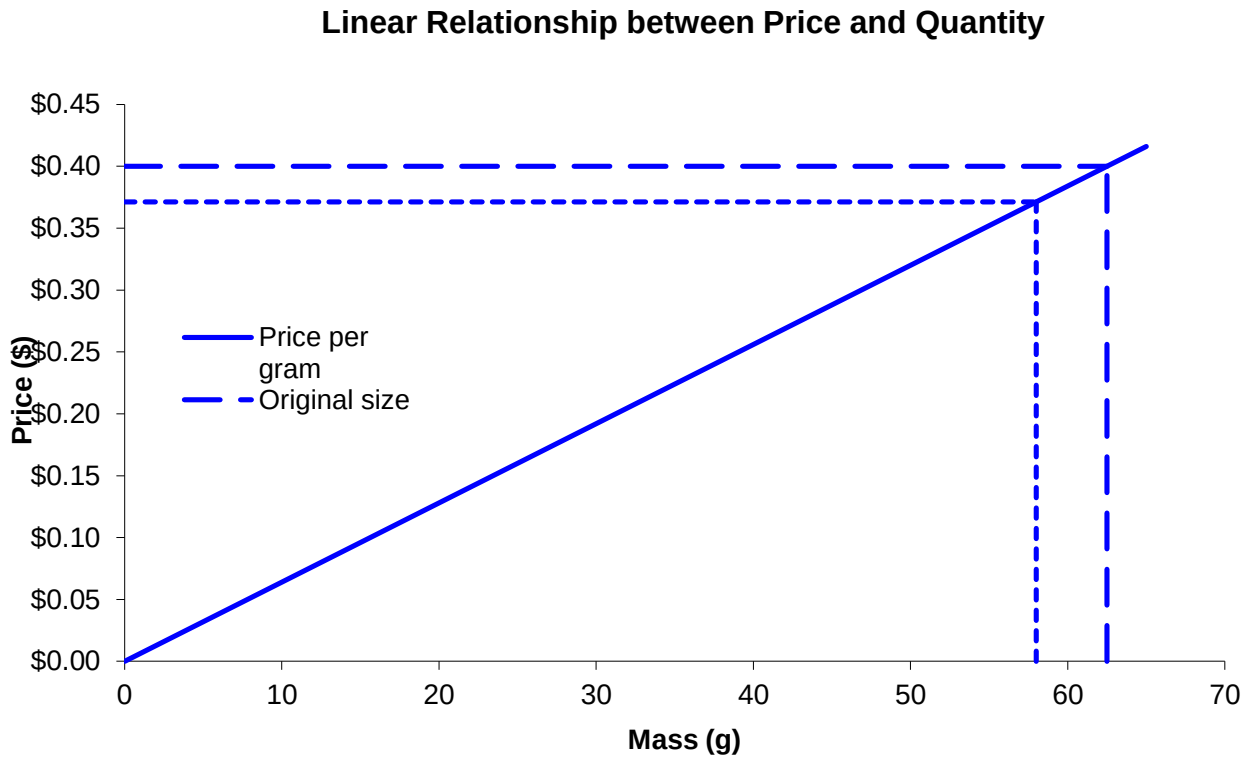


Figure 4.2– Linear relationship between price and quantity [redacted]

4.54 ***Adjustment by Difference as a percent***

4.55 The method of ***difference as a percent*** adjustment means that the value of the quality change between an old, replaced model and a new, replacing model, as a proportion of the price, is assessed as the relative change in a given function of one particular characteristic of the models. This is a more general case of the "Quantity adjustment" approach outlined above.

4.56 This quality adjustment is applicable in product areas where it is deemed that quality changes to be adjusted for are essentially captured by changes in functions of a single variable.

4.57 ***Option cost or option pricing***

4.58 The method of option pricing means that the value of the quality change between an old replaced model and a new replacing model is assessed as some fixed proportion of the market price of features by which the two models differ; that is, difference in quality is measured as (some proportion) of the difference in value that consumers place on the different options.

4.59 The quality adjustment is applicable in product areas where quality changes often consist in changes in the presence of specific product features, for which prices can be collected or estimated (for example, motor vehicles).

4.60 The applicability of the method rests on the assumption that the difference in value between similar models (product variants) is equal to some given or previously estimated proportion of the price for separately purchased features by which the models differ. It is only suitable where technology (and tastes) is relatively stable between the price reference period 0 and the current period *t*.

4.61 It is not immediately obvious that the quality adjustment is based on a proportion of the difference in the value of options and not the entire difference in value.

4.62 Consider the addition of a feature to a commodity. Chairs, for example, can be produced and sold as standard or with a lever mechanism for height adjustment. The height adjuster may be valued at an additional amount *c* when sold separately. There is likely to be a segment of the market that particularly values height adjusters and is willing to spend the additional amount.

4.63 Now consider the situation where the standard chair is replaced by the chair that has the height adjuster included (this type of replacement is often called "option-made-standard"). When the height-adjuster is sold as standard, many of the purchasers will not value it as highly as that segment that chose the option, since these were the very ones who chose the standard chair. The overall user value for the additional option – the height adjuster - would be less than *c*, (say $a \times c$, with $0 < a < 1$), although it is not immediately apparent how much less (this phenomenon is sometimes called "option-not taken"). It is clear that a factor of $a=1$ (resulting in an option value of *c*) is almost always an overestimate of the value that purchasers', as a whole, place on the option. Similarly, a factor of $a=0$ is an underestimate of the value purchasers' place on the option. [redacted]

4.64 The key issue is to determine both the cost of the option *c*, and the proportion that would take up the option *a*. Ideally, these measures need to be determined for the price reference period. However, such data are unlikely to be available, particularly if the availability of the option is a recent innovation. Instead, these terms are measured in the previous period *t-1* – that is, in the period during which the older, outgoing model was last available. Highlighting that the factors are indeed time dependent, these will be written as a^{t-1} and c^{t-1}.

4.65 Some insight into the proportion of the market purchasing the standard commodities would help generate more precise estimates.

4.66 Computation for the difference as a proportation quality adjustment method uses

the cost c^{t-1} and the adjustment factor (or take-up rate, or proportion-valued) a^{t-1}, with both measures determined from the previous period ($t-1$). The estimate of the price from the price-reference period for the new (option included) quality is then determined as:

$$g = 1 + \frac{a^{t-1} \times c^{t-1}}{p_{OLD}^{t-1}}$$

$$\hat{p}_{NEW}^{0} = g \times p_{OLD}^{0} = \left(1 + \frac{a^{t-1} \times c^{t-1}}{p_{OLD}^{t-1}}\right) \times p_{OLD}^{0} \qquad \textbf{Equation 4.4}$$

4.67 If features were present in the older model but have been taken away in the replacing model, then the prices of those features shall be taken as negative numbers in the computation.

Example 4.5 Proportional adjustment cost (Option cost) for cars using consumer prices

In June 2007 the [redacted] Sports model was replaced with an identical model, except that this new version had included, as standard, an attachment that allowed MP3 players to be plugged straight into the stereo system.

According to [redacted] Magazine, the MP3 attachment had been previously available as a separate option for the price of \$75. Assuming "previously available" meant "available at that price in May 2007", and that the take-up rate for the option was 50% (again in May 2007). The Option Cost quality adjustment[51] for this car was as follows:

$$p_{OLD}^{Jan-07} = \$16{,}722$$
$$p_{OLD}^{May-07} = \$16{,}742$$
$$c^{May-07} = \$75$$
$$a^{May-07} = \tfrac{1}{2}$$
$$g = 1 + \frac{a^{May-07} \times c^{May-07}}{p_{OLD}^{May-07}}$$
$$= 1 + \frac{\tfrac{1}{2} \times \$75}{\$16{,}742}$$
$$= 1.022398$$
$$\hat{p}_{NEW}^{Jan-07} = g \times p_{OLD}^{Jan-07}$$
$$= 1.022398 \times \$16{,}722$$
$$= \$16{,}759.45$$

[51] [redacted]

4.68

4.69

4.70

4.71

52

4.72 ***Expert judgement methods (or judgmental quality adjustment methods)*** **-** The method of expert judgement adjustment means that the value of the quality change between a replaced and a replacing model is assessed by judgement of some assigned person(s). Expert quality adjustment is sometimes controversial in view of its "subjective" character[53].

4.73 The applicability of the method rests on the assumption that the difference in value between models (product variants) can be assessed by judgement of the assigned persons. That capability of the assigned persons may be based on either expert knowledge on specific kinds of consumer products, or on professional experience in price statistics production, combined with general consumer experience.

4.74 [redacted]

4.75 Application of an expert quality adjustment results in assignment of a value of quality difference (ideally valued in the previous period). If the value of the difference in quality due to changing resources costs is valued at d^{t-1}, the estimated price for the new quality in the price reference period is determined as

$$g = 1 + \frac{d^{t-1}}{p_{OLD}^{t-1}}$$

$$\hat{p}_{NEW}^{0} = g \times p_{OLD}^{0} = \left(1 + \frac{d^{t-1}}{p_{OLD}^{t-1}}\right) \times p_{OLD}^{0} \qquad \textbf{Equation 4.6}$$

[53] [redacted]

[54] [redacted]

B.12 Implicit methods

4.76 The assumptions needed for implicit methods of quality adjustment concern the way models are priced in the market. A common basic assumption underlying the most important implicit methods is:

- The difference in quality between models simultaneously available in the market is assumed to be equal to the difference in price between the models.

4.77 This is perhaps best illustrated from the consumers' point of view[55]. The idea is that since all the current models co-exist in the competition they are all equally "good buys" for their price. From the consumers' perspective, each model gives just as much quality as he or she pays for, according to the assumption. However, this reasoning, sometimes referred to as the argument of 'revealed preference', is far from unproblematic.

4.78 For the argument to be valid, it is assumed that the consumers are rational in their thinking and well informed about available alternative choices. It also has to be assumed that the market is "in a state of equilibrium", i.e. in a state of balance between supply and demand. In practice these assumptions may be adequate or inadequate to varying degrees in different product areas[56]. Equilibrium conditions may be temporarily disrupted in situations such as stock clearances, or initial shortages of new models that are not produced as rapidly as they gain popularity.

4.79 A further difficulty is that products like computers and refrigerators are indivisible. The consumer does not have a choice between one top-performance computer and, say, 1.6 medium performance computers, or between one large refrigerator and say 1.4 medium-size refrigerators.

4.80 A consumer with a preference for a computer in a certain performance range, or a refrigerator in a certain size range, is not likely to seek the best value for money among models of all performance-levels or sizes. So the competition between different performance-levels or sizes is not perfect; different performance-levels or sizes are to some extent in separate markets.

4.81 Implicit quality adjustment methods may seem less laborious than explicit QA methods, as less information on product characteristics has to be collected and evaluated. They may also be more readily replicable than explicit methods, i.e. likely to give the same result again if applied once more in the same situation.

4.82 But the implicit methods are problematic in two respects. First, the fulfilment of the assumption in paragraph 4.76 is generally uncertain, and would in principle have to be verified for each product area.

4.83 Second, quality adjustment by implicit methods is frequently[57] implemented via "black box", offering no actual control of what is going on inside the box, as the value of the quality difference is obtained indirectly as an overall figure without specification of the factors that contribute to the quality change.

4.84 ***Price change taken as quality change, automatic linking, link to show no [price] change, or price difference equals quality difference***. The "Price change taken as quality change" quality adjustment method means that the value of the quality change is assessed as the change in observed prices since the preceding period.

4.85 The applicability of the method rests on the assumptions that true price changes in conjunction with quality changes are negligible, and that the difference quality between currently available and recently available models is equal to the difference in observed price. This assumption will never hold true as a general rule – that introduction

[55] [redacted]

And as noted previously, for services and other bespoke products, the market allows for price discrimination, and so equilibrium may not occur as frequently, or for as long.

[57] Considered design of quality adjustment and imputation systems can of course allow for detailed management information to be presented for all quality adjustment techniques – but as noted this is not frequently considered at the outset of system design.

of new features are not accompanied by any change in true price. Frequent or automatic application of this method would risk hiding some occurring price changes, so that those price changes would not be properly shown in the index[58].

4.86 In use of "Price change taken as quality change", the index is computed by

$$g = \frac{p^{t}_{NEW}}{p^{t-1}_{OLD}}$$

$$\hat{p}^{0}_{NEW} = g \times p^{0}_{OLD}$$

$$= \frac{p^{t}_{NEW}}{p^{t-1}_{OLD}} \times p^{0}_{OLD}$$

4.87 The immediate consequence of applying the "price change taken as quality change" is that the price relative for *t-1* is the same as period *t*, and equivalently that no price movement occurs between periods *t-1* and *t*.

4.88 Automatic (or frequent) use of this method of quality adjustment biases index movements towards zero. Since the method results in no price change for the replaced item, this will be an underestimate of change (for an upward moving index) or an overestimate of price change (for a downward moving index).

4.89 Although strictly not recommended as a method for quality adjustment, discussion of "price change equals quality change" allows a contrast with the "Direct Comparison" quality adjustment method (see B.10). These two quality adjustment techniques assume that the difference in observed price between two models is either all due to pure price change (as the Direct Comparison method), or all due to quality change (as in the Price Change as Quality Change method). These two positions can be viewed as being at opposite ends of a "quality adjustment spectrum".

[58] [redacted]

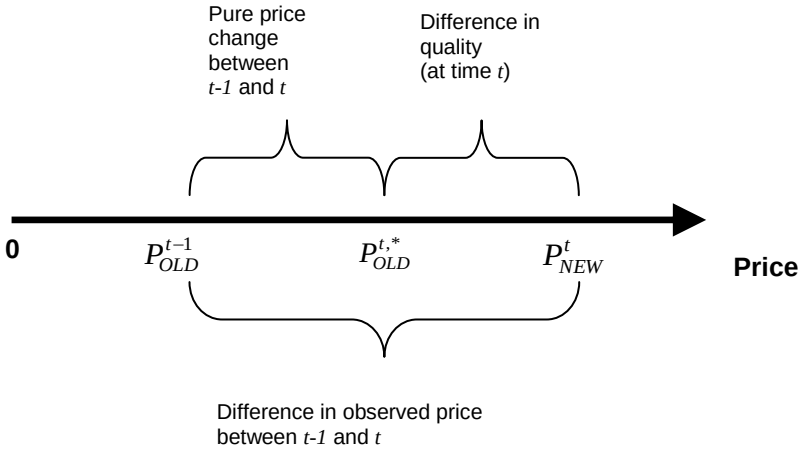


Figure 4.3 – Quality adjustment spectrum – the general quality adjustment problem

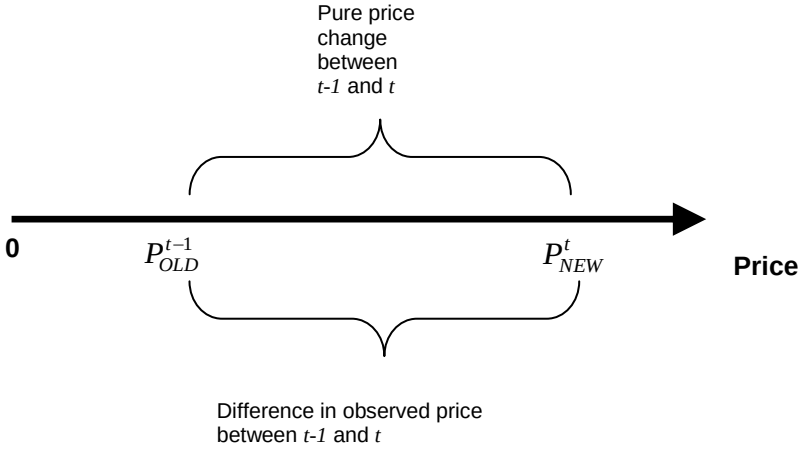


Figure 4.4 - Quality adjustment spectrum – Direct Comparison, no quality difference

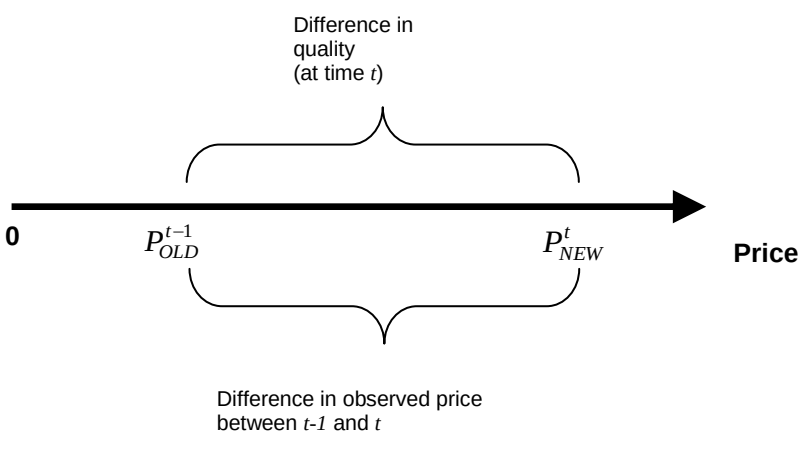


Figure 4.5 - Quality adjustment spectrum – Price Change as quality change, no price difference

4.90 ***Overlap pricing:*** Overlapping pricing typically arises where a particular item (brand, model, etc.), being priced is no longer available in the market place from one period to the next, however there is another similar item which has been, and continues to be, available in the same market as the initial product and is expected to be a substitute once it is discontinued.

4.91 In this situation, provided the two items have sold side by side for some time in the same market and both have sold in reasonable quantities, the approach is to collect prices for both items at the one date and to assume that the difference in prices represents the difference in quality between the two. The implicit assumption is that the market has adequate knowledge of the qualities and prices of each product and that the difference in price is regarded by them as a reasonable measure of the difference in quality. The second item is then substituted for the first using the technique of *splicing price series*, as illustrated below in Figure 4.6.

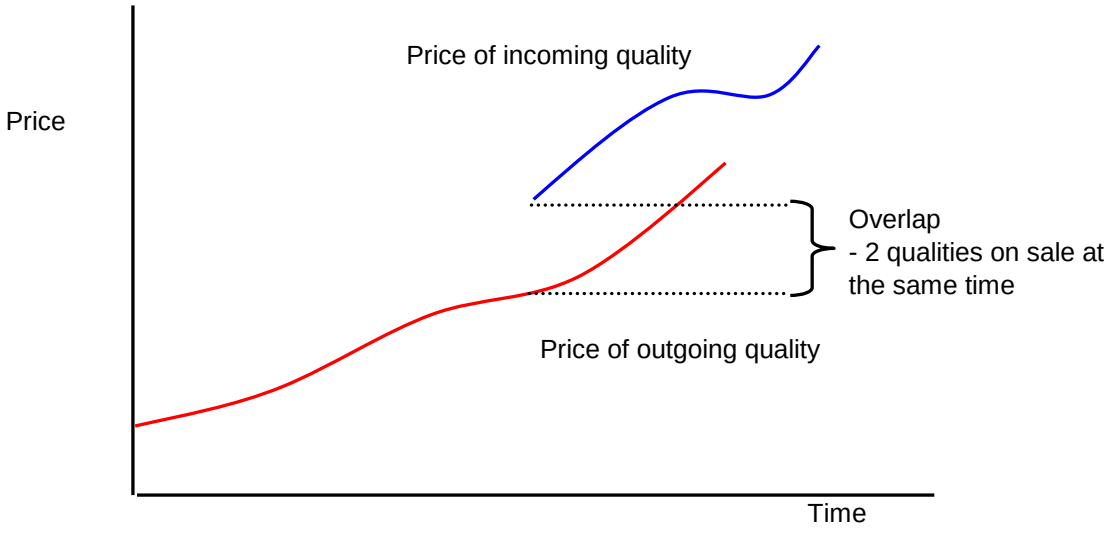


Figure 4.6 – Overlapping sales

Example 4.6 Adjusting for quality change using overlapping sales

TABLE 4.2 - PRICE OF HARVESTERS, MAKING QUALITY ADJUSTMENT FOR PERIOD 1 TO PERIOD 2 MOVEMENT

	Period 0	Period 1	Period 2
Harvester Type A	80,000	85,000	
Harvester Type B		95,000	98,000
Price relative – change since period 0	$\frac{P_A^0}{P_A^0}\times 100.0 = 100.0$	$\frac{P_A^1}{P_A^0}\times 100.0 = \frac{85{,}000}{80{,}000}\times 100 = 106.3$	$\frac{P_B^2}{\hat{P}_B^0}\times 100 = 109.7$

The quality adjustment process using overlapping prices uses the relationship observed from the overlap period (in this case, period 1) to make an estimate of the price of the new quality in the price reference period, period 0. This may be viewed in two ways.

First, the quality adjustment can be seen as "valuing the new quality (B) at period 0 prices". Taking this view, the price change between period 0 and 1 for the older quality (A) is applied to the period 1 price of the new quality. This gives an estimate of the period 0 price of quality B. This estimate is then used to determine a price relative at period 2. This interpretation (estimating a price for the new quality in period 0) is the more general approach that can be applied to other quality adjustment techniques.

$$\hat{P}_B^0 = \frac{P_B^1}{\left(\frac{P_A^1}{P_A^0}\right)} = \frac{95{,}000}{106.3} = 89{,}370$$

Overlap – considering the estimation of a period 0 price for quality B

$$\frac{P_B^2}{\hat{P}_B^0}\times 100.0 = \frac{98{,}000}{89{,}370}\times 100 = 109.7$$

The alternative view, yielding the same result (since this is a simple rearrangement of the formula) is to "apply the price movement from period 1 to 2 for quality B to the price index determined at period 1 for quality A". This is the more frequent interpretation in which we "splice" the price movements from quality B to the price index from quality A.

$$\frac{P_A^1}{P_A^0}\times\frac{P_B^2}{P_B^1} = 106.3\times\frac{98{,}000}{95{,}000} = 109.7$$

Overlap – considering the splicing of period 1 to 2 movement onto the period 0 to 1 movement

Under such a view the movement reflected in the index from period 0 to period 1 is the movement in the price of Harvester A, whereas the price movement from period 1 to period 2 is based on Harvester B, which will be priced in subsequent periods to replace Harvester A. The difference in price between Harvester A and Harvester B has been eliminated through the process of splicing the new price series to the old price series.

4.92 In some cases, even with overlapping sales, simple splicing of the price of the new specification to the existing price series is not a satisfactory way of eliminating changes in quality. This situation occurs, for example, when the price of a new model reflects not only the extent of modifications but also a degree of price change, upwards or downwards, for reasons quite distinct from these modifications. In these circumstances, a simple splicing of the old and new prices would eliminate the elements of pure price change as well as the elements of change in quality. In such cases, it is necessary to assess the degree of pure price change involved and to ensure that this is reflected in the price series after splicing.

4.93 ***Bridged overlap, overall mean or targeted mean imputation (t-1 to t)*** method uses the *consecutive period price changes* of other items as estimates of the *consecutive period price changes* of the missing items.

4.94 The applicability of this method relies on the assumption that "all products of a given type tend to move the same way" – at least over the short period such as consecutive months. This method of implicit quality adjustment is relatively straightforward, but its use depends on the exact type of index formula applied. As it depends on the exact type of index formula in use, its explanation will be broken down into separate steps. The key issue in applying this technique is that the aim, like other quality adjustment techniques presented here, is to determine a price for the new quality in the price reference period

- *Determine the consecutive period price change for the matched sample* – for those observations that match (to constant quality) between period t-1 and period t, determine an average price movement using the appropriate index formula. Call this $I_{MATCH}^{t-1:t}$

- *Impute a quality adjusted price for the OLD quality in the current period by applying the consecutive period movement to the price for the OLD item in the previous period* – this assumes that had the old quality been on sale in the current period its price movement between the previous (t-1) and current (t) periods would have been the same, on average, as the other matched items in the price sample. $\hat{p}_{OLD}^{t} = I_{MATCH}^{t-1:t} \times p_{OLD}^{t-1}$

- *the price of the NEW quality in the price reference period is determined by dividing the observed current period price for the NEW quality by the price relative determined from the imputed current period price for the OLD quality* – this assumes that the new, incoming, quality would have the same price movements as the outgoing, old, replaced item, remembering that the movement between the previous period and current period has been imputed

$$\hat{p}_{NEW}^{0} = p_{NEW}^{t} \times \Big/ \left(\frac{\hat{p}_{OLD}^{t}}{p_{OLD}^{0}} \right)^{1} \quad \textbf{Equation 4.7}$$

4.95 This can be rewritten using the quality adjustment factor approach, as

$$\begin{aligned} \hat{p}_{NEW}^{0} &= p_{NEW}^{t} \times \Big/ \left(\frac{\hat{p}_{OLD}^{t}}{p_{OLD}^{0}} \right)^{1} \\ &= p_{NEW}^{t} \times \frac{p_{OLD}^{0}}{\hat{p}_{OLD}^{t}} \\ &= p_{OLD}^{0} \times \frac{p_{NEW}^{t}}{\hat{p}_{OLD}^{t}} \qquad \textbf{Equation 4.8} \\ &= p_{OLD}^{0} \times \frac{p_{NEW}^{t}}{p_{OLD}^{t-1} \times I_{MATCH}^{t-1:t}} \\ g &= \frac{p_{NEW}^{t}}{p_{OLD}^{t-1} \times I_{MATCH}^{t-1:t}} \\ \hat{p}_{NEW}^{0} &= g \times p_{OLD}^{0} \end{aligned}$$

4.96 Targeted class mean approaches follow the same reasoning as above, but rather than take an average over all other items in the elementary aggregate, the index used for the imputation is determined from a specific sub sample (for example, restricting to a similar manufacturer, retailer, store type or region).

Example 4.7 Class mean imputation[59]

Consider a hypothetical example of 3 items sampled over 3 periods (Jan-08 through Mar-08). In Mar-08, Item 3 is replaced – we will use 3-OLD and 3-NEW to distinguish between the outgoing and incoming items.

TABLE 4.3- THREE ITEMS OVER THREE PERIODS, REPLACEMENT OCCURRING IN THE THIRD PERIOD

	Jan-08	Feb-08	Mar-08
	Prices ($)		
Item 1	100	150	160
Item 2	200	225	250
Item 3 – OLD	100	140	-
Item 3 - NEW	-	-	180
	Relatives		
Item 1	1.000	1.500	1.600
Item 2	1.000	1.125	1.250
Item 3 – OLD	1.000	1.400	-
Item 3 - NEW	-	-	?

(Table continued next page …)

Example 4.7 continues next page

[59] This example is adapted from the seminal paper on class mean quality adjustment: "Quality Adjustment in Price Indices: methods for imputing Price and Quality Change", Armknecht, PA and Moulton, BR, (1995)

	Jan-08	Feb-08	Mar-08
	Price indexes (Jan-08 = 100.0)		
Dutot (Ratio of Average prices)	100.0	128.75	?
Carli (Average of Price Relatives)	100.0	134.17	?
Jevons (Geometric mean)	100.0	133.19	?

Bridged overlap quality adjustment determines a matched sample index (according to the appropriate index number formula), and imputes a price for the outgoing item in the current period that is then used to determine a quality adjusted base period price for the outgoing item.

DUTOT

For the Dutot (RA) index, the quality adjusted base period price for Item 3-NEW is:

$$I_{Dutot,MATCH}^{Feb-08\&Mar-08} = \frac{\frac{1}{2}(160+250)}{\frac{1}{2}(150+225)} \times 100$$
$$= \frac{205}{187.5} \times 100$$
$$= 109.3$$
$$\hat{p}_{3,OLD}^{Mar-08} = p_{3,OLD}^{Feb-08} \times \frac{I_{Dutot,MATCH}^{Feb-08\&Mar-08}}{100}$$
$$= 140 \times \frac{109.3}{100}$$
$$= 153.07$$
$$\hat{p}_{3,NEW}^{Jan-08} = p_{3,OLD}^{Jan-08} \times \frac{p_{3,NEW}^{Mar-08}}{\hat{p}_{3,OLD}^{Mar-08}}$$
$$= 100 \times \frac{180}{153.07}$$
$$= 117.60$$

The Mar-08 Dutot index, accounting for the change in quality of Item 3, then becomes

$$I_{Dutot}^{Jan-08\&Mar-08} = \frac{160+250+180}{100+200+117.60} \times 100$$
$$= 141.3$$

Example 4.7 continues next page

CARLI

For the Carli (AR) index, the quality adjusted base period price for Item 3-NEW is:

$$I_{Carli,MATCH}^{Feb-08\&Mar-08} = \frac{1}{2}\times\left(\frac{160}{150}+\frac{250}{225}\right)\times 100$$
$$= 108.9$$

$$\hat{p}_{3,OLD}^{Mar-08} = p_{3,OLD}^{Feb-08}\times\frac{I_{Carli,MATCH}^{Feb-08\&Mar-08}}{100}$$
$$= 140\times\frac{108.9}{100}$$
$$= 152.44$$

$$\hat{p}_{3,NEW}^{Jan-08} = p_{3,OLD}^{Jan-08}\times\frac{p_{3,NEW}^{Mar-08}}{\hat{p}_{3,OLD}^{Mar-08}}$$
$$= 100\times\frac{180}{152.44}$$
$$= 118.08$$

The Mar-08 Carli index, accounting for the change in quality of Item 3, then becomes

$$I_{Carli}^{Jan-08\&Mar-08} = \frac{1}{3}\times\left(\frac{160}{100}+\frac{250}{200}+\frac{180}{118.08}\right)\times 100$$
$$= 145.8$$

JEVONS

For the Jevons (GM) index, the quality adjusted base period price for Item 3-NEW is:

$$I_{Jevons,MATCH}^{Feb-08\&Mar-08} = \sqrt{\left(\frac{160}{150}\times\frac{250}{225}\right)}\times 100$$
$$= 108.9$$

$$\hat{p}_{3,OLD}^{Mar-08} = p_{3,OLD}^{Feb-08}\times\frac{I_{Carli,MATCH}^{Feb-08\&Mar-08}}{100}$$
$$= 140\times\frac{108.9}{100}$$
$$= 152.41$$

$$\hat{p}_{3,NEW}^{Jan-08} = p_{3,OLD}^{Jan-08}\times\frac{p_{3,NEW}^{Mar-08}}{\hat{p}_{3,OLD}^{Mar-08}}$$
$$= 100\times\frac{180}{152.41}$$
$$= 118.10$$

The Mar-08 Jevons index, accounting for the change in quality of Item 3, then becomes

$$I_{Jevons}^{Jan-08\&Mar-08} = \sqrt[3]{\left(\frac{160}{100}\times\frac{250}{200}\times\frac{180}{118.10}\right)}\times 100$$
$$= 145.0$$

4.97 ***Variations on class-mean methods:*** The use of imputation as a technique to deal with quality adjustment has many variations. In the previous section, imputation was described by considering consecutive period movements for the matched sample. One simple alternative is to use "movement from the base period" as the criteria for imputation, rather than from the previous period. This results in the new, incoming quality receiving the same price relative (change since price reference period) as the entire price sample.

4.98 A second (and frequently related) alternative is to delete the "changing item" from the sample for a short period (for example, in the month that it disappears and the next two months). It's eventual re-entry in the sample then derives a price from the price reference period by assigning the new, incoming item the price relative of the entire sample, and then calculating the price reference period price from the current period price. If an item is replaced in period *t*, it is omitted from the index for period *t* and period *t+1*, and is replaced in period *t+2* with a price reference period price as

$$\hat{p}^{0}_{NEW} = \frac{p^{t+2}_{NEW}}{I^{0:t+2}_{MATCH}}$$ **Equation 4.9**

4.99 This technique is applied in the CPI and RPI. One key feature of this quality adjustment method is that during those periods the item was omitted, for the Carli and Jevons indexes it gives results identical to that which would be achieved if the price reference period price were imputed (explicitly) from the price relatives of the matched sample (this is not the case with the Dutot price index however).

4.100 The implementation of this methodology, however, masks that fact that a quality adjustment has been made. Even though the product is replaced in period *t+2*, a decision was made in period *t* that the outgoing product and the incoming product were of different qualities. This assessment, intentional or otherwise, results in a change in quality for the outgoing product, with the size of the quality change (implicitly) valued at the difference between p^{t}_{OLD} and $\hat{p}^{0}_{NEW}$.

B.13 Hedonic methods

4.101 Quality adjustment techniques that use hedonic functions span both the explicit (direct) methods and the implicit (indirect) techniques, and consequently in this *Participants' Guide* will be given a treatment in their own right. However, many factors associated with hedonics are well beyond the scope of this training course, and as such this *Guide* will provide a superficial overview of hedonic methods[60].

4.102 Hedonic price indexes are a tool frequently employed to counter rapid change in features and abilities of products from the "high tech" industries[61]. All hedonic methods, in some form or another, are based on a *hedonic function* that relates the price of an item to quantifiable and measurable characteristics that are associated with that item.

For example, a hedonic function relates the price of a computer to the size of its hard

[60] For a detailed overview of the concepts behind hedonics, see *Handbook on Hedonic Indexes and Quality Adjustments in Price Indexes*, Triplett J (2006). Information on the actual regression processes can be obtained from statistical textbooks, or in manuals on statistical software such as SAS.

[61] ICT is perhaps a more suitable term – information and communication technologies

drive, the dimensions of its screen, the size and type of its memory, etc.

4.103 Hedonic functions typically[62] take the form of a linear model, albeit on a log scale. For example (considering hard drive and RAM alone):

$$\begin{aligned}\ln(p) &= f(\text{HDD}, \text{RAM}) \\ &= \beta_0 + \beta_1 \times \text{HDD} + \beta_2 \times \text{RAM} + \varepsilon \\ p &= h(\text{HDD}, \text{RAM}) \\ &= \exp(\beta_0 + \beta_1 \times \text{HDD} + \beta_2 \times \text{RAM} + \varepsilon)\end{aligned}$$

4.104 Hedonic price indexes then differ in how these functions are estimated, and how these estimated functions are used to measure price to constant quality.

4.105 ***Estimation of hedonic functions*** is typically undertaken via some form of regression analysis for the linear model component. Large and detailed datasets are obtained for a given product type, and then models fitted using statistical analysis software. For example

$$\begin{aligned}y &= \beta_0 + \beta_1 \times \text{HDD} + \beta_2 \times \text{RAM} + \varepsilon \\ \underset{\sim}{y} &= \mathbf{X}\underset{\sim}{\beta} + \varepsilon \\ \underset{\sim}{\hat{\beta}} &= (\mathbf{X}'\mathbf{X})^{-1}\mathbf{X}'\underset{\sim}{y} \\ \underset{\sim}{\hat{y}} &= \mathbf{X}\underset{\sim}{\hat{\beta}} \\ &= \hat{\beta}_0 + \hat{\beta}_1 \times \text{HDD} + \hat{\beta}_2 \times \text{RAM}\end{aligned}$$

4.106 ***The time dummy method*** is an implicit quality adjustment method, where the hedonic function is used to directly calculate the price index itself. The output of the hedonic modelling process is not data to be used to quality adjust groups of prices, *but the actual measure of price change* for all observations from period 0 to period *t*.

4.107 ***The characteristics price index method*** is another implicit quality adjustment technique that produces a price index by constructing a price index from *quantities of characteristics* in the quantity reference period, and regression coefficients $\hat{\beta}$ from the modelling process. Each period a modelling process is undertaken, resulting in different values of $\hat{\beta}$, namely $\hat{\beta}^0, \hat{\beta}^0, \ldots, \hat{\beta}^{t-1}, \hat{\beta}^t$. Price indexes are then constructed as

$$I^{0:t} = \frac{\sum_{i=1}^{n} X_i \beta_i^t}{\sum_{i=1}^{n} X_i \beta_i^0}$$

4.108 Under the characteristics price index, prices are only to determine estimates of the coefficients, and are not used directly in the price index calculation.

4.109 ***Hedonic imputation methods*** are a family of explicit quality adjustment methods where the price for an incoming (or outgoing, or both) item is imputed based on the characteristics of the particular item. Under this approach, the hedonic function is used to impute a price for only those objects that change or are replaced, with all other price movements coming directly from sample observations as with all other price index construction.

4.110 ***Hedonic quality adjustment methods*** are another family of explicit quality adjustment methods. Under this methods, the hedonic function is not used to directly impute a price for a replacement item, but instead used to gauge a measure of how different the quality of the incoming item is compared with the outgoing, replaced item. Using the terminology introduced previously, we have

[62] [redacted]

$$\hat{p}^t_{OLD} = h\left(\underset{\sim}{x}_{OLD}\right)$$

$$\hat{p}^t_{NEW} = h\left(\underset{\sim}{x}_{NEW}\right)$$

$$g = \frac{\hat{p}^t_{NEW}}{\hat{p}^t_{OLD}} = \frac{h\left(\underset{\sim}{x}_{NEW}\right)}{h\left(\underset{\sim}{x}_{OLD}\right)}$$

$$\hat{p}^0_{NEW} = g \times p^0_{OLD} = p^0_{OLD} \times \frac{h\left(\underset{\sim}{x}_{NEW}\right)}{h\left(\underset{\sim}{x}_{OLD}\right)}$$

4.111 ***Issues with hedonics:*** Estimation of hedonic functions requires collection, processing and scrutiny of vast amounts of price and characteristic data for each product type. These functions are utilised because of the rapid change in characteristics and consequential change in quality for items. In some circumstances, however, the change in characteristics is so rapid that the relationship between price and characteristics changes over very short periods of time. For example, it is clear that 8 GB of RAM is of higher value to the purchaser of a computer than 4 GB of RAM. Yet the difference in value (utility to the customer) between 4 GB and 8 GB varied between, say, January 2005 and January 2009. In terms of the hedonic hypotheses, the underlying hedonic functions change[63], requiring frequent re-estimation of the hedonic functions (and subsequent quality adjustment factors).

4.112 A second issue is that the modelling processes are subject to masked variable problems – namely that the estimated models only explain the data that are fed into them. If characteristic data are not captured, their contribution to value (to the model) cannot be determined. A practical example helps illustrate this: BlueRay DVDs were introduced into home computers in 2007. However, to include these characteristics in the model, price index practitioners need to know that this feature is being introduced, and *before* the incorporation into the price sample begin modelling the impact of the change in technology.

4.113 ***Empirical versus econometric interpretation:*** Hedonics is a powerful tool that can be extended beyond its use in quality adjustment. One frequent use is in modelling and interpreting consumer behaviour, which (amongst other things) adds an interpretation to the size of the estimated regression coefficients that reflects consumer behaviour, preference functions etc, based on underlying hypotheses regarding consumption functions and so forth. The use in price indexes, as described here, uses the observed empirical relationship between price and characteristics to account for changes in those characteristics over time. It is this observed relationship, and only this relationship, that is used in quality adjustment of prices.

[63] It is convenient to think of hedonic functions as a curve that relates price to characteristics (such as price to RAM). The shifting value encountered in practice means that not only are characteristics changing – which we might view as "sliding along the curve" – but the curve itself is bending and shifting over time.

F. Key concepts for Module 4

- Quality change must be reflected as a change in volume
- Quality change is not a price change for a consumer because it is the monetary value of the change in satisfaction or utility that is derived from the new quality
- Quality adjustment is concerned with estimation of a period 0 price for the new (incoming) quality

Module Content and Learning Outcomes

- Quality and quality adjustment
  - explain quality change, it's importance, and what we do about it
- Price index biases
  - describe the 5 biases that are particular to price indexes and the different types of activities the ABS undertakes to avoid or minimise bias
- Modifying the price basket
  - how the ABS updates its indexes through the regular updating of the basket contents
- Other conceptual ideas

Module 4 – Practical Issues – Quality Change and other Bias 2

[redacted]

Open question to the class: **What to we mean by quality?**

Answer – how long will something last/ it's unique characteristics/ how much is it valued.

Quality Change

- Recall that price change differs when viewed from different perspectives; likewise, the concept of quality differs when viewed from different perspectives
- Change in utility for consumers
  - Quality change is represented as the (monetary) value of the additional satisfaction or utility that is derived from the new quality
- Change in production value for producers
  - Evaluation of quality change is an estimate of the per-unit change in revenue that a producer will receive for the new characteristics possessed
- ***Quality change is not price change***

Module 4 – Practical Issues – Quality Change and other Bias 4

Quality change is not price change - even though we talk about the quality change in monetary terms.

Going to refer you to the manual quite a bit in this module so turn to page 6 example 4.1.

Talk through the conceptual example in the manual.

Explain that this wouldn't be an issue for the price index compiler until/unless the Nova replaced the Omni in the market place and what the implications would be in that case.

Give an example in numeric terms.

Reduction in pack size OR new car with additional features

Differences in Quality

- The issue is then
  - to identify characteristics that purchasers value
  - to make an estimate of that value
  - to measure change in value when characteristics change
- Some are obvious
  - freshness or otherwise of fresh produce
  - strength of materials & stitching in a garment
  - leather versus vinyl shoes

Module 4 – Practical Issues – Quality Change and other Bias 5

Sticking with the manual. *Refer to the section in the manual "What determines quality?"*

How do we observe quality in a **product?**:

Consumers recognise and appreciate the differences and are prepared to pay different prices for the different products.

Differences in Quality

- Others perhaps less so …
  - location (such as goods delivered to Sydney vs. Melbourne)
  - model options (such as with or without leather interior)
  - timing (such as electricity supply: off-peak vs. peak)
  - conditions of sale (such as a good sold with after service care)
- And others less obvious still …
  - circumstances in which goods or services are supplied or delivered (silver service vs. meal in a club)
  - The same goods or services sold by different kinds of retailers, such as local shops, specialist shops, department stores or supermarkets have to be treated as different qualities.

Module 4 – Practical Issues – Quality Change and other Bias 6

What about a **service?**:- quality of service more difficult to measure

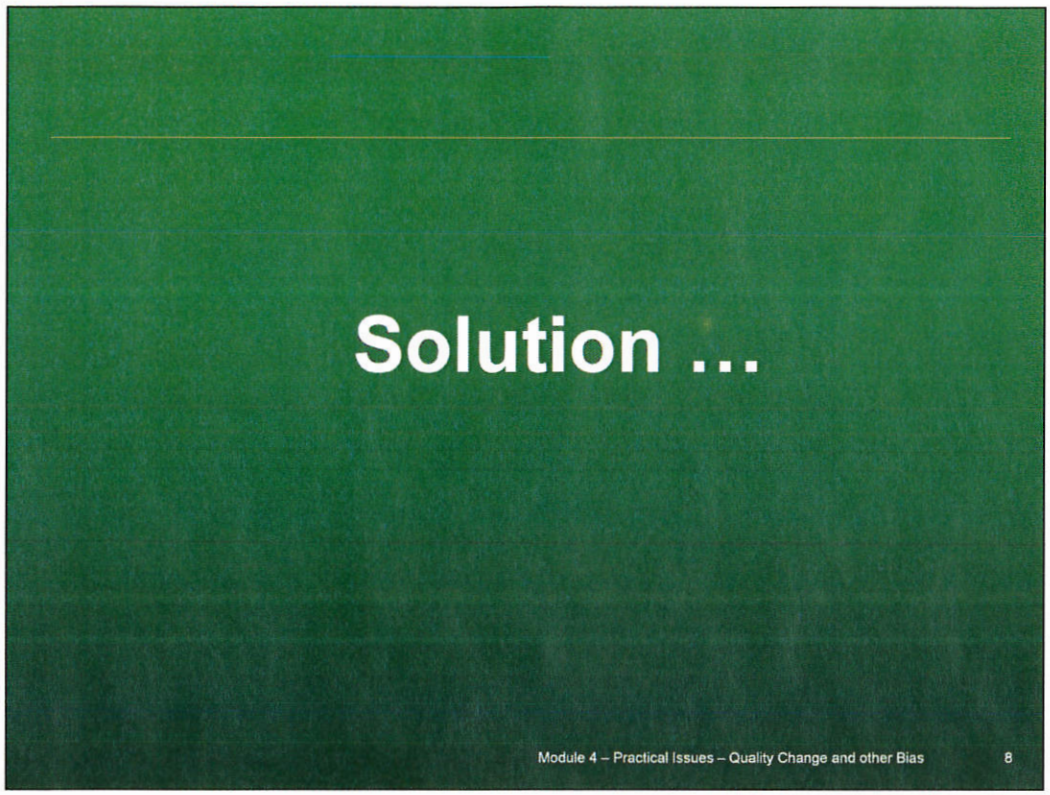
- Post – Whether it arrives and *where*
- Electricity – Timing
- Retail – After sales service
- Restaurant – quality of service.

Does Price Change Inform us About Quality Change?

- Existence of price differences does not always reflect differences in qualities
- ***Price is not a quality determining characteristic***

Existence of different prices does not always reflect corresponding differences in quality.

Again in the manual, we're going to do a short exercise on determining quality change. Activity 4.1 page 10

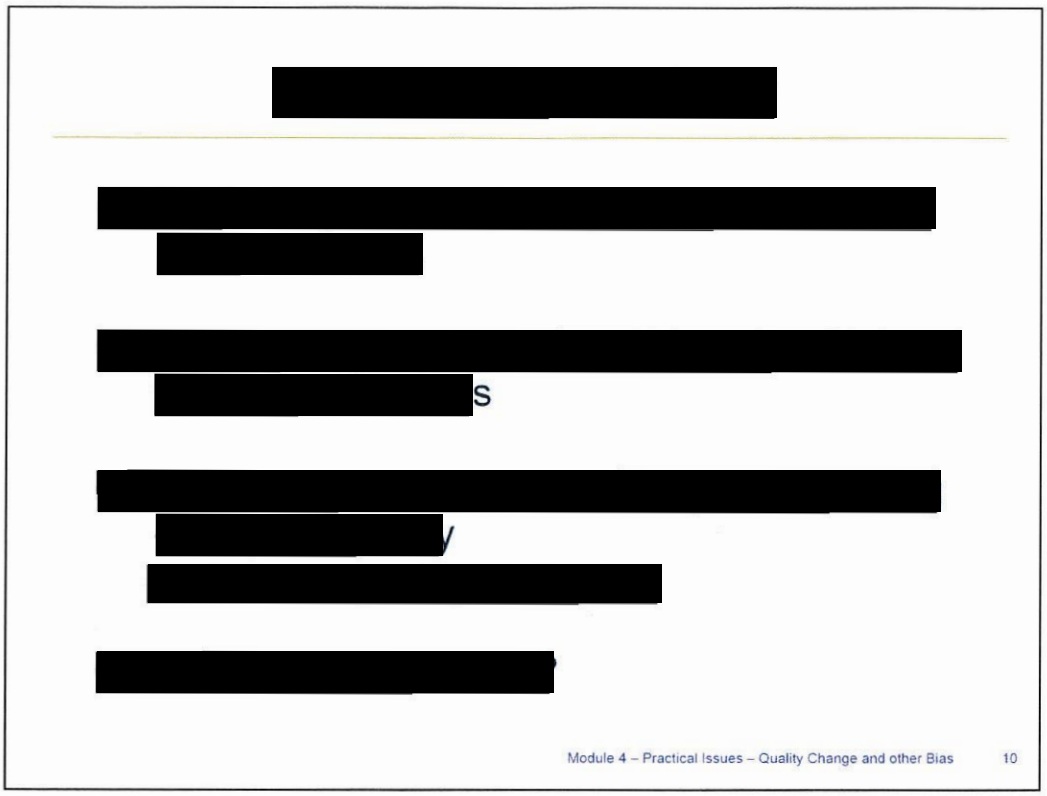


9.45 solutions discussion

Click through, do as group exercise

Discussion

- Did quality …
  - Increase? Decrease? Stay the same?
- Coffee
- Chocolate Biscuits
- Chips
- New Car
- Car Rental
- Baked Beans
- Sand
- Apples


[redacted]

s

y

Module 4 – Practical Issues – Quality Change and other Bias 10

[redacted]

Pricing to Constant Quality

- Need to ***price like with like***
- Failure to price to constant quality means a price index no longer measures pure price change
- Why is this important?

Module 4 – Practical Issues – Quality Change and other Bias 11

Fixed Basket Concept: Need to price like with like. We took fixed to mean two things;

Specific goods and services remain the same

The quantity of those goods and services remain the same

Failing to take account of quality change means we have a price index that **does not** measure the pure price change; in addition to price change the index would also measure the impact of a change in the product being delivered

For price index purposes it is necessary to devise techniques to identify quality differences and eliminate their effect on prices from the calculation of price change for inclusion in the index.

Importance of Pricing to Constant Quality

- We noted earlier that a change in quality is not a change in price
- Failure to price to constant quality means we overestimate (or underestimate) price change
- Decisions based on price indexes are then misinformed
  - Payments, contracts, monetary policy, national accounts

Module 4 – Practical Issues – Quality Change and other Bias 12

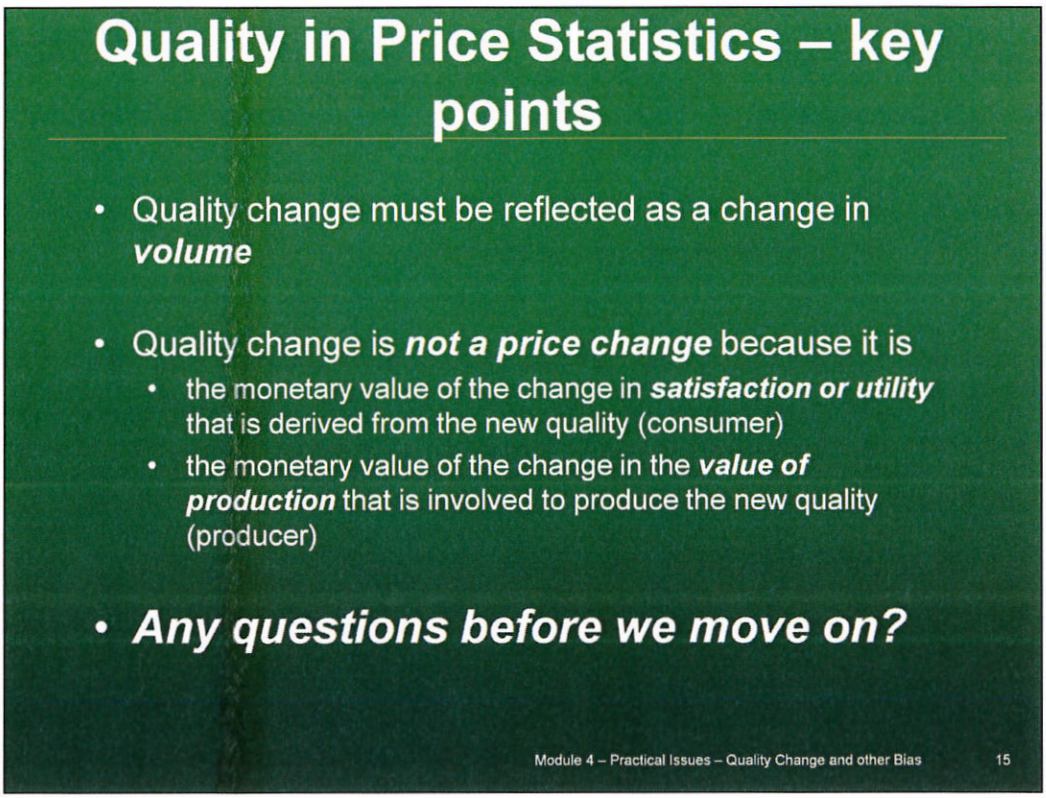
This impacts on all users of price statistics

It is essential that in the compilation of a price index each item in the basket is priced to the same quality that it was in the price reference period

Pricing to Constant Quality- Internet Shopping Example

- With the increase of on-line shopping it is now possible to purchase the same product on-line for a cheaper price.
- Shopping on-line increases the quality of service as shoppers do not need to leave their home.
- However, shopping on-line decreases quality as buyers need access to a computer with the internet, have to wait to get the product delivered and the after sales service is often of a lower quality.
- Does this represent a price change or a quality change?
- In pricing to constant quality, the prices statistician must account for the difference in the service. The difference between the on-line price and in store price is currently treated as a quality difference.

[redacted]



Key points to take away

Quality Adjustment

- Mechanism to ensure price indexes measure pure price change
- Need to make an assessment (valuation) of difference of quality and incorporate this difference into the price index calculation
- How to make the assessment?
- How to incorporate it in the price index?

Module 4 – Practical Issues – Quality Change and other Bias 16

Quality Adjustment is a mechanism to enable price indexes to measure the pure price change

Price statisticians need to make an assessment of how to adjust for differences in quality. Specifically

•How to assess the quality change? How to incorporate it into the price index?

Making the Assessment

[redacted]

- Assessment of quality change needs to be considered across ***all consumers***
  [redacted]
- If different consumers [redacted] have different assessments of the quality, we need to be able to determine ***on average*** what the change in quality is
- And we need to apply robust and transparent procedures in those cases where we cannot make a reliable assessment of the ***average*** change in quality

Module 4 – Practical Issues – Quality Change and other Bias 17

Most importantly, we need to explain to users what we do: Use robust and transparent and consistent procedures where we can not make an assessment of the **average** quality change.

The Problem

- We need to measure pure price change from period 0 to period *t*
- We price to constant quality between period 0 and period *t-1*
- We observe a change in quality between period *t-1* and period *t*
- Do we adjust the new p^t price to make comparisons on the old quality?
- Or do we adjust the old p^0 price to make comparisons on the new quality?

Module 4 – Practical Issues – Quality Change and other Bias 18

A practical problem – say we have observed a change in quality and we wish to apply a change to the index measure of change to account for this.

Should we adjust the current period price p^t? i.e. What price would the item have in the current period if it had the same quality as observed in the price reference period? Or should we adjust the reference period price p^0? i.e. What price would the item have been in the price reference period if it had the same quality as observed in the current period?

Expediency

- If we adjust the new period *t* price so it is valued at the same quality as in period 0 we need to do this again, every subsequent period *t*+1, *t*+2, *t*+3, …
- But if we adjust the period 0 price so it is valued at the same quality as in period t, we can carry this price forward into future periods
- ***Adjust the period 0 price to reflect the new quality***

Module 4 – Practical Issues – Quality Change and other Bias 19

If we adjust the **current price** we will need to **adjust every price we record going forwards**

If we adjust the **period 0 price**, we can **carry this forwards** into future periods to compare against the actual price each period.

So – just adjust it once and then price relative to that.

Put an example up on the board.

Formulation of the General Solution

- If the OLD quality is replaced by an equivalent item on the NEW quality, our aim is to estimate a period 0 price for the NEW quality
- We need to determine some adjustment factor *g* such that

$$\hat{p}^{0}_{i,NEW} = g \times p^{0}_{i,OLD}$$

A theoretical illustration of how we would adjust the reference period price

Techniques

- Direct comparison
- Explicit methods
- Implicit methods

We will describe the three classes of assessment techniques to take account of quality change

•Direct comparison - we assume quality changes are negligible g=1

•Explicit methods – assess how characteristics contribute to quality and adjust for them

•Implicit methods – we assume that the difference in quality = difference in price

Direct Comparison

- Also called
  - unadjusted price comparison
  - essentially equivalent
  - directly equivalent
- The value of the quality difference is assessed at zero
  - The two qualities are essentially equivalent
  - The entire difference in observed prices is due to pure price change
    - And we set g=1

$$\hat{p}^{0}_{i,NEW} = p^{0}_{i,OLD}$$

Module 4 – Practical Issues – Quality Change and other Bias 22

As its name suggests, Direct Comparison is just treating the old and new quality as essentially equivalent.

Assumes the entire difference in price is due to pure price change

Set quality adjustment factor g = 1

In ABS terminology "QDC" Quality Directly Comparable

No adjustment to compilation figures, but a change has occurred to the specification with no difference in quality compared to the previous specification e.g. the model number has changed, the colour of the packaging has changed.

Assumptions for Direct Comparison

- Negligible quality differences as products change
- Fallback position
  - If can't value the quality change
- Long term use has serious bias

Module 4 – Practical Issues – Quality Change and other Bias 23

Assumes that there is virtually no quality difference. Is the fall back position, if no other techniques appear to be appropriate, use this.

However, long term use has serious bias: The pictures pretty much tell the story. The key thing is that the change from the LHS to the RHS would have been incremental over time, i.e. very minor changes in quality which if we ignore long term leads to very different "qualities" from the reference period to the current period.

Explicit Methods

- Methods where an attempt is made to quantify the difference between the OLD quality and the NEW quality
- Differences in methods depend on available information and type of product

Second of our assessment techniques – Explicit methods

Try to quantify the difference between the old and new quality using the information about the type of product

Refer to the car example from earlier

Explicit Method – Quantity Adjustment

- Linear relationship
  - Between quantities for OLD and NEW
- Assume ratios between NEW and OLD quantities gives difference in period 0 prices

$$g = \frac{u_{NEW}}{u_{OLD}}$$

$$\hat{p}^{0}_{NEW} = g \times p^{0}_{OLD} = \frac{u^{NEW}}{u^{OLD}} \times p^{0}_{OLD}$$

- Example in the manual

Module 4 – Practical Issues – Quality Change and other Bias 25

Work through the example in the manual

Explicit Method – Option Cost

- NEW quality is the same as the OLD quality except for some option that has now been made standard
  - e.g. GPS on a car
- Typically observe the cost (c^{t-1}) of the separate option in the previous period
  - Ideally like to know the cost in period 0 but this is very rare

Another explicit method is option cost

We would like to observe what was the cost of the option in the reference period, but if not available use the previous period.

Explicit Method – Option Cost

- If the option was available in the previous period it is likely that not all customers desired the option
  - But at least some would, otherwise it would not be offered
- Need to determine the "take up rate"
  - For other customers the option is not valued as a change in quality
  - [redacted]

[redacted]

Other Explicit Methods – Expert Judgment

- Rely on assessment by expert(s) as to monetary difference due to change in characteristics
- Need to realise this price in the period 0
  - Usually requires assumptions about observations at *t-1* or *t* and how they would hold at period 0

[redacted]

Expert judgement relies on an expert to estimate the monetary difference due to change in characteristics. Not ideal – if we ask 3 people on 3 occasions = 3 different answers

Involves assumptions about what happens now and how it would hold at period 0

[redacted]

Implicit Methods

- Based on the assumption that
  The difference in quality between product variants simultaneously available in the market is assumed to be equal to the difference in price between the variants
- Therefore assumes that the difference in price is all due to the difference in quality
- Less labour intensive than explicit quality adjustments
- Assumption generally uncertain (and often entirely invalid)
  - Difficult to scrutinise

Module 4 – Practical Issues – Quality Change and other Bias 30

This technique makes the assumption that the difference in quality between the OLD and NEW product is **equal** to the price difference between the two.

Less labour intensive than the explicit adjustments.

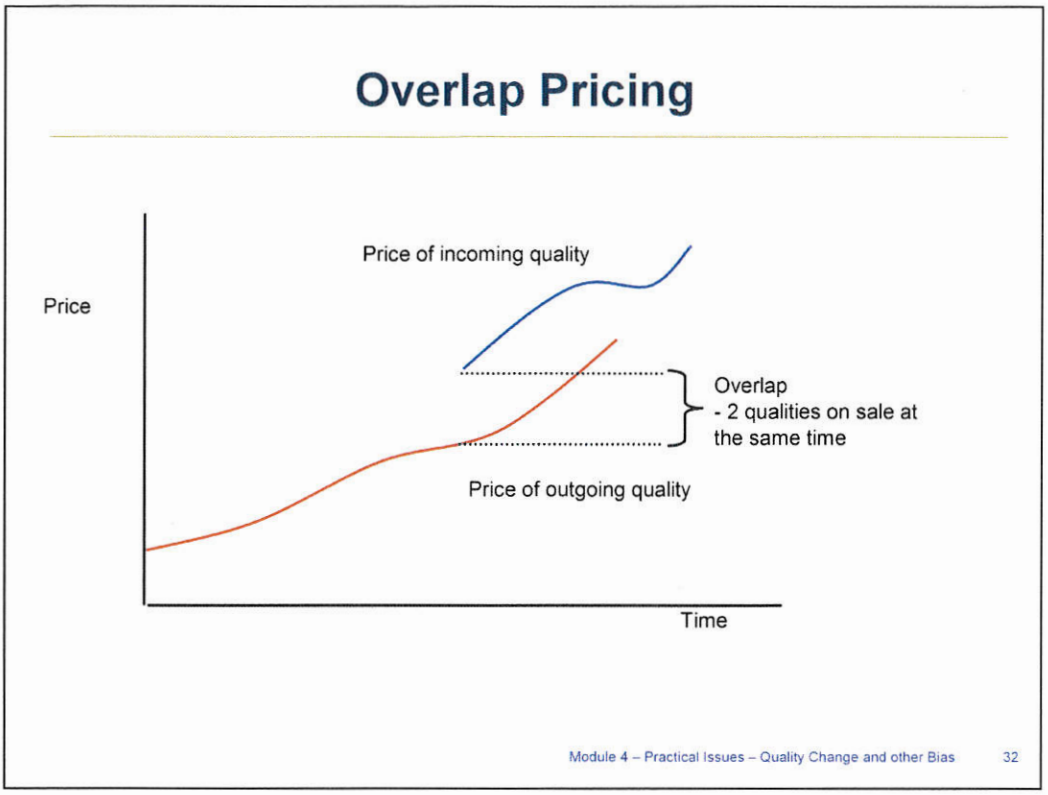
Generally agreed that this is not a good method [redacted]

Overlap Pricing

- Where two qualities exist in the market at the same time for several periods
  - Would generally apply this via sample change
- Difference in quality determined by difference in price
- Pricing to constant quality achieved by chaining

Overlap pricing - For this, need to have the two qualities available in the market at the same time.

Use overlap pricing by chaining or linking the two products together.



Graphically, red line shows the price of the outgoing quality. Blue line shows the price of the incoming quality

Chain the two together using the information from the overlap period

Let's look at the example 4.6 on page 32 in the manual.

Bridged Overlap

- Or *overall mean imputation* or *class mean imputation*
- Assumption that contemporary movement of price sample gives best measure of price change for replacement items
- Derive period 0 price for NEW quality based on observed NEW price and consecutive period movement of the remainder of the price sample (*t-1* to *t*)
- Bridged overlap gives same price movement of the full price sample (*t-1* to *t*) as would be observed if the replacement item was omitted entirely
- Note the difference between "overall" where all of the sample is used and "class" where a sub-sample is used
  - examples in the manual

Module 4 – Practical Issues – Quality Change and other Bias 33

Basically another example of sample change – the 'old' quality is removed and replaced with the new quality and the reference period price is determined by the movement in the existing sample.

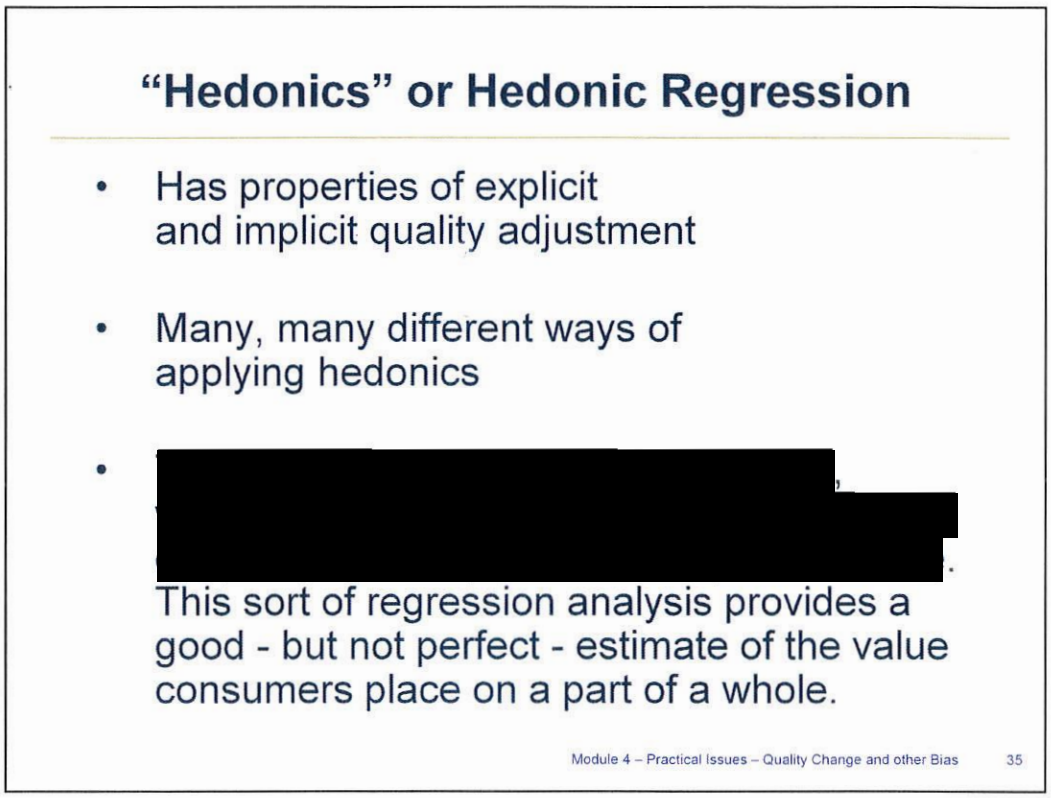
Again there is an example in the manual – no need to work through

Alternative Bridged Overlap

- Rather than impute the *t-1:t* movement, use the *0:t* movement
  - Assumes long term behaviour more typical than short term
- Often implemented as "drop, impute and replace"
  - Care needed as a quality adjustment still being made, although hidden

Another option is to use the period 0:t movement instead of just the previous periods movement.

Often called the "drop, impute and replace", but difficult to interpret what is going on in this case



A method used to determine the value of a good or service by breaking it down into its component parts. The value of each component is then determined separately through regression analysis. For example, the value of a home can be determined by separating the different aspects of the home - number of bedrooms, number of bathrooms, proximity to schools - and using regression analysis to determine the value of each variable.

Hedonics

- Applied where a product can be seen as a bundle of separately measurable components
  - High tech goods
- Applied when products change so rapidly that other mechanisms don't work
  - High tech goods

Module 4 – Practical Issues – Quality Change and other Bias 36

We use hedonic modelling on products that can be measured by their components.

We generally apply it to products whose features change rapidly so that other quality adjustment tools do not work.

Hedonics as Used in ABS

- Express price as a function of characteristics
- Estimate unknown parameters of the function
- In the current period, use the function to estimate the pure price change

When quality changes, use the function to **predict the price** of both the OLD and the NEW qualities

This ratio (g) gives the **new reference period price**

Hedonics as Used in ABS

- Determining hedonic function and estimating parameters time intensive
- Parameter estimation requires hundreds of observations
- For each observation we need to collect prices and all characteristics
  - Sometimes several dozen
    - RAM size, type, HDD size, CPU size, type, Graphics etc,
  - Labour intensive (at the moment)

Module 4 – Practical Issues – Quality Change and other Bias 38

Hedonics is very labour intensive. Need to collect hundreds of prices and all their corresponding characteristics

Quality Change

- We have seen
  - Direct Comparison, where qualities are directly comparable and the observed price difference is the pure price difference
  - Price change as quality change, where the observed price difference is entirely due to quality, and pure price change is zero
- Can view these as extremes on a quality adjustment spectrum *(refer to your manual)*

Lets take a look at the quality adjustment "spectrum" in the manual

Key points on Quality

•When measuring prices, we are using a **fixed basket**

•Must measure prices holding quality constant

•Utility for Consumers, [redacted]

•Apply the quality adjustment to the **reference period price.**

CHAPTER 7 - QUALITY ADJUSTMENT

Introduction

During the course of price collection Field Officers will be confronted with situations where quality adjustments (QA's) are required. This is particularly so with RS specs where changes to products are an ongoing procedure, however they are not restricted to RS items. Likewise, they may apply to all collections e.g. free recycling bins provided by a local government authority can be considered to be a change in quality of the service provided, and therefore requiring a QA.

QA's can be performed at the actual time of pricing. This chapter will cover the reasons for doing quality adjustment, the situations faced which indicate when it's required and when it's not, and how to actually perform the procedure in the prices system and on the handheld computer.

What is quality adjustment?

Quality adjustment can be described as the procedure undertaken to modify the raw price movement for a good or service to account for any change in the quality of that good or service between two consecutive pricing periods. Broadly, an increase in quality would reduce a price rise or reduce the effect of a price increase while, conversely, a reduction in quality would increase a price rise or reduce the effect of a price fall.

Reasons for performing quality adjustment

Price **movements** are measured for a basket of goods and services of a given quality from a base period. In the real world however, things don't remain constant. Manufacturers and service suppliers are continually changing and improving their products. Therefore to truly reflect price movements, and only price movements, we have to convert the current basket of goods and services to the equivalent of the original baskets of goods and services. This ensures that any difference between the prices of two periods can then be said to be due to inflation.

Quality adjustment is the main process we use to ensure the continuity of consistent quality in the basket of goods and services (apart from sample maintenance of course). In practice, we actually adjust the previous period quality to be the equivalent of the current period's new quality. This doesn't change the underlying concept, but merely how we approach the problem.

What is quality?

The quality of a product could be defined as the relative nature and character of that product. That is, those features which distinguish it from competing products and from previous versions of the product. Another way of looking at the quality of a product is to consider it as a measure of the utility of a product to the consumer.

What is utility?

The utility of a product is often defined as the satisfaction derived from consumption of a good or service

For our purposes the measure of utility is chiefly found in the price which a consumer is willing to pay for the fulfilment or satisfaction of their desire.

When is quality adjustment required?

As a general rule, quality should be considered whenever the good or service priced in the current period isn't exactly the same as the good or service priced in the previous period. Given the previous definitions of quality, we have two ways of determining whether or not the quality has changed: when its perceived usefulness to the consumer has changed, or when one or more attributes have changed (hopefully measurably). The most common reasons for quality adjustment being required are new models (or revised services), and temporary bonus features with the product. For a quality adjustment to be considered the magnitude of the change has to be both measurable and (usually) discernible to the consumer. By this, it is meant that changes have to be more significant than mere marketing ploys to an otherwise unchanged product.

Situations when quality adjustment would be inappropriate.

There can be situations where changes are made to a product but an adjustment to the price considered inappropriate despite this change in quality. Generally, this would arise where the consumer has no choice but to accept the change, and would ignore it if choice was an option, particularly if the change is not directly related to the primary purpose for which the product is purchased. These types of changes are often related to changes in laws which compel change to the product for reasons which do not directly affect the consumer. Another reason could be changes in the market place which cause the replacement of otherwise suitable products.

A real example of such a situation is where a change in the laws about poisons in one State forced a dishwasher detergent manufacturer to change the formula to avoid having to place onerous health warning signs on the product. This involved more production costs and therefore the price increased. Notwithstanding the safety benefit of the new formula, it was decided that as the primary purpose of purchasing the product was to clean dishes the full price movement should be reflected in the index.

Another situation when a quality adjustment is not appropriate arises when the change in quality is not available to all consumers. For instance, buy three and get the fourth one free, when the CPI standard is to price one. Advertising stunts such as a free trip for a few lucky purchasers are also ignored.

Permanent or temporary adjustments

Some quality adjustments are temporary as the change will only last for a short period of time. Examples are when offers occur such as an extra 50 grams of coffee for no extra cost or free air-conditioning if you buy a car within a specific time. As implied, temporary changes are those that are available for a limited time, and the products do not undergo permanent changes. It is possible however that some of these temporary changes may overlap CPI pricing periods.

Permanent changes relate to changes such as packaging size or new models e.g. reduction in size of a snack bar from 60g to 55g. It is important to determine whether a change in quality is temporary or permanent.

Types of quality adjustment (QAs)

Quality adjustments may be perform**e**d through the *Respondent Form screen* within the Prices System or by using the QA function on the Handheld. The benefit of using the handheld option is that Field Officers are able to perform the QA at the time of pricing while in the respondent outlet, thereby reducing the risk of overlooking the adjustment.

There are 6 quality adjustment options from which to choose.

Quality Symbol	Label	Meaning	Result
QCPPP	Change to Previous Period Price	Typically used when there is a specification change (quality change) and both the previous and current price of new spec is available	New Previous Period Price = Obtained Value. New Base Period Price = Base Period Price * Previous Period Price / Obtained Value. Should only be used if the price recorded last quarter for the old specification was its normal retail price. If the product was on special then do not use this option as the system cannot make the correct adjustment.
QDA%	Quality difference as percentage	Is used when a respondent is able to supply an estimate of quality change ie 20% extra soft drink	Double check that this symbol has been used correctly and that the calculations are correct.
QDAP	Quality difference as a proportion	Is best used when the quantity changes. It is also useful when the product changes and you are prepared to accept that all the price difference is related to quality changes.	
QDC	Quality Directly Comparable	No change in quality between the old product and the new product	This is most often used when the packaging changes but there is no change to the utility of the product to the consumer.
QIN	Quality Adjustment on an interim In	An adjustment to an interim in is required to account for a change to the specification.	
QNDC	Quality Not Directly Comparable	Used (sparingly) when it is not possible to quantify the quality difference between two items and there has definitely been some quality change.	The system will impute the current price and store the collected price in a temporary field to be used next quarter as a back price. (QNDC over 2 consecutive periods is never allowed)
QNS	Quality Adjustment on a national standard	An adjustment to a national standard is required to account for a change to the specification.	
QPVC	Price value of change	Price Value of Quality Change - Used when change in quality can be measured in dollars ($) ie Bicycle increases $50 and the respondent says the $50 is attributable to an improved	Make sure correct Quality Adjustment is applied

front suspension.

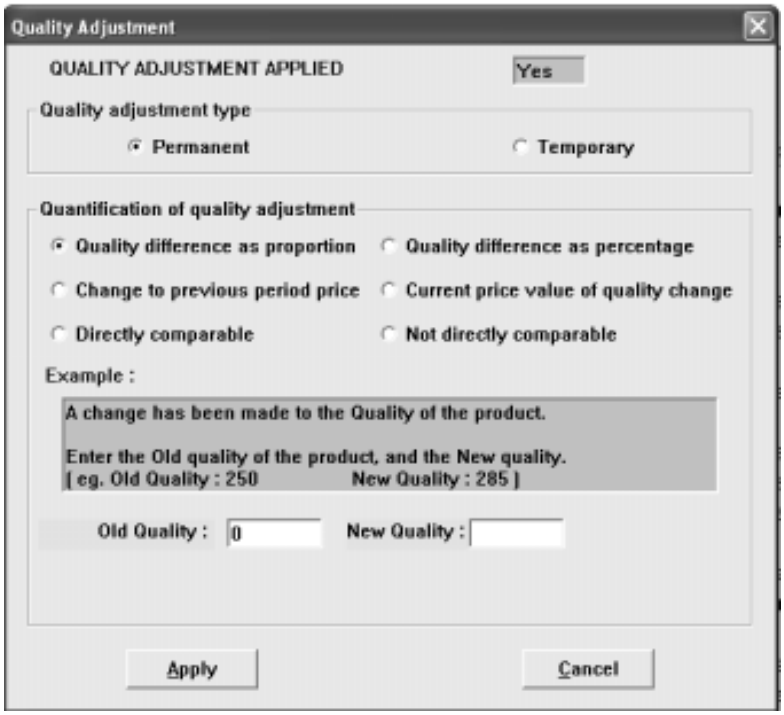
Important note: Quality Adjustments after a S

Due to methodology issues, a QNDC, QCPPP and QDC cannot be applied in the period after a special (S) is applied. If a quality adjustment is a required use the edit symbol '?', and place a comment in remarks column advising IMAE staff of the issue and they will apply the appropriate corrections.

Quality difference as proportion (QDAP)

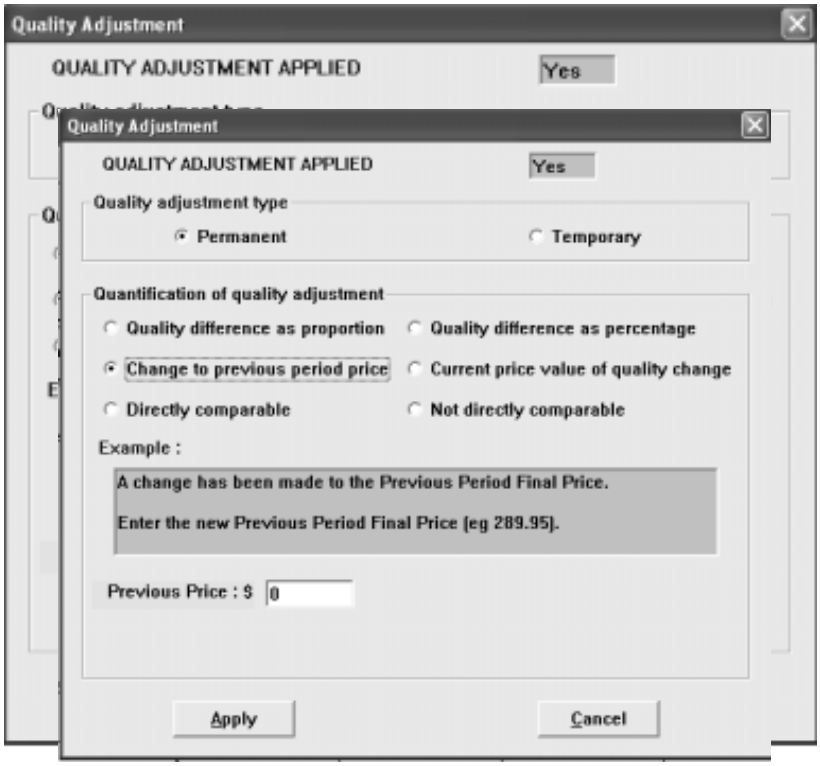
This option should be used when the old and new quantities (however measured) are known.

While quantity will probably be the most common attribute used to measure difference, this option can be used whenever any attribute of the product can be measured and compared meaningfully over time. These would include things like time (e.g. change in number of hours of lessons provided), number of concerts/magazines provided for annual subscription.



Quality difference as percentage (QDA%)

Use this option when the change in quality has been expressed in percentage terms. For example, a wine cask might be sold as containing "an extra 20 per cent for no extra cost". In this case there would be no need to convert the percentage value to another measurement, say litres, to enter the difference into the prices system. However, when using this option please remember that the percentages must be entered as a positive number when an increase has occurred and as a negative number when a decrease has occurred. This is also a preferred option, as there is minimal chance of error when measuring an attribute like quantity.



Change to previous period price (QCPPP)

This option can only be selected when the normal recommended retail price applicable to the previous pricing period is known. If the item was on special in the previous period a QCPPP cannot be used. However the item can be on special in the **current period**. Choosing to use this option can usually be dealt with in either of two ways;

- Firstly, if at the time of pricing the nominated spec is no longer in stock or it can be established that it should be replaced, then note all details for use in the next period and show the nominated item as Out Of Stock (OOS) with zero price entry. At the next pricing period the then current price would be entered in the Price field and the Previous Period price entered into the QA "Change Previous Price" field.
- Secondly, if the nominated spec is not in stock and a suitable replacement is available which would also have been in stock during the previous pricing period, and a price can be obtained which was applicable to that period, then the current price can be entered in the Price field and the previous period's price in the QA.

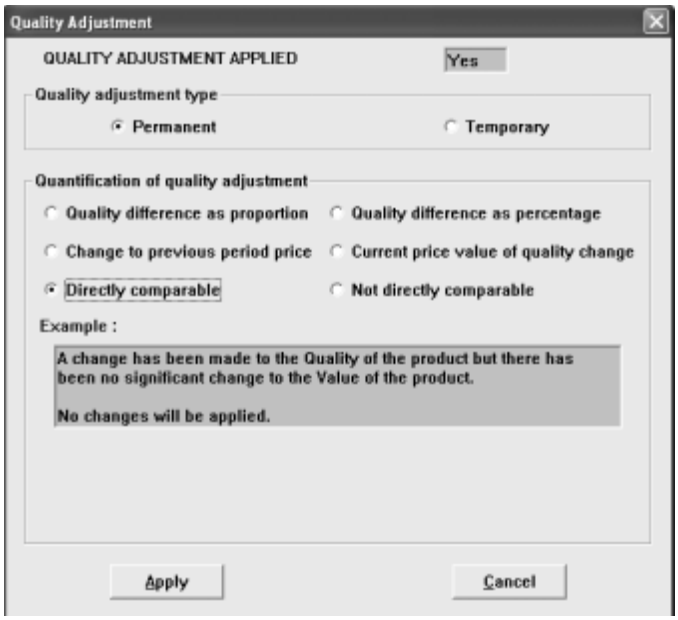
Current price value of quality change (QPVC)

This option is used when the change in quality can be measured in current dollar terms. For example the **normal price** of a bicycle has increased from $699 to $749 and the respondent has advised that the full increase of $50 is attributable to an improved front suspension. The $749 is entered in the current price field and a positive value of $50 in the QA field. A positive value is entered for an increase in quality or a negative value for a decrease in quality.

Directly comparable (QDC)

QDC should not be used if the previous price was on special – use the edit symbol **'?'** and record the details in remarks. Technically this option is not really a quality adjustment, however we use this option when a substitution has occurred and where both the old and the new product are deemed to be of equivalent quality. While the practical result of this procedure is the same as no quality adjustment, the creation of a quality adjustment record indicates that an examination of the two products was carried out with the result that the two qualities were determined to be equal.

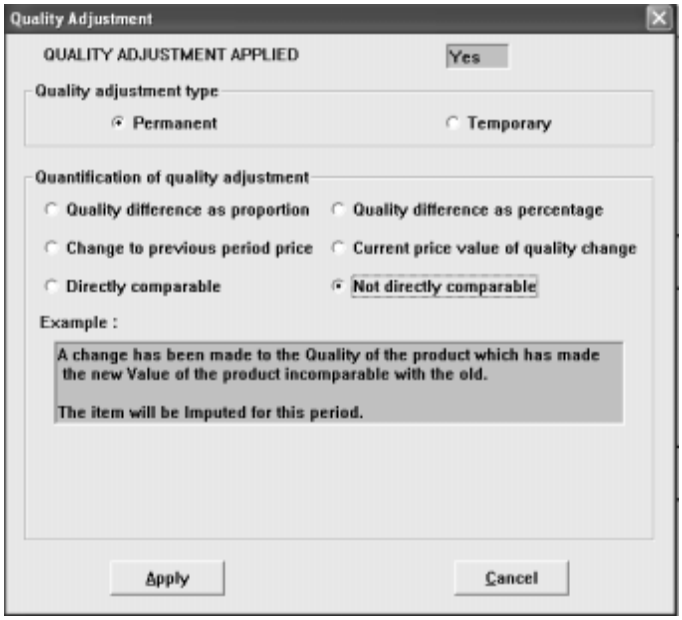
i.e. Women's winter jacket - The item in the previous period was a wool blend jacket with four buttons and a large collar, this is not available to price in the current period. It is replaced with a wool jacket with five buttons and a smaller collar. The utility to the customer was judged to be the same and therefore the item is deemed to be directly comparable. Similarly a washing machine priced in the first period may be replaced with another with the same features but a different product code and slight styling change.



Not directly comparable (QNDC)

QNDC should not be used if the previous price was on special – use the edit symbol '**?'** and record the details in remarks. The purpose of this option is to link in the new product when the relative qualities of the old and replacement products can't be compared in any meaningful way. What will happen is that an imputed price will be calculated for the old product for use in the current period's index calculation, and the price collected for the new product will be stored for use as the 'back price' in the following period.

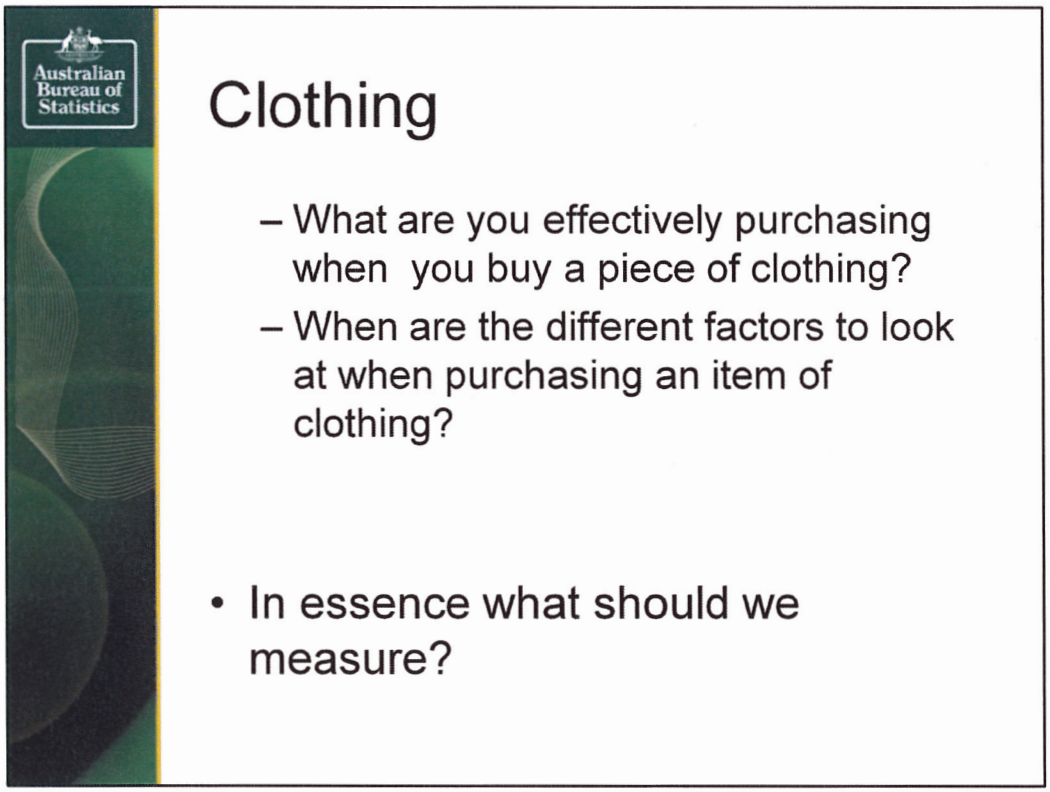
All of the examples shown above are for permanent adjustments. You can see that when 'Temporary' is selected the 6th option 'Not Directly Comparable' is blanked out and therefore not useable.



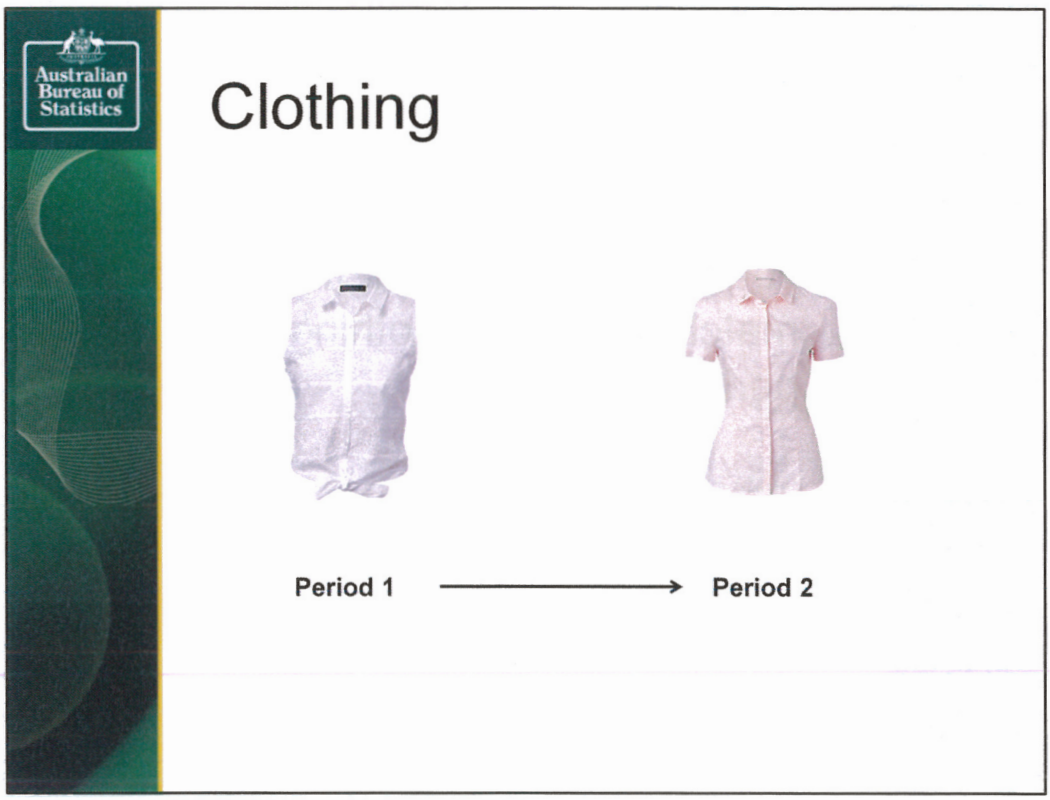
Australian Bureau of Statistics

Clothing

One of the areas which experiences frequent change in the consumer price index basket is that of clothing. In particular there are a number of quality considerations to take into account when pricing clothing to ensure that we are pricing to a consistent standard each quarter.

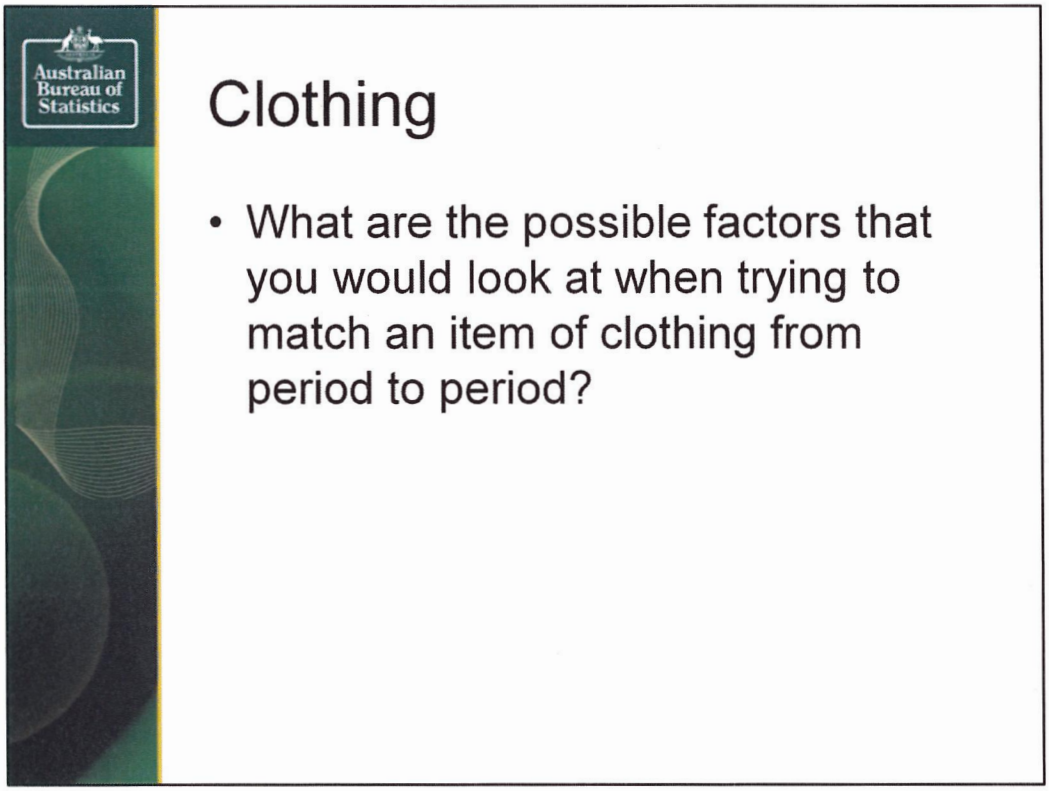


What are the primary consideration when purchasing a piece of clothing? Or rather what are the primary considerations for a consumer when purchasing an article of clothing?



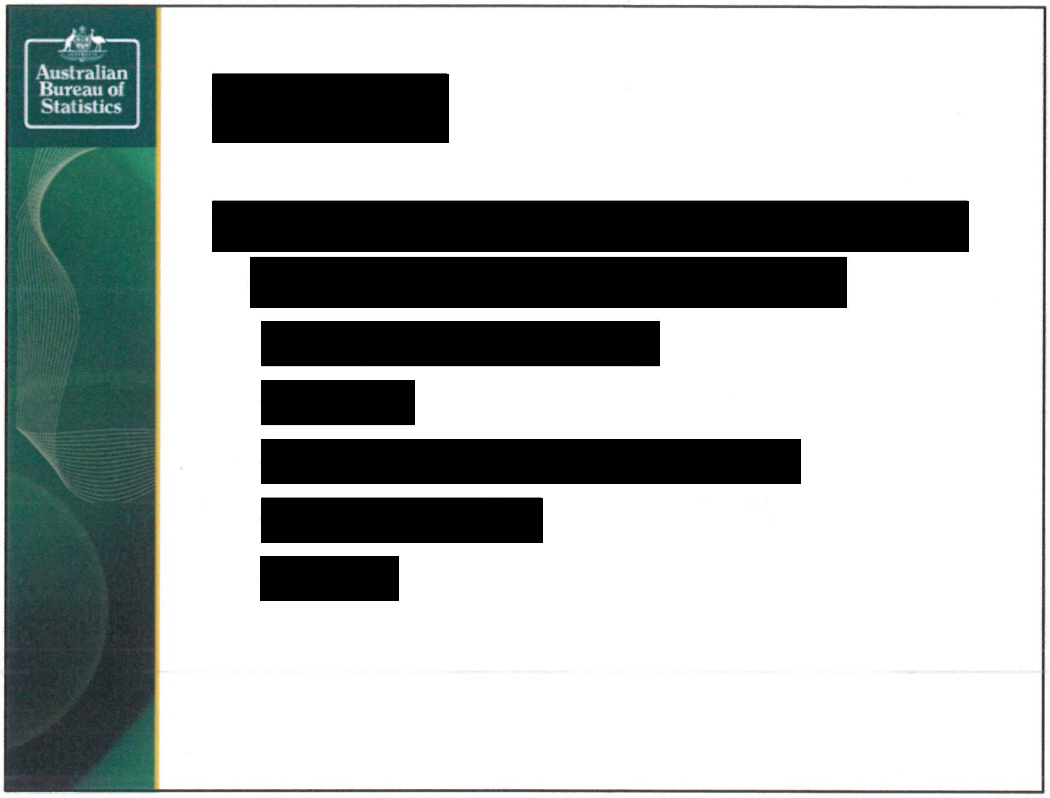
What would you do in this instance? Are these two items of clothing comparable?

What is the first shirt was exactly the same as the second except its was a different colour? What if it didn't have sleeves? Would it be considered different then?



The emphasis of matching within this particular expenditure class is to ensure that comparable products are matched period to period.

When I say comparable products in this instance it mean that the consumer can derive the same amount of utility from that product in question. [redacted]


Australian Bureau of Statistics

In this particular example if the previous specification is out of stock we would have to consider which of the two products shown on the slide would be considered comparable to the old specification.

[redacted]

Australian Bureau of Statistics

Clothing

[redacted]

[redacted]

[redacted]

[redacted]

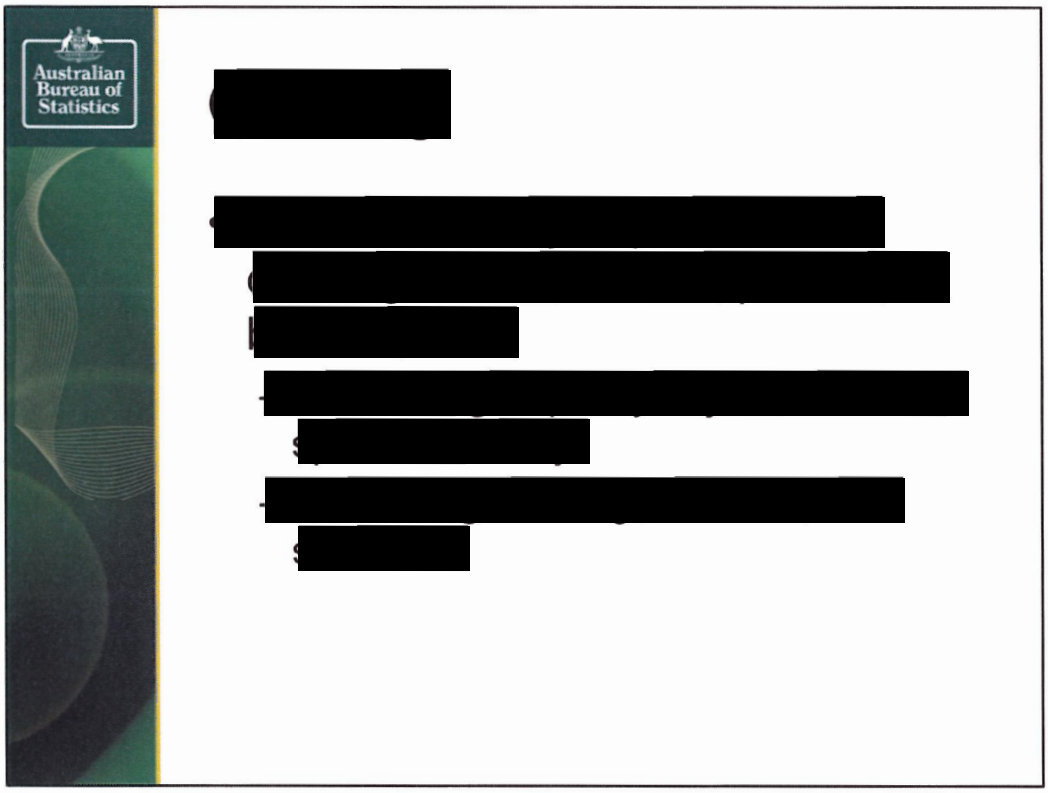
[redacted]


Australian
Bureau of
Statistics


Australian Bureau of Statistics


Australian
Bureau of
Statistics


Australian Bureau of Statistics

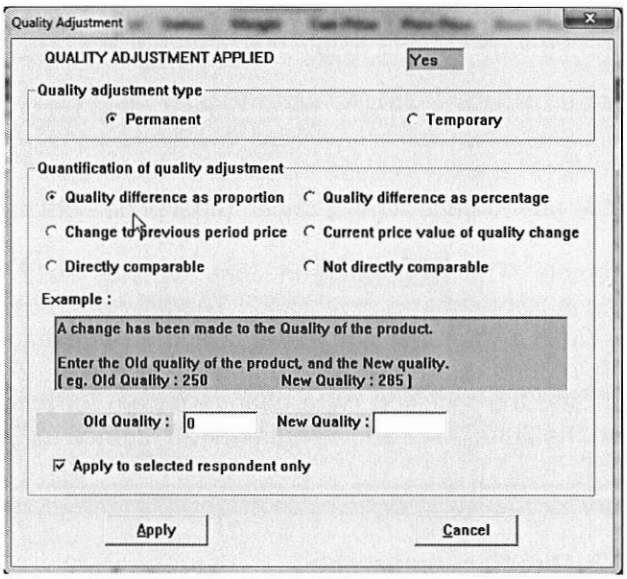

Australian Bureau of Statistics

2.4.7.1. Introduction

Most types of products and services are available in the marketplace in many different qualities; that is, they have physical characteristics which differ from each other. For example, potatoes may be old or new, red or white, washed or unwashed, loose or prepacked. Loose unwashed russet burbank potatoes (used for french fries) are different qualities of potatoes from washed, prepacked atlantic potatoes (used for crisps).

When sets of products are sufficiently similar to be considered the same generic type of product (such as a potato), but have sufficiently different characteristics that make them distinguishable from each other from an economic viewpoint, the products are said to possess *different qualities*. Not all differences in quality are attributable to differences in physical characteristics of products. Products with identical physical characteristics delivered to different locations, or at different times, are considered to have quality differences. Purchasers situated in one location frequently have different marginal utility from that of purchasers in other locations; hence, different locations may result in different qualities.

Quality differences may also be determined by a range of other nonphysical attributes. Quality may be determined by conditions of sale, presence of free after sales service, guarantees for durable goods, inclusion of delivery, methods for payment, and so forth. The objective of price indexes is to measure pure price change over time; that is, to measure the extent to which the cost of an identical basket of goods changes over time, not affected by changes in quality or quantity or the terms of sale.



The problem facing index analysts is isolating and quantifying the direct effects of changes in the quality on goods and services they are pricing in the fixed basket, to achieve an index of pure price change.
The method used to adjust for changes in the composition of a quality is to identify the quality difference and place a value on that difference. Frequently the composition of a particular product changes because of the use of different materials or the addition or deletion of particular features. This process discusses applying quality change within the prices system.

2.4.7.2. Options for quality adjustments

2.4.7.2.1. Quality difference as a proportion

Typically used when a relative description of quality rather than a dollar value.

New previous period price = (new quality / old quality) * previous period price.

New base period price = (new quality / old quality) * base period price.

For example: The price received for a 500g jar of coffee in June quarter 2012 was $5. In September quarter 2012, the price received is $6 with a note stating the jar size has increased to 750g. To implement this quality adjustment, the new quality is 750 and the old quality is 500 with the resulting change shown for this specification of -20.0%.

[redacted]

2.4.7.2.2. Quality change to previous period price

Typically used when a previous period price for the (new quality) good or service observed in the current period can be obtained. As a result, this value can be directly compared against the current period price to obtain the required price movement for this specification.

New previous period price = (final price / (final price - obtained value)) * previous period price.

New base period price = (final price / (final price - obtained value)) * base period price.

For example: The [redacted] in June Quarter 2012 sold for $20,000, and is no longer available in September quarter 2012. The provider provides data for the [redacted] at a price of $22,000 in September quarter 2012 and we subsequently find the [redacted] was sold for $21,000 in June quarter 2012. To implement this quality adjustment, the 'obtained value' is $21,000 and the resulting price change shown for this specification is 4.8% (the difference between the June 2012 and September 2012 price for [redacted]).

[redacted]

2.4.7.2.3. Directly comparable

Used when there has been an observed change in the quality of the good or service; however, the decision is made that the difference is immaterial and the two prices can be directly compared.

Previous period price and base period price are unchanged. For this reason, this option is the value to which all quality adjustments are reset.

For example: The price received for a red [redacted] in June quarter 2012 was $20,000. In September quarter 2013, the price collected was $20,200; however, the colour of the car being manufactured is now green. Clearly a difference in the quality of the car has been observed (it is green instead of red), but is determined to be immaterial. Selecting directly comparable ensures the previous period price and base period price remain unaltered and the movement shown for this specification is 1.0%.

[redacted]

2.4.7.2.4. Quality difference as a percentage

Typically used when the quality difference can be expressed as a percentage.

New previous period price = ((100 + obtained value) / 100) * previous period price.

New base period price = ((100 + obtained value) / 100) * base period price.

For example: The price received for a 500g jar of coffee in June quarter 2012 was $5. In September quarter 2012, the price received is $6 with a note stating the jar size has increased by 10.0%. To implement this quality adjustment, the obtained value is 10, with the resulting change shown for this specification of 9.1%.

[redacted]

2.4.7.2.5. Current price value of quality change

New current period price = current period price – observe value.

For example: The price received for a crate of 24 coffee jars in June quarter 2012 was $200. In September quarter 2012, the price received was $400 with the respondent advising the additional value of the 24 coffee sets was $70. To implement this quality adjustment, the observed value is $70 giving a movement of 65.0%.

[redacted]

2.4.7.2.6. Not directly comparable

Used (sparingly) when it is not possible to quantify the quality difference between two items and there has definitely been some quality change.

Current period price (in which not directly comparable is selected) is imputed and base period price and previous period price remain unaltered.

Previous period price = final price observed at time of not directly comparable.

Base period price = (final price observed at time of not directly comparable / imputed final price) * base period price.

For example: The price received for [redacted] model A shoes is $80 in June quarter 2012. In September quarter 2012, a price of $100 is provided with a note stating model B shoes are now being produced. The new shoes have an additional shock absorption technology; however, the valuation of this (significant) quality change cannot be quantified. Marking this observation as not directly comparably will ensure imputation occurs in the current period giving a movement of (say) 5.0%. Thus, the difference between the imputed final price ($82) and the observed price ($100) is attributed to quality (If 'carry forward' imputation is used, the imputed price will always equal the previous period price, meaning all the difference between the observed prices is attributed to quality).

[redacted]

2.4.7.3. Applying a quality adjustment

Note: Before applying any quality adjustments, ensure you have investigated the specification(s) and components fully by reading any commentary in the remarks column and checking historical details.

CPI Field Operations

View in slideshow mode to use hyperlinks

Module 2.4
Price Editing & Quality Adjustments

What is a Quality Adjustment (QA)?

- A procedure undertaken to modify the raw price movement for a good or service to account for any change in quality between two consecutive pricing periods
- An increase in quality -> reduced price rise, or reduces effect of a price increase
- A decrease in quality -> increased price rise, or reduces the effect of a price fall.

Reasons for performing a QA

- Performing a QA ensures continuity of **consistent quality** in the basket of goods and services

- CPI is about measuring price change of a fixed basket of goods and services from a base period
- In the real world however, products are continually changing and improving
- To truly reflect price movements, and only price movements, we have to convert the basket to an equivalent of the original basket
- This is to ensure any difference in price between the two periods can be said to be due to inflation

What is quality?

- Nature and character of the product i.e. distinguishing features

OR

- When its perceived usefulness to the consumer has changed

When TO perform a QA

- Whenever a good or service priced in the current period **isn't** exactly the same as the good or service priced in the previous period
- Most common reasons:
  - new models, and
  - temporary bonus features
- Changes must be measureable and discernible to consumer, and more significant than marketing ploys

When NOT to perform a QA

1. When consumer has no choice but to accept the change (i.e. changes in laws which compel changes for reasons which do not affect the consumer)

2. When a change in quality is NOT available to all consumers

1. Example: A change in law about poisons led a dishwasher detergent manufacturer to change the formula to avoid warning labels. This increased production costs. As a result the price increased. As products primary purpose was to clean dishes the full price movement was reflected in the CPI.

2. Example: Buy three get fourth one free. CPI standard is price one.

Permanent or Temporary QA

- Temporary QA is one that only lasts for a short period of time

And

- Products do not undergo permanent change

Example: 50 grams coffee at no extra cost

Types of QA

[redacted]

- Ideally, FO's should perform QA's at the time of pricing in order to reduce the risk of overlooking the QA

Add table showing all Quality Adjustments [redacted]

QA after Special (S)

- QNDC, QCPPP and QDC cannot be applied right after a special has been applied

- If a QA is required enter '?' in edit symbol field and add comments in remarks field to advise CPI Analysts – who will apply the correction

Quality Difference as Proportion (QDAP)

- Only use when old and new quantities are known
- Use whenever any attribute of the product can be measured and compared meaningfully over time

Example: A change in number of hours of lessons, number of concerts/magazines provided for annual subscription

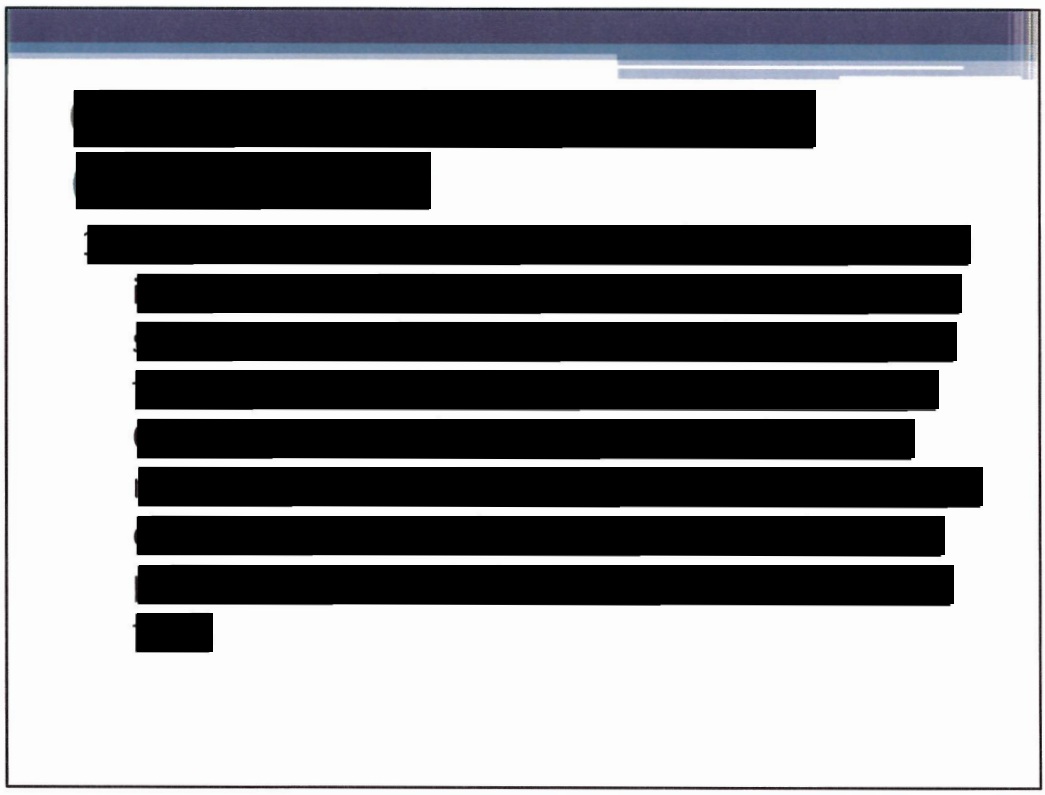
Quality Difference as Percentage (QDA%)

- Use when quality has been expressed in percentage terms
- Note: Percentage must be entered as a +'ve number when increase occurs, and –'ve number when decrease occurs

Example: Wine cask sold with extra 20 % at no extra cost.
In this case you might change to another measure i.e. litres, and enter this into prices system

Change to Previous Period Price (QCPPP)

- Only used when normal recommended retail price applicable to previous pricing period is known
- If item was on special in previous period QCPPP cannot be used
- If on special in current period, then ok.



Change to Previous Period Price (QCPPP) (con't)

2. If the nominated specification is not in stock and a suitable replacement is available which would also have been in stock during the previous pricing period, and a price can be obtained which was applicable to that period, then the current price can be entered in the Price field and the previous period's price in the QA.

Current Price Value of Quality Change (QPVC)

- Used when the change in quality can be measured in current dollar terms
- A positive value is entered for an increase in quality or a negative value for a decrease in quality.

Example: The **normal price** of a bicycle has increased from $699 to $749 and the respondent has advised that the full increase of $50 is attributable to an improved front suspension. The $749 is entered in the current price field and a positive value of $50 in the QA field.

Directly Comparable (QDC)

- QDC should not be used if the previous price was on special – use the edit symbol '?' and record the details in remarks
- Technically this option is not really a quality adjustment, however we use this option when a substitution has occurred and where both the old and the new product are deemed to be of equivalent quality.
- The practical result of this procedure is the same as no quality adjustment, the creation of a quality adjustment record indicates that an examination of the two products was carried out by the data collector with the result that the two qual were determined to be equal.

Example: Women's winter jacket. The item in the previous period was a wool blend jacket with four buttons and a large collar, this is not available to price in the current period. It is replaced with a wool jacket with five buttons and a smaller collar. The utility to the customer was judged to be the same and therefore the item is deemed to be directly comparable.

Example: A washing machine priced in the first period may be replaced with another with the same features but a different product code and slight styling change.

Not Directly Comparable (NDC)

- QNDC should not be used if the previous price was on special – enter '?' and record details in remarks

The purpose of this option is to link in the new product when the relative qualities of the old and replacement products can't be compared in any meaningful way. What will happen is that an imputed price will be calculated for the old product for use in the current period's index calculation, and the price collected for the new product will be stored for use as the 'back price' in the following period.

Here is the official list of quality adjustment symbols, their meaning and impacts. In order to ensure that new analysts and field staff do not get confused please only use the QA symbols listed in the table below.

Quality Symbol	Label	Meaning	Result
QCPPP	Change to Previous Period Price	Typically used when there is a specification change (quality change) and both the previous and current price of new spec is available	New Previous Period Price = Obtained Value. New Base Period Price = Base Period Price * Previous Period Price / Obtained Value. Should only be used if the price recorded last quarter for the old specification was its normal retail price. If the product was on special then do not use this option as the system cannot make the correct adjustment.
QDA%	Quality difference as percentage	Is used when a respondent is able to supply an estimate of quality change ie 20% extra soft drink	Double check that this symbol has been used correctly and that the calculations are correct.
QDAP	Quality difference as a proportion	Is best used when the quantity changes. It is also useful when the product changes and you are prepared to accept that all the price difference is related to quality changes.	
QDC	Quality Directly Comparable	No change in quality between the old product and the new product	This is most often used when the packaging changes but there is no change to the utility of the product to the consumer.
QIN	Quality Adjustment on an interim In	An adjustment to an interim in is required to account for a change to the specification.	
QNDC	Quality Not Directly Comparable	Used (sparingly) when it is not possible to quantify the quality difference between two items and there has definitely been some quality change.	The system will impute the current price and store the collected price in a temporary field to be used next quarter as a back price. (QNDC over 2 consecutive periods is never allowed)
QNS	Quality Adjustment on a national standard	An adjustment to a national standard is required to account for a change to the specification.	
QPVC	Price value of change	Price Value of Quality Change - Used when change in quality can be measured in dollars ($) ie Bicycle increases $50 and the respondent says the $50 is attributable to an improved front suspension.	Make sure correct Quality Adjustment is applied

Quality Adjustments

Removing a QA or Changing to another Edit Symbol

To remove a QA (as distinct from changing it); go to the Respondent form. Select the appropriate specification. Print a copy or make notes of all data entered, including any remarks. Go to Edit mode (Select Pencil icon). Double check you are on the correct entry then Press 'Select to Null' button which will rest the entry to the state it was before any data was collected for the quarter, signified by *. Re-enter the collected price and any remarks, adding IMAE remarks to explain your action. Click on another line, then edit symbols will pop up, choose what you want, then save by selecting pencil icon and retrieve. Changes should flow through from respondent form to Component module on retrieval.

QCPPP
The use of this QA is circumscribed so its use will usually be inappropriate and it will most likely require IMAE QA adjustment action. If you are unsure, seek advice in each case regarding the replacement QA.

QNDC after QNDC
QNDC + QNDC is never allowed as Prices system cannot handle it. Quality adjust 2nd QNDC to another suitable QA. When we replace 2 QNDCs in a raw, need to be clear what we replace with, for instance if we do QADP, keep all the information. Good thing is to add detailed remarks in the Spreadsheet.

No QNDC or QCPPP after DS
If there is a QNDC after DS, we have to restore the relatives before go ahead with QNDC (see notes on restoring relatives and seek advice). When there is a QNDC following a history of specialling including last quarter, eg DS, (check the 5 quarter history to ascertain) then the new spec will impute its price from a low relative as CP/PP price relatives will be low so the new spec will work from a low base henceforth. To avoid this but still recognise the QA, it is better to do a QDAP using old and new spec np prices if there is no better alternative so that a valid price results, the chain continues and the relatives will be able to reset themselves. The other alternative is to apply QPVC - price value of quality change. Both QDAP and QPVC produce similar results BUT if there is a difference, please check with an expert before doing a QA for this.

QDC on DS (drop special)
New replacement for the spec is on DS. Only in the case of **QNDC**, we **cannot** use special price. All other cases we can apply DS price.

QIN - Quality adjustment on an interim in
Do not enrol in. Leave it until next period or until two normal prices appear.

Records which have an Edit Symbol of QNS
QNS - Quality National Standard

This entry comes up on the report because a field officer has applied a quality adjustment to a national standard. The IMAE staff need to check this and change the QNS to the Q that has been selected within the 'quality change' box. To do this, follow the process below. Go into Component module, Select item as normal and bring up under the 'SMT' screen, To identify correct month, may have to check each one in turn to find the QNS (only need to do this on the monthly collections), Go into the 'quality change' box and check what QA has been applied. Note down or remember, When the item has been located, select Edit and go into the 'quality change' box and ensure the right selection has been made. If not, select the correct QA. Save changes. The QNS should now be changed to Q.

1. QA DaP (Difference as a Proportion)

Typically used when the size of the quality change (rather than dollar value) can be obtained.

EXAMPLE:-
Period 1 - Bread A = $4.00 for 650gm
Period 2 - Bread A = $4.00 but increases in size to 700gm

ACTION:-
Apply a QA DaP New Quality 700 and Old Quality 650.
Enter $4.00 and note the details of this change in the Remarks Column and update the Spec Description.

.....

2. QA Da% (Difference as a Percentage)

Typically used when the quality difference can be expressed as a percentage

EXAMPLE:-
Period 1 - Jam A = $5.00 for 500gm
Period 2 - Jam A = $5.00 with a Bonus 20% more.

ACTION:-
Apply a QA Da% = 20%.
Enter $5.00 and note the details of this change in the Remarks Column.

.....

3. QA CPPP (Change to Previous Period Price)
Should not be used if the last Price Recorded for the Previous Item was a SPECIAL PRICE.
(if the last price recorded was a special price a better option may be QA VofC with any value difference being compared back to the 'normal or start price' of the previous item).

Typically used when a price for a new item can be obtained in the current period and no equivalent or comparable item is available.

EXAMPLE:-
Period 1 - Camera A = $400
Period 2 - Camera A = $400 but will soon be discontinued. Camera B is noted at $600
Period 3 - Camera B is now $625

ACTION:-
Apply a QA CPPP - the previous price = $600.
Enter the current price of $625 and note the details of this change in the Remarks Column and update the Spec Description.

.....

4. QA VofC (Current Price Value of Quality Change)

Typically used when the (current period) dollar value of the quality difference can be obtained

EXAMPLE:-
Period 1 - Bike A = $800
Period 2 - Bike A is replaced with Bike B which is $850. The only difference between the two Bikes is Bike B has an improved seat valued at $25.

ACTION:-
Apply a QA VofC = $25.
Enter $850 and note the details of this change in the Remarks Column and update the Spec Description.

.....

5. QA DC (Directly Comparable)

Typically used when there has been an observed change in the good or service, however the decision is made that the difference is immaterial and the two prices can be directly compared.

EXAMPLE:-
Period 1 - Shirt A = $49.95 and has a stripe pattern
Period 2 - Shirt B = $49.95 and is a plain colour

ACTION:-
Note DC (Directly Comparable) in the Remarks Column and update the Spec Description - No System QA is required.

.....

6. QA NDC (Not Directly Comparable)

Typically used (sparingly) when it is not possible to quantify the quality difference between two items and there has definitely been some quality change.
Should not be used if the last Price Recorded for the Previous Item was a SPECIAL PRICE.
(if the last price recorded was a special price a better option may be QA VofC with any value difference being compared back to the 'normal or start price' of the previous item).

EXAMPLE:-
Period 1 - Sports Shoe A is $80.00
Period 2 - Sports Shoe B is $150.00 and is a totally different shoe.

ACTION:-
Apply a QA NDC.
Enter $150.00 and note the details of this change in the Remarks Column and update the Spec Description. The system will carry this price forward to the next period and impute a current price.

Remove respondent that do not need any more.
When you remove a respondent in the SMT screen, it comes up in the validation report under Respondents without a sample (Item 6). Then you have to remove those from the respondent module. Go to Respondent, click on the Form, Open file, select Do not filter->Do not filter ->Do not filter for first three boxes then select All physical regions. Press Ok then you can select the respondent you want to remove from the pop up list and press DELETE from the top menu.

[redacted]

[redacted]

[redacted]

[redacted]

Changing a National Standard to a Respondent Standard
Instruct field officers to identify which price observations require changing. For each affected price, field officers should enrol in the same respondent, but under 'Respondent Standard'. After two valid prices have been collected, the price observations that are 'National Standard' can be enrolled out. IMAE staff will do this. Respondent standards should now be the only price observations in the sample.

BONUS QUANTITY at no EXTRA CHARGE

Common Example:
- 6 Razor Blades for the price of 5
- Bonus coffee pack
- 2 photo prints for the price of one

Your task: Assess whether the bonus offer is aimed squarely at the purchasers of the CPI specification. Are they likely to switch to the bonus offer? Is there a catch involved? Does the customer have to make a bulk purchase? Or is the bonus applicable only to an unpopular variant of the CPI specification? Weigh up whether such trade-offs could be a major deterrent to customers making the switch. (Of course, if the bonus pack has completely displaced stock of the ongoing standard, such assessment is unnecessary).

You record: If bonus offer is deemed the volume purchase OR there is no stock of the normal specification, record the price and specification of the BONUS offer in REMARKS. On return to the office or using the calculator in Hand-held, place in the 'RP' column, the EFFECTIVE price for the Standard CPI specification e.g. a 1.25 kg offer of $3.00 would be entered do $ $2.40 if the ongoing CPI standard is specified as 1 kg. Also record 'QC' in the Editing Symbol Column.

HOWEVER: If bonus offer is NOT the volume purchase, its availability and price should NOT appear on your collection form but SHOULD be referred to in a price editing advice.

Cash Backs

Check how long these offers were and whether that period lies within our scope (within the quarter). If it is for a part of the quarter (for monthlies) we can apply the proportion of time to the cash back and apply that price. However we need to know the take up rate of any offer that further reduces the price with that proportion.

Here we need to apply a QA - QCPV, **remember to select Temporary** at the top of the pop up QA box. Then apply the cash back value you calculated using above phenomenon.

CASH BACK from manufacturer

Common Examples: - $300 - for purchase of run-out model of motor car;

- 10c for wrapper of chocolate bar;

- $2.00 for 2 labels off jam container.

Your task: Gain a complete understanding of the specifics of the offer in particular, pick up on any 'small print' that limits its accessibility.

You Record: The price in the RP column `Q' in the Editing Symbol Column and the specifics of the offer in your Collection Report. There is no need for Remarks entries, unless the offer applies only to selected respondents. An Investigations Officer will follow up your report with an interview of the manufacturer. He/She will report to Central Office on the offers:

. Take-up rate;

. CPI specification-unit saving (e.g. if spread over 3 purchases);

. Net unit saving per average purchase (applying take-up rate and deducting out-of-pocket expenses e.g. postage).

Only if the final saving is significant, will the Central Office compilation group, make adjustments to current prices.

BONUS offer of prizes for entering COMPETITIONS linked to PRODUCT WRAPPERS

Common Examples: - Trip to Disneyland if 'winning slogan' written by purchasers on product wrapper;
- Cash prize for 'scratch-it' success on wrapper.

Your task: For CPI purposes ignore them. These competitions offer a remote and uncertain benefit to customers interested in responding. They are of no interest to Central Office and should not be mentioned on Collection forms or in the Collection Report.

FREE GIFT as Purchase Bonus

Common Examples: - Free Photo Album with processed film;

- Free Helmet with Motor Bike purchase;

- Free juicer with Food processor purchase;

- Free delivery of Refrigerator.

Your task: Determine if the latest CPI collections form has anticipated the bonus offer by pre-specifying it and identifying a column for its value to be shown. If so, ask the respondent for his/her estimate of that value. If no such forewarning, ensure the offer has 'no strings attached' obtain its specification and estimate of value. Length of offer would also be helpful.

Enquire if as an alternative to the bonus offer, a CHEAPER CASH PRICE for the CPI standard as specified, is acceptable and, as a transaction, at least as popular.

Your Record: As first preference you should place in the RP column the cheapest price without receipt of the gift. Any accompanying Remarks comment noting the bonus offer should make clear the fact that 'RP' price is a net one and is not to be adjusted.

However, if the respondent will not offer a lower price if customers forfeit the gift, show the NET price in the RP column, `QEC' in the Editing Symbol Column and your basis of estimation of the Net Price in 'Remarks'. Your `QEC' in the Editing Symbol Column transmits the message `Quality change resulting in Estimated Current Price'.

Note: That YOUR estimate of the gift's value may be different from the respondent's.

If the gift is courtesy of the manufacturer, always provide comment in your Collection Report.

'BOGUS' Trade-in OFFER

Common Examples: - $100 off for trade-in of old fridge ('dead' or 'alive') for CPI.standard.

- Minimum $1000 'off' for your 'old bomb' on CPI standard motor car.

Your task: Does the CPI specification preclude, make no mention of or include reference to price AFTER trade-in? If reference is made to trade-in as a price offset, ensure price taken for CPI standard reflects average trade-in discount. If description does not implicate existence of trade-in, establish most common price made (inclusive of with and without trade-in deals). If 'trade-in' value is prescribed as not to be taken off price, ask if customers without trade-ins are given a discount in-lieu in any circumstances. Establish on this basis the most common price paid by such customer.

You record: Most common (or average) price in RP column as established from one of the 3 lines of enquiry stated above. Provide the basis of arriving at this price in 'Remarks'.

Normally, no Collection Report entry would be necessary.

"CHEAP" FINANCE or OPTION to DEFER PAYMENT of PURCHASE PRICE

Common Examples: - Purchase of Christmas Giftware, no payment needed until March.

Your Task: For CPI purposes ignore. The intricacies of deducing what the average customer would pay in REAL terms on offers of this type are just too hard to assess. Look, therefore to the immediate cash purchase price for entry in the 'RP' column. Comments in your Collection Report are not required.

DISCOUNT FOR MIXED BULK PURCHASE

Common Examples: - Any 3 garments dry-cleaned for $10.00

- Freezer Pack Meat Purchase

Your Task: For CPI purposes ignore. All CPI standards are single, specific articles or packages. Weights, also, are assigned on this basis. There is no facility for compiling the CPI on the basis of divergent groupings of such standards. No Collection Report entry is required.

Note: The situation is a little different for multi-packs. E.g. 5 kg string baskets of oranges or multi-packs of chocolate bars. These may be acceptable standards if not in conflict with the CPI specification (which may simply ask for a 'per kg' price). The important consideration here is that if a 'standard' is formed on this basis, that the quantity or pack size be frozen over time, in which context no short term price movement based on arbitrary unit price variations enters the CPI.

PREPAYMENT DISCOUNT /EARLY PAYMENT

Common Examples: - Discount on cost for Dry-cleaning if paid for in advance.

- Discount on Council Rates if full payment made within 30 days.

Your Task: Ensure you detect the offer in the Collection Period that it is first made. Assess the popularity of the offer and the extent of 'loss of liquidity' that applies. If the saving appears genuine and taken up by most customers, the reduced price can be accepted as a price fall.

You record: The reduced price in the RP column. Record `QC' in the Editing Symbol Column and 'confirmed' in Remarks, specifying the changed nature of the pricing basis. Adhere to that pricing basis in future periods, subject to its continuing availability and popularity. An entry in your City's Collection Report should be made particularly if the early payment discount appears likely to spread to other respondents.

Apply PNS, OOS and QNC

USE OF `OOS'
This Editing Symbol is to be used when the CPI specification is stated or assumed to be out-of-stock. For this symbol to be appropriate, the respondent must be in the position that he is TEMPORARILY unable to access the product. It is not sufficient that the spec. is simply not 'on the floor'. For example, the specification may be 'on range' for the respondent AND is available for immediate delivery either from the store's local warehouse or from the brand name's local distributor. In these circumstances, record the spec's current retail price in the "RP Column", accompanied by the entry "List Price" or "Book Price" in "Remarks". This price is not to be regarded as an 'Estimate'.

While TEMPORARY non-availability is the key condition for use of this symbol, the word "temporary" should not be interpreted too narrowly. In fact, the duration that the specification has been and could remain out-of-stock is IRRELEVANT. The salient point is that an intention has been conveyed to you by the respondent contact, that stock of the spec WILL BE REPLENISHED when circumstances permit. This is a crucial consideration for Sample Maintenance purposes.

For Store-standard specifications, the symbol "OOS" must always be accompanied in "Remarks" by the description AND PRICE of a prospective, alternative spec. If an when you are satisfied that the 'OOS' standard is unlikely to be replenished, the availability of a back-price allows for the splicing in of the new 'SS' spec. WITH a price movement.

USE OF `QNC'
This abbreviation stands for "Quality not Carried" and denotes the lack of applicability of a specification to a respondent. It should accompany a lack of price entry when the relevant specification:

a) is unknown to the respondent OR

b) is explicitly advised by the respondent contact as never or no longer to be carried OR

c) is, in your view, unlikely to become available from the respondent because of many successive periods of 'OOS' OR

d) has, almost certainly, been superseded by a new version of the spec. with apparently major 'quality' differences.

Situation (a), (b) and (c) above will usually indicate the need for selective sample maintenance. 'Remarks' and Collection Report entries would therefore seldom be called for. However, in relation to discontinued store standards (as for OOS), an alternative should be described and priced in 'Remarks'.

Additionally, this Remarks entry should be labelled "CHANGE OF STANDARD" and have specified against it, the spec's previous as well as current price. This will flag a requirement by the Compilation Group (or responsible State Officer) to splice in the replacement spec. with a price movement.

Reverting to situation (d) where a CPI specification appears to have been superseded.

There are 3 separately identifiable situations of this type

The first is where the CPI standard description doesn't precisely reconcile to the specification sighted at respondents. There may be a small difference in container size, the fabric content of a garment may not precisely as sought or the style or store reference No. listed on Collection Sheet may be different, yet every other feature corresponds.

One of two explanations is likely. Either the manufacturer of the item has "got under our guard" with a product modification not picked up by our investigation staff or an error has occurred in the drafting of the form.

Your action: If you are confident that the CPI standard description on the Collection form is for whatever reason erroneous and that the item you have sighted at retail IS what SHOULD have been specified, Enter QNC in the Editing Symbol Column and Enter description and price of the "look-alike" in 'Remarks'. On return to the office, contact Sample Maintenance Group in Central Office, providing them with your findings. You are assured of a quick response, so that a price if applicable can be entered in the RP column and other Offices can be advised of what action to take . If it transpires that a quality adjustment is necessary to the price, Central Office will take the required action.

A situation a little similar to the above is where the Collection Sheet description is still met by what is sighted at retail BUT packaging 'hype' suggests a product formulation improvement. e.g. "20% extra cleaning power" for a washing detergent or cheese that is "now cheesier". If such stock predominates, your procedure here is to record the price in the RP column, show QB' in the Editing Symbol Column and enter the claimed improvement in 'Remarks' and follow up with an entry in your States' Collection Report. Note the Editing Symbol Column `QB' alerts compilers to the possible need for a quality - related Base Year price adjustment.

A situation where any 'interventionist' action on your part is usually unnecessary is where there is change in the type or colour scheme of container. In such situation, no comment is usually required. Rarely encountered exceptions would apply where the new container is in itself claimed to enhance the quality or usability of the product. E.g. an easier way to use and more economic pouring spout or longer lasting freshness. In these instances, `QB' symbol Remarks comments and Collection Report entries are necessary.

Thus, neither of the situations encountered in 9.8.5 or 9.8.6 appear to infringe the integrity of the CPI standard and so QNC is not appropriate.

Aside from OOS and QNC, there is a third possible entry you could make in the "RP" Column. This is "PNS" (Stands for "Price not Suitable")

USE OF `PNS'

This Editing Symbol denotes a price non-response when the CPI standard, while in stock, is not a representative price measure because of:

- Extremely limited choice of colours, sizes, etc.

OR

- is of sub-standard quality or size

OR

- is shopsoiled or damaged

OR

- is being "cleared" at an unrepresentative price

You may, on rare occasions, have misgivings about using the prices of an ENTIRE RESPONDENT. The business may for example, have recently undergone a change of giving rise to a substantial overtime of the business's pricing structure.

If you choose not to ESTIMATE prices in these circumstances leave the RP Column blank, enter PNS in the Editing Symbol Column and a justification in 'Remarks'. Subsequent sample maintenance may be necessary.

Intro

- [redacted]

- Quality Adjustments
  - Which to use where?
  - Why do IMAE alter them?

[redacted]

Quality Adjustments

- Quality Adjustments are applied to ensure that quality change in a priced item is not reported as price change for the item.
- Car 1 = $5,000

Car 2 = $10,000

  - Here you could not compare the price for the first car with the price of the second without adjusting for quality.

Quality Adjustments

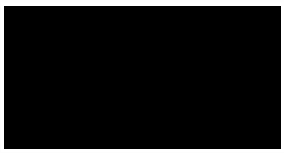
QCPPP	Quality Adjustment - Change of Previous Period Price
QDA%	Quality Adjustment as a percentage
QDAP	Quality Adjustment as a proportion
QDC	Quality is Directly Comparable
QNDC	Quality is Not Directly Comparable
QPVC	Quality Adjustment - Price Value of Change

Quality Adjustments

- Quality of an item is **subjective** and is based on the **consumers utility**.
  - A bigger frypan for the same price might be good for someone with a large family, but bad for someone who has limited cupboard space.

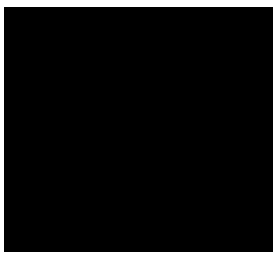
Quality Adjustments

- QDC – is not really a Quality Adjustment
- QNDC – is used when the replacement product is so dissimilar from the original product that the amount of change from quality change is not possible to determine.



Quality Adjustments

- QDA% and QDAP are generally used where the change in size of the product is 10% or less. (Usually only in supermarket products but this rule is not absolute)



- 250 gram jar

275 gram jar

Quality Adjustments

- QCPPP is used when an item was OOS last quarter and a back up price has been taken.

- QPVC is used when the amount of price change due to quality can be effectively determined.

Quality Adjustments

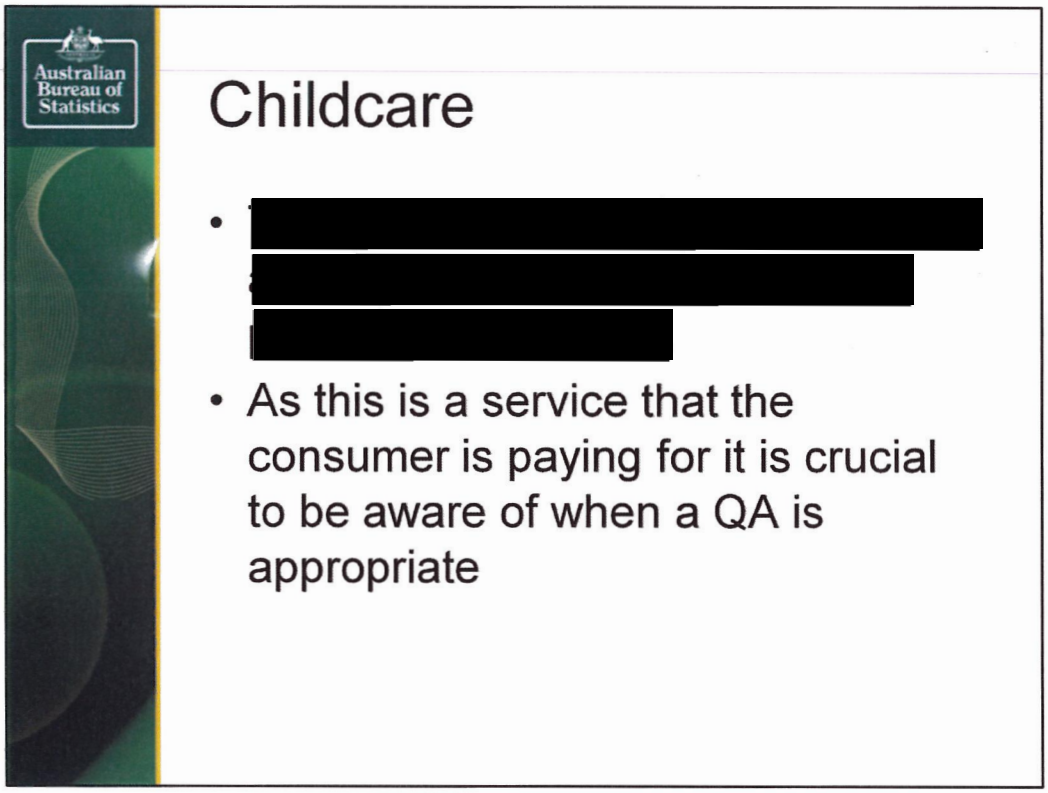
[redacted]

- Why do IMAE staff make changes ? [redacted]
  - IMAE take an overview of all movements to ensure correct story is being told.
  - IMAE check history (and correct errors) to ensure relatives are at correct levels.

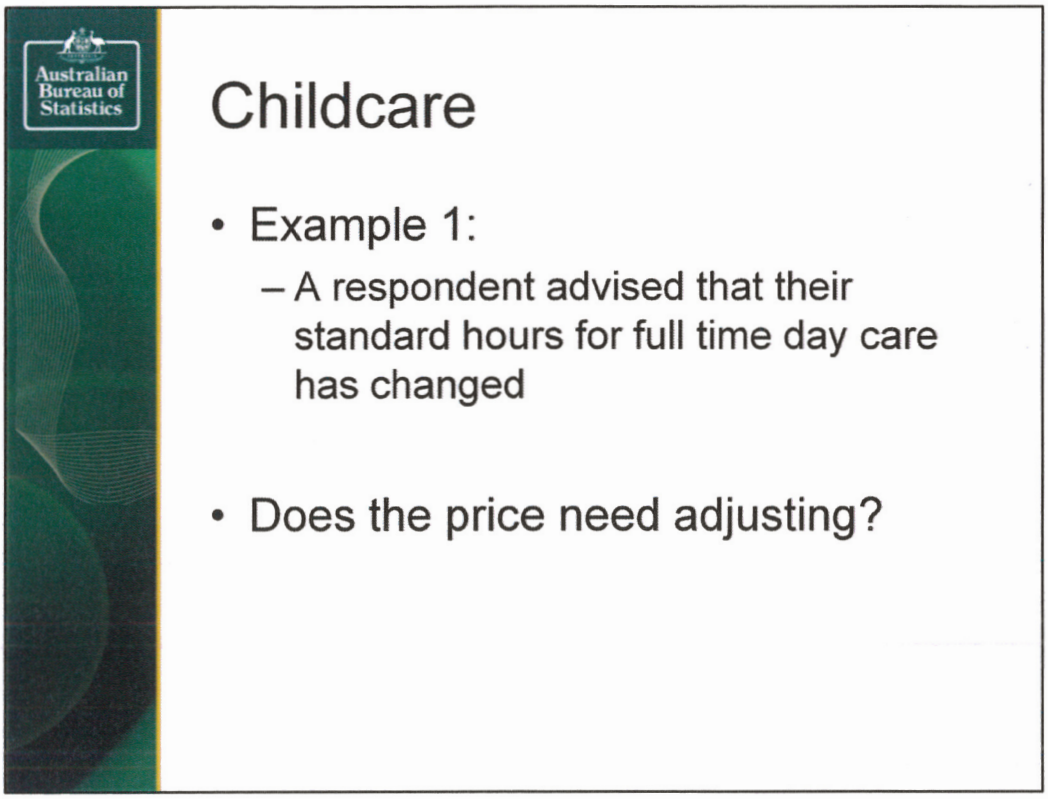
[redacted]

[redacted]

[redacted]

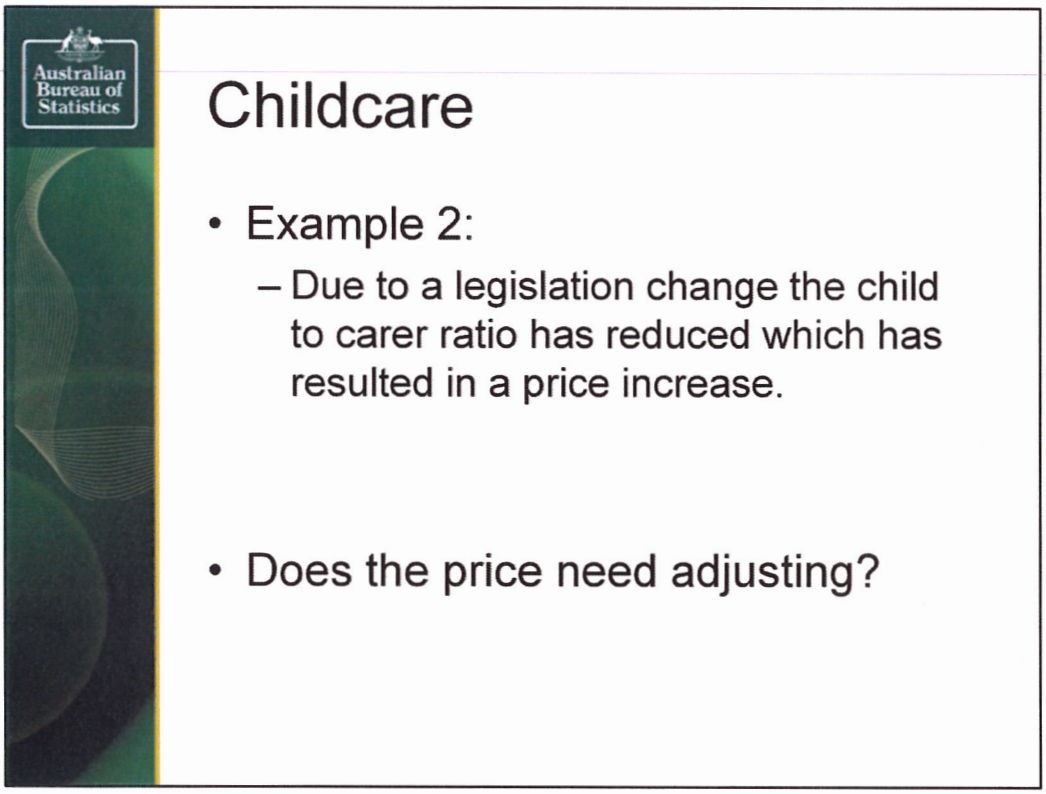

Australian Bureau of Statistics
Childcare
[redacted]
As this is a service that the consumer is paying for it is crucial to be aware of when a QA is appropriate

[redacted]



In this instances YES if all we are recording is just the final price but considering that we do have an hours field for childcare prices it is likely to be NO.

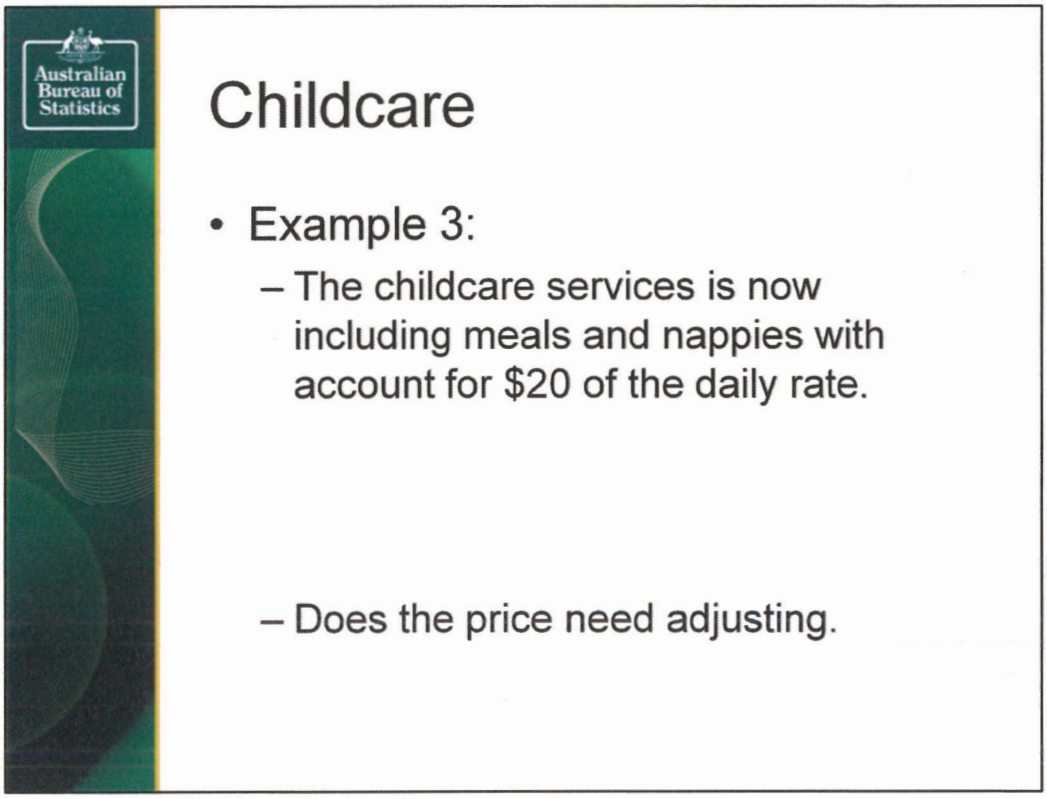
More usual example of a quality adjustment is the introduction of an additional service like lunch and/or nappies.



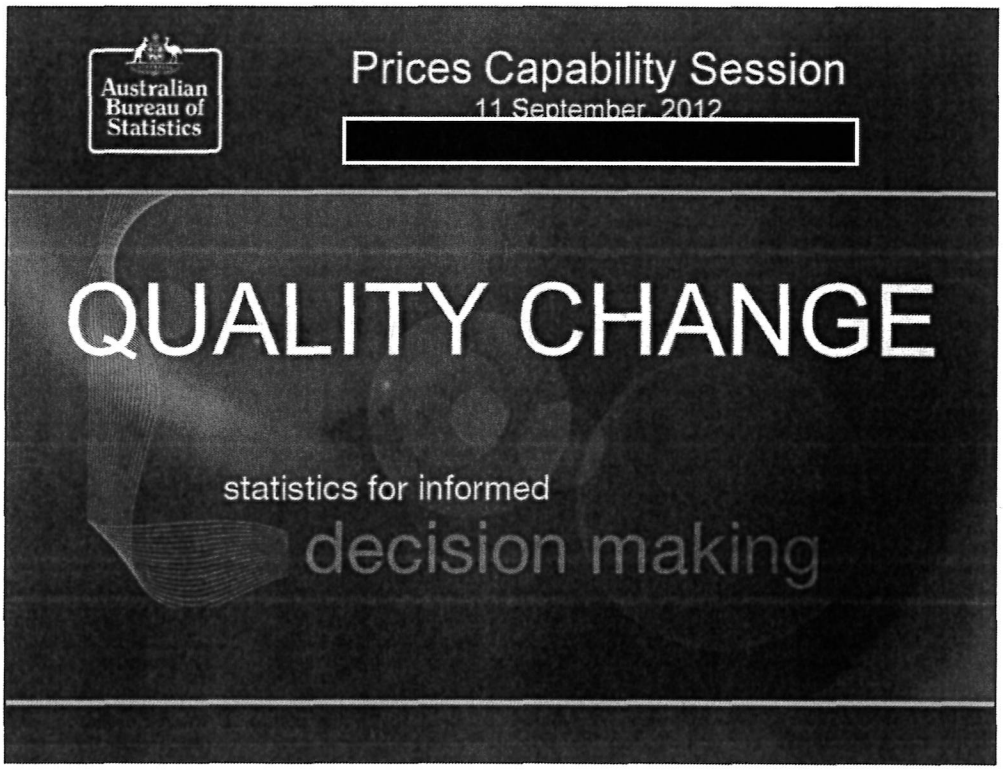
In this instance you wouldn't quality adjust for two main reasons:

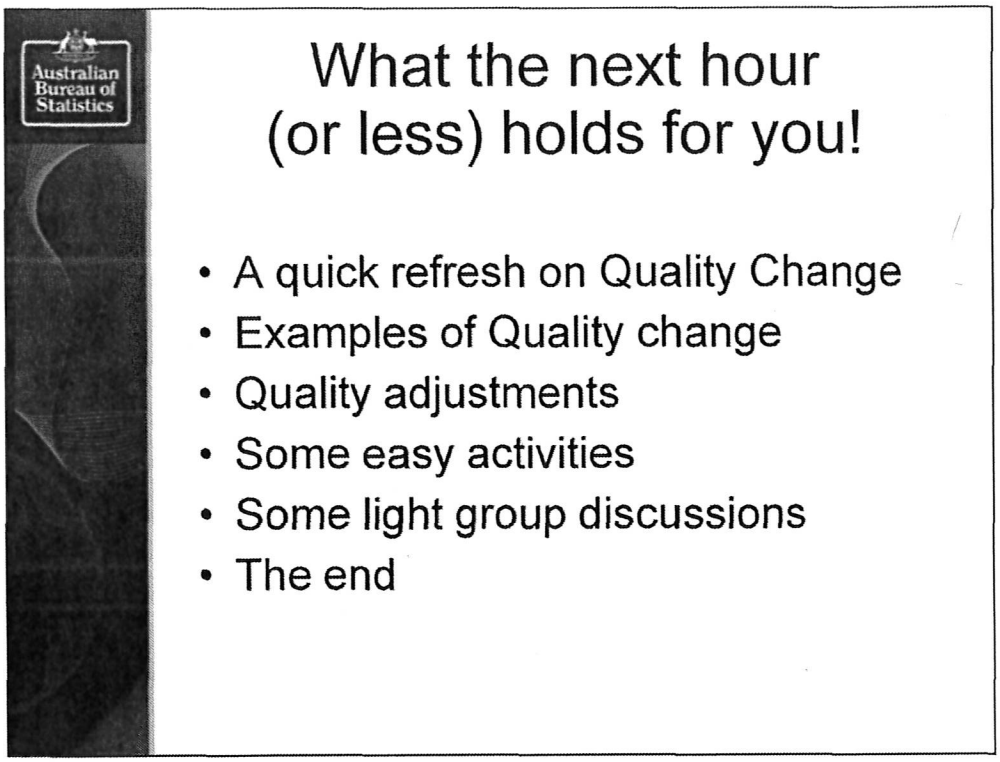
1) The change is not quantifiable (i.e. we cannot put a dollar amount on how much the additional care is valued at)

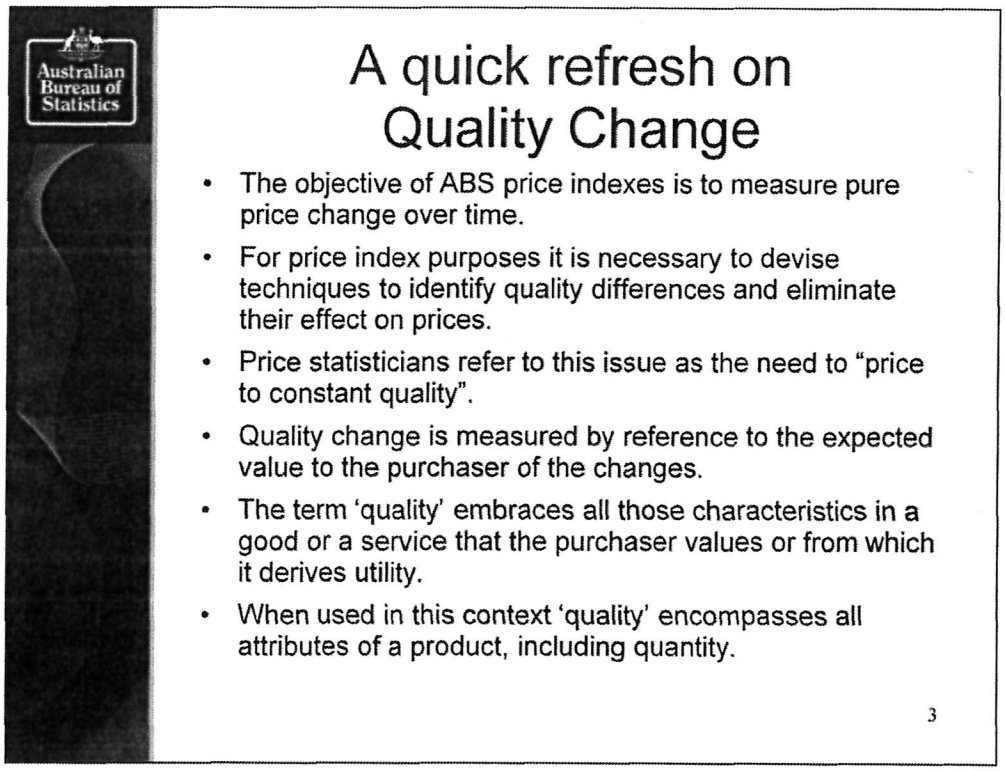
2) the consumer has no choice but to continue using this service and they would perceive no difference in their service (i.e. their child is minded either way)


Australian Bureau of Statistics
Childcare
• Example 3:
– The childcare services is now including meals and nappies with account for $20 of the daily rate.
– Does the price need adjusting.

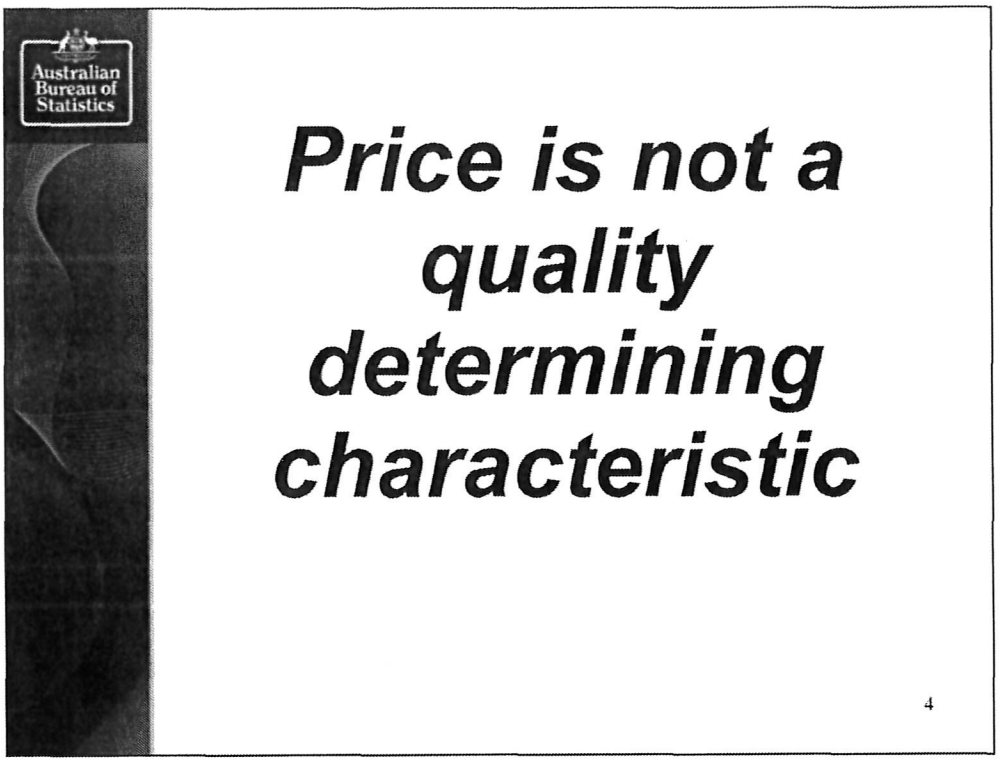
[redacted]




Australian Bureau of Statistics
What the next hour (or less) holds for you!
• A quick refresh on Quality Change
• Examples of Quality change
• Quality adjustments
• Some easy activities
• Some light group discussions
• The end



- The objective of ABS price indexes is to measure pure price change over time, not affected by changes in quality or quantity or the terms of sale.
- For price index purposes it is necessary to devise techniques to identify quality differences and eliminate their effect on prices from the calculation of price change for inclusion in the index.
- Price statisticians refer to this issue as the need to "price to constant quality". These adjustments are called quality adjustments.
- Quality change is measured by reference to the expected value to the purchaser of the changes.
- The term 'quality' embraces all those characteristics in a good or a service that the purchaser values or from which it derives utility.
- In economic theory it is generally assumed that whenever a difference in price is found between two goods and services, which appear to be physically identical there must be some other factor which is introducing a difference in quality.
- The expression "change in quality" is used to cover sets of goods or services whose identifiable characteristics are sufficiently different to make them distinguishable from each other from an economic point of view BUT which are sufficiently similar to each other to be described by the same generic term such as potato, computer or transportation.



What does price tell us about quality? NOTHING!

Just because there is a price difference does not necessarily mean there is a quality difference

•Freshness or otherwise of fresh produce e.g.: an Apple -Freshness, weight, type, taste, bruised or a Potato – red white, washed, packaged. Graded

•Strength of materials & stitching in a garment e.g.: a Shirt – Material , fashion, size, test breaking point of fabric to measure durability

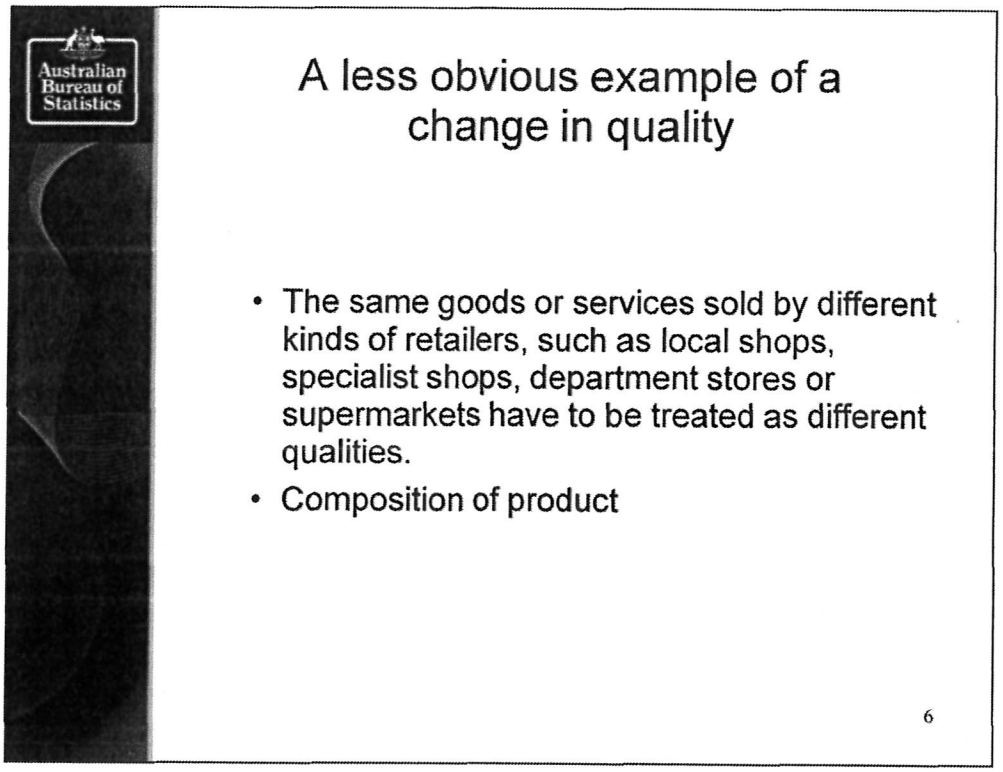
•Leather vs vinyl shoes e.g.: a Shoe – Durability

•Location (such as goods delivered to Sydney vs. Melbourne)

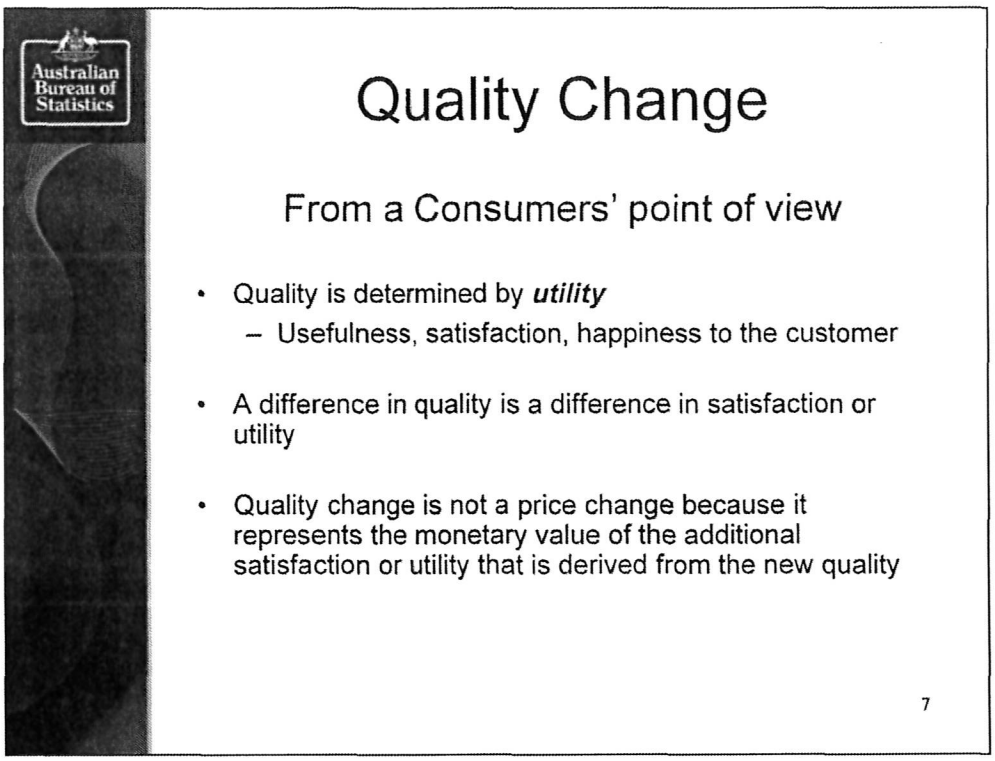
•Model options (such as with or without

leather interior)

- Timing (such as electricity supply: off-peak vs. peak)
- Conditions of sale (such as a good sold with after service care)
- Circumstances in which goods or services are supplied or delivered (silver service vs. meal in a club)



Composition of product – exported coal is graded differently and as a result the water content will determine the end use.

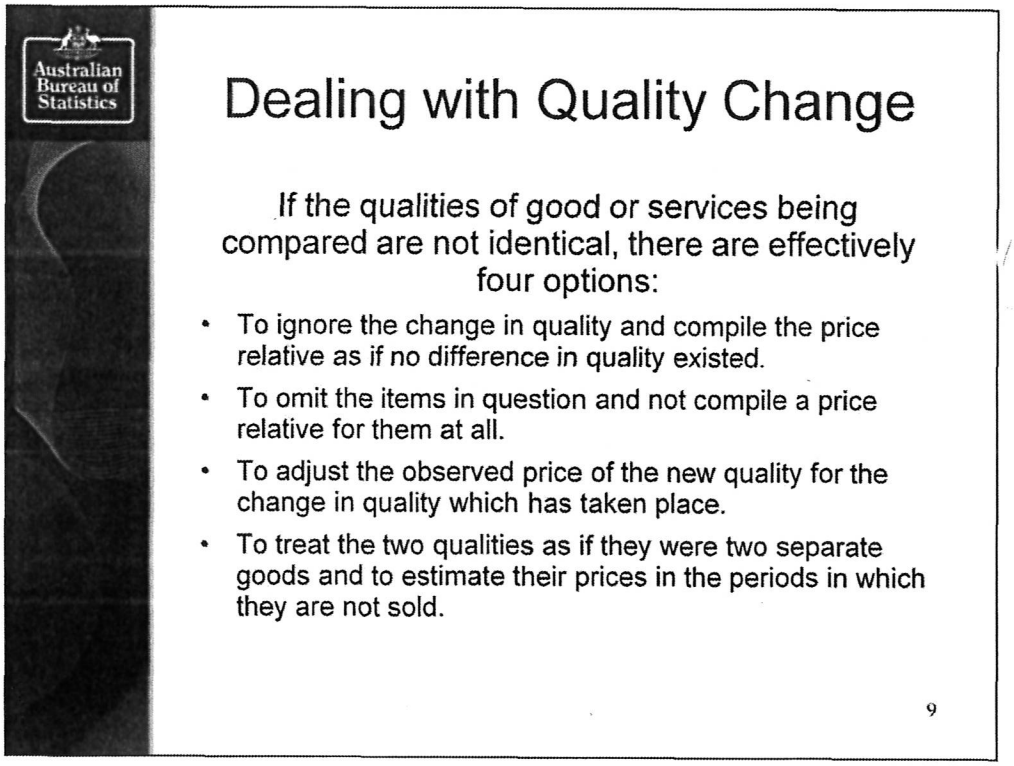


From Consumers' point of view – for CPI and input price indexes in general

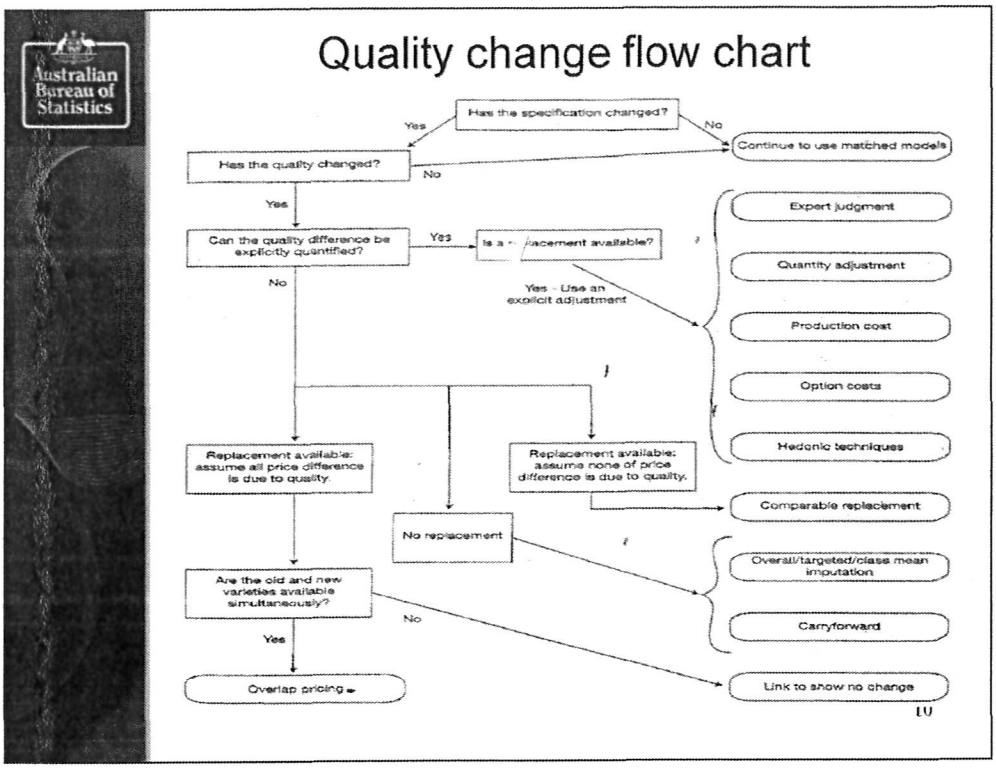
•Change in your happiness/utility = quality change (If one in each hand and no price which would you prefer)

Key point: Quality change is NOT a price change - it is essentially an estimate of the additional satisfaction derived from the new quality.

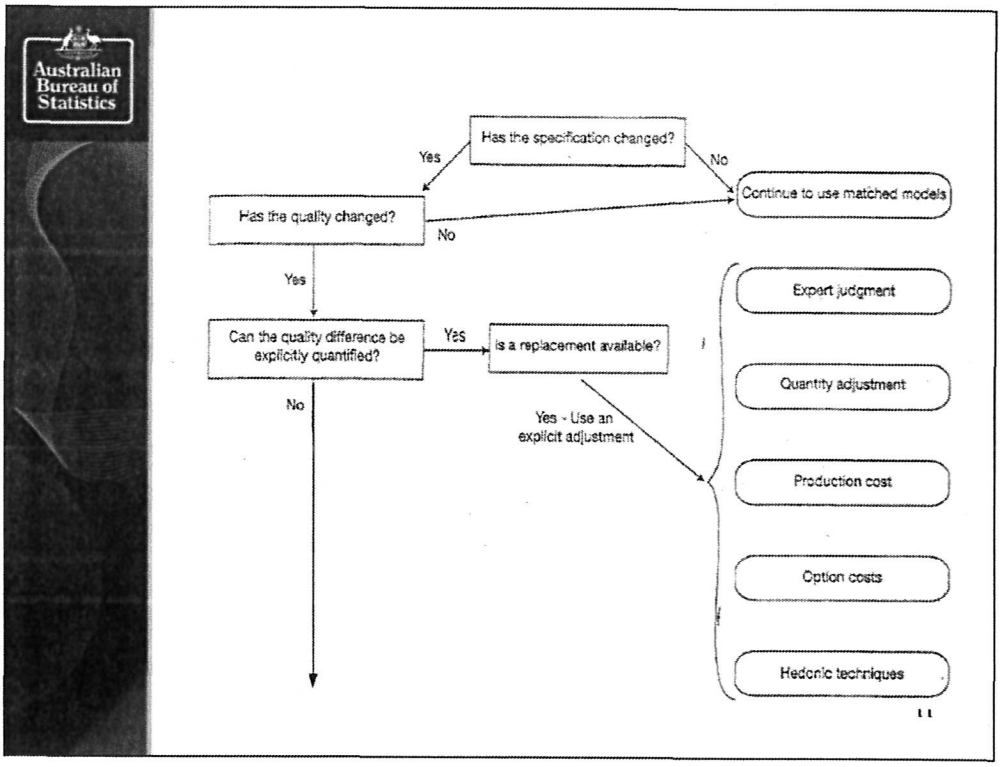
We measure this as a monetary value, but it is not a price change – it is an estimate of the additional amount that a consumer is willing to pay for the new characteristics possessed by the new quality


Australian Bureau of Statistics
Dealing with Quality Change
If the qualities of good or services being compared are not identical, there are effectively four options:
• To ignore the change in quality and compile the price relative as if no difference in quality existed.
• To omit the items in question and not compile a price relative for them at all.
• To adjust the observed price of the new quality for the change in quality which has taken place.
• To treat the two qualities as if they were two separate goods and to estimate their prices in the periods in which they are not sold.
9

[redacted]



This flow chart is in the CPI, PPI and ITPI International manual.



If the specification has changed then questions need to be asked to determine what action is required.

If quality has changed and the quality difference can be explicitly quantified and a replacement is available, then use an explicit adjustment.

What is an explicit adjustment? .....Explicit adjustments use available information to apply a direct estimate of the effect of the quality change on price, such as a change in size or contents.

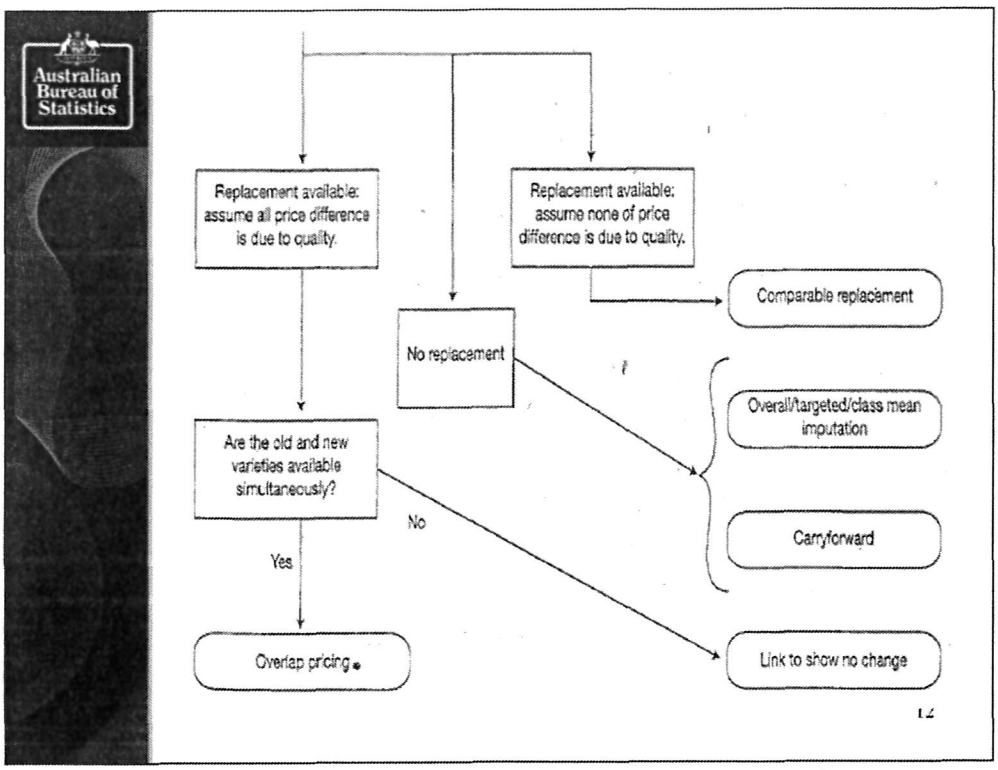
Expert Judgement: Where expert opinions are used to estimate the value of quality change. (incl. the Delphi Method).

Quantity Adjustment: Is applicable to products for which the replacement is of a different size than the available one.

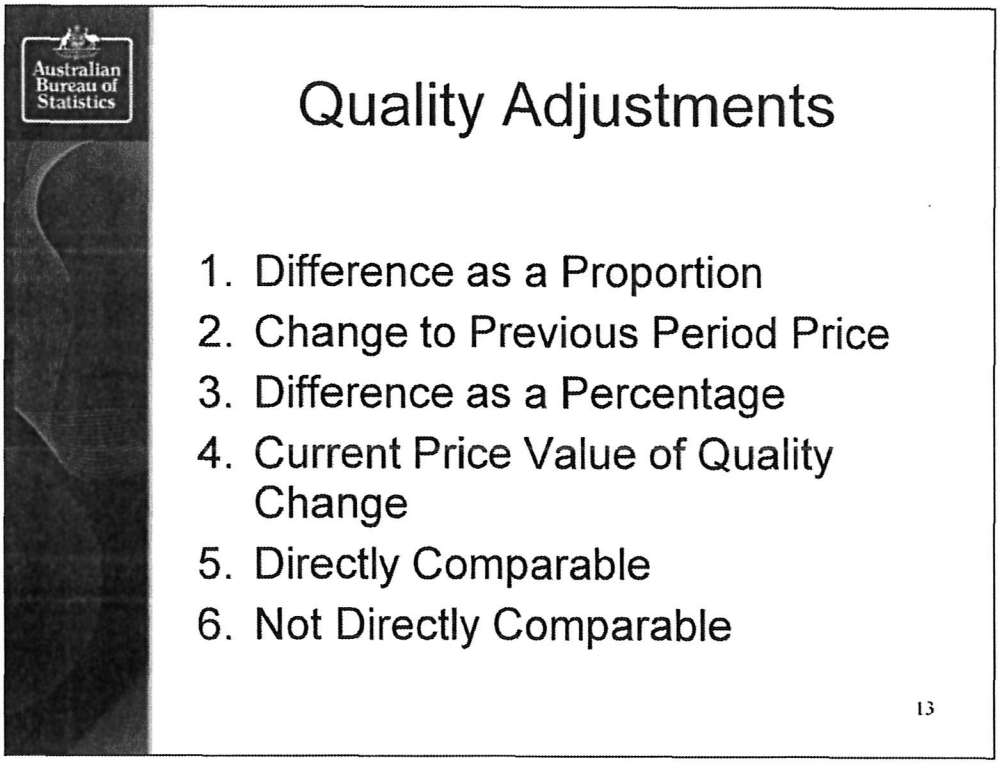
Production Costs: When the difference in the cost of producing an item is used to estimate the change in quality compared to the overall change in price.

Hedonic: Applying a hedonic regression model to estimate how various product characteristics determine the price.

Implicit QA: Using an option which automates the adjustment between goods, such as directly comparable and not directly comparable.

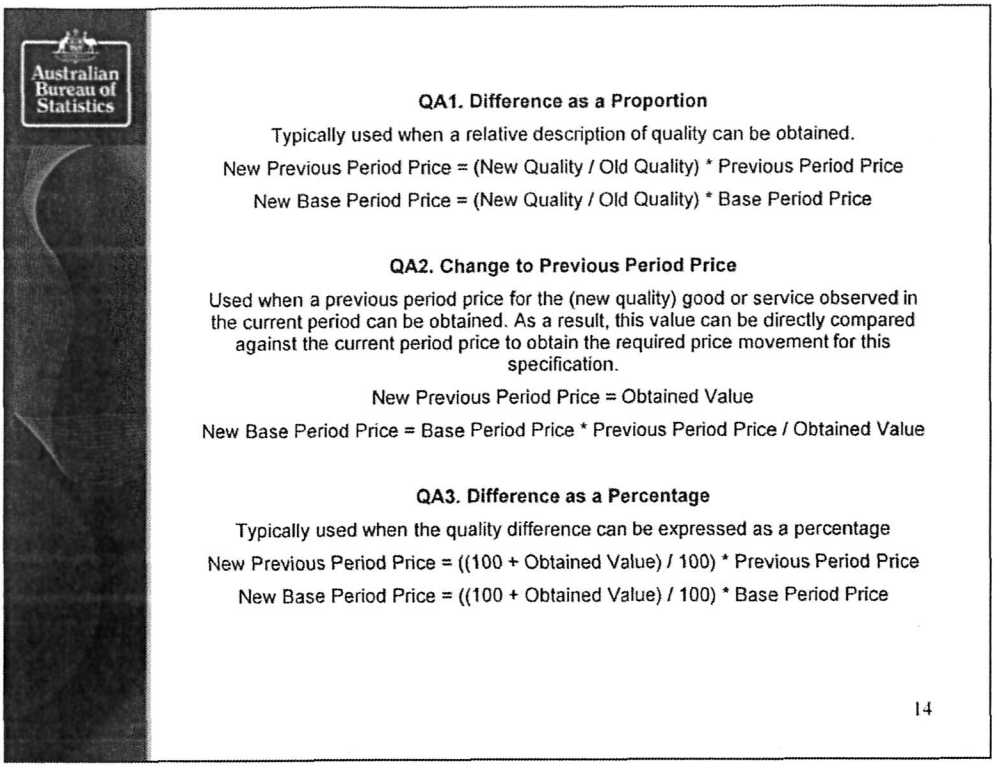


If quality has changed and the quality difference cannot be explicitly quantified, then there are 3 options available.



There are six quality adjustment (QA) that may be applied on a permanent basis; with four of these able to be applied on a temporary basis (QAs 1; 2; 3; & 4).

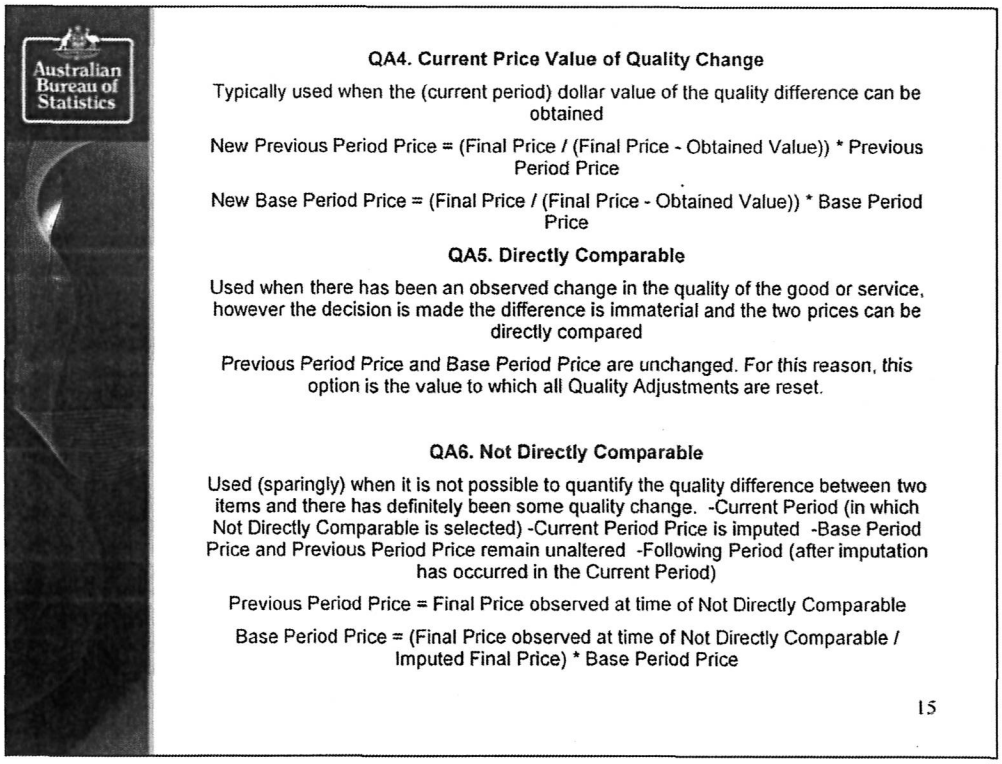
What is the difference between a permanent quality adjustment and a temporary quality adjustment?



QA1 - Typically used when a relative description of quality (rather than dollar value as in 2) can be obtained

QA2 - Typically used when a previous period price for the (new quality) good or service observed in the current period can be obtained. As a result, this value can be directly compared against the current period price to obtain the required price movement for this specification.

QA3 - Typically used when the quality difference can be expressed as a percentage



QA4 - Typically used when the (current period) dollar value of the quality difference can be obtained

QA5 - Used when there has been an observed change in the quality of the good or service, however the decision is made the difference is immaterial and the two prices can be directly compared

QA6 - Used (sparingly) when it is not possible to quantify the quality difference between two items and there has definitely been some quality change. -Current Period (in which Not Directly Comparable is selected) -Current Period Price is imputed -Base Period Price and Previous Period Price remain unaltered -Following Period (after imputation has occurred in the Current Period)

Options for Temporary Quality Adjustment

QA1. Difference as a Proportion

New Current Period Price = (Old Quality / New Quality) * Current Period Price

EG. The price received for a crate of 24 coffee jars in JQ12 was $200. In SQ12, the price received was $250 with the respondent advising there was a one off special whereby each crate of 24 was accompanied by one additional free coffee jar. To implement this quality adjustment, the New Quality is 25 and Old Quality is 24 giving a movement of 20%.

QA2. Change to Previous Period Price

New Current Period Price = (Previous Period Price / Observed Value) * Current Period Price

EG. The price received for a crate of 24 coffee jars in JQ12 was $200. In SQ12, the price received was $400 with the respondent advising the crate consisted of 24 coffee sets valued at $350 in JQ12. To implement this quality adjustment, the Observed Value is $350 giving a movement of 14.29%.

QA3. Difference as a Percentage

New Current Period Price = (100 / (100 + Observed Value)) * Current Period Price

EG. The price received for a crate of 24 coffee jars in JQ12 was $200. In SQ12, the price received was $250 with the respondent advising there was a one off special whereby each the size of each jar was increased by 10%. To implement this quality adjustment, the Observed Value is 10 giving a movement of 13.64%.

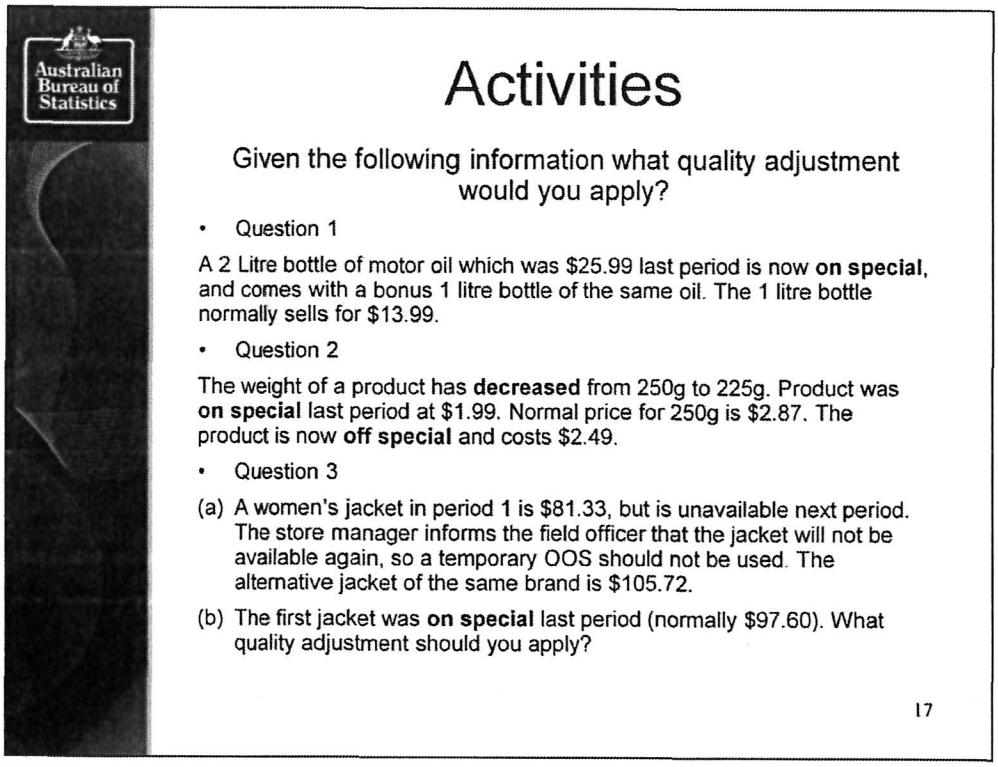
QA4. Current Price Value of Quality Change

New Current Period Price = Current Period Price - Observed Value

EG. The price received for a crate of 24 coffee jars in JQ12 was $200. In SQ12, the price received was $400 with the respondent advising the additional value of the 24 coffee sets was $70. To implement this quality adjustment, the Observed Value is $70 giving a movement of 65%.

16

[redacted]



Given the following information what quality adjustment would you apply?

Question 1.

A 2 Litre bottle of motor oil which was $25.99 last period is now **on special**, and comes with a bonus 1 litre bottle of the same oil. The 1 litre bottle normally sells for $13.99.

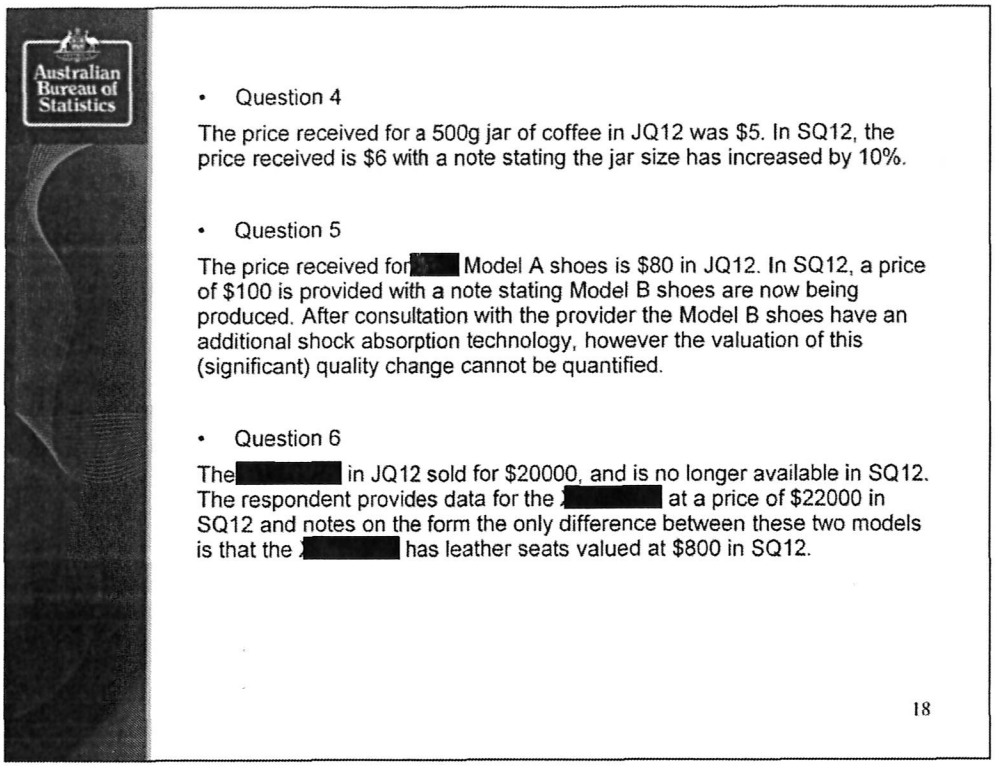
Question 2.

The weight of a product has **decreased** from 250g to 225g. Product was **on special** last period at $1.99. Normal price for 250g is $2.87. The product is now **off special** and costs $2.49.

Question 3.

(a) A women's jacket in period 1 is $81.33, but is unavailable next period. The store manager informs the field officer that the jacket will not be available again, so a temporary OOS should not be used. The alternative jacket of the same brand is $105.72.

(b) The first jacket was **on special** last period (normally $97.60). What quality adjustment should you apply?



Question 4.

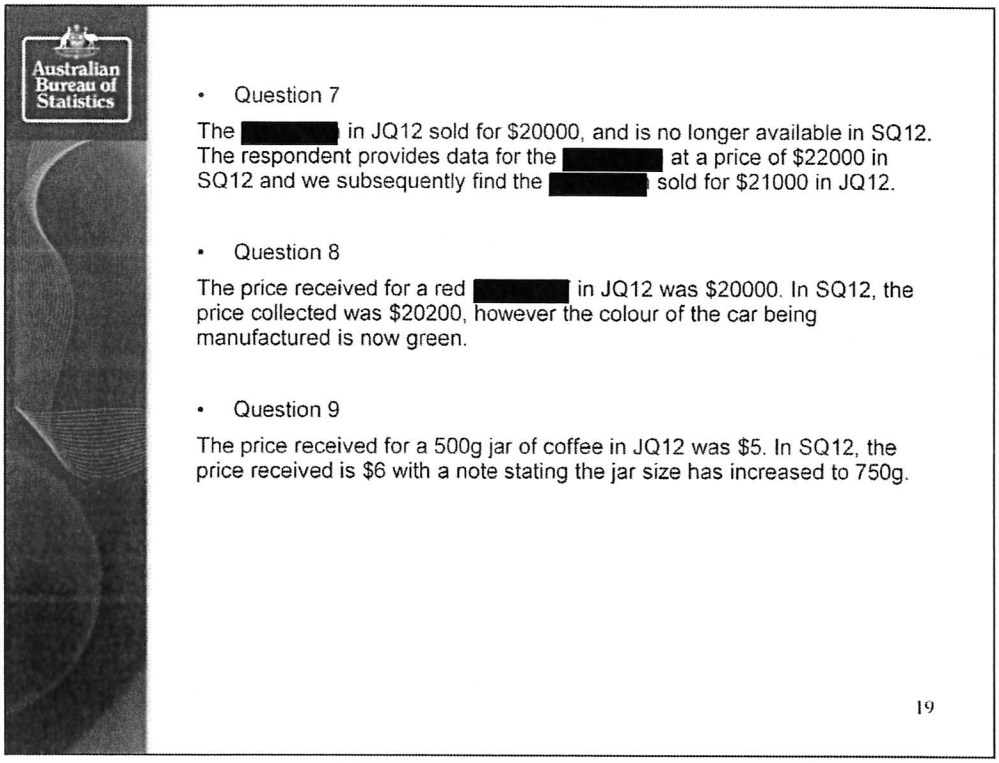
The price received for a 500g jar of coffee in JQ12 was $5. In SQ12, the price received is $6 with a note stating the jar size has increased by 10%.

Question 5.

The price received for [redacted] Model A shoes is $80 in JQ12. In SQ12, a price of $100 is provided with a note stating Model B shoes are now being produced. After consultation with the provider the Model B shoes have an additional shock absorption technology, however the valuation of this (significant) quality change cannot be quantified.

Question 6.

The [redacted] in JQ12 sold for $20000, and is no longer available in SQ12. The respondent provides data for the [redacted] at a price of $22000 in SQ12 and notes on the form the only difference between these two models is that the [redacted] has leather seats valued at $800 in SQ12.



Question 7

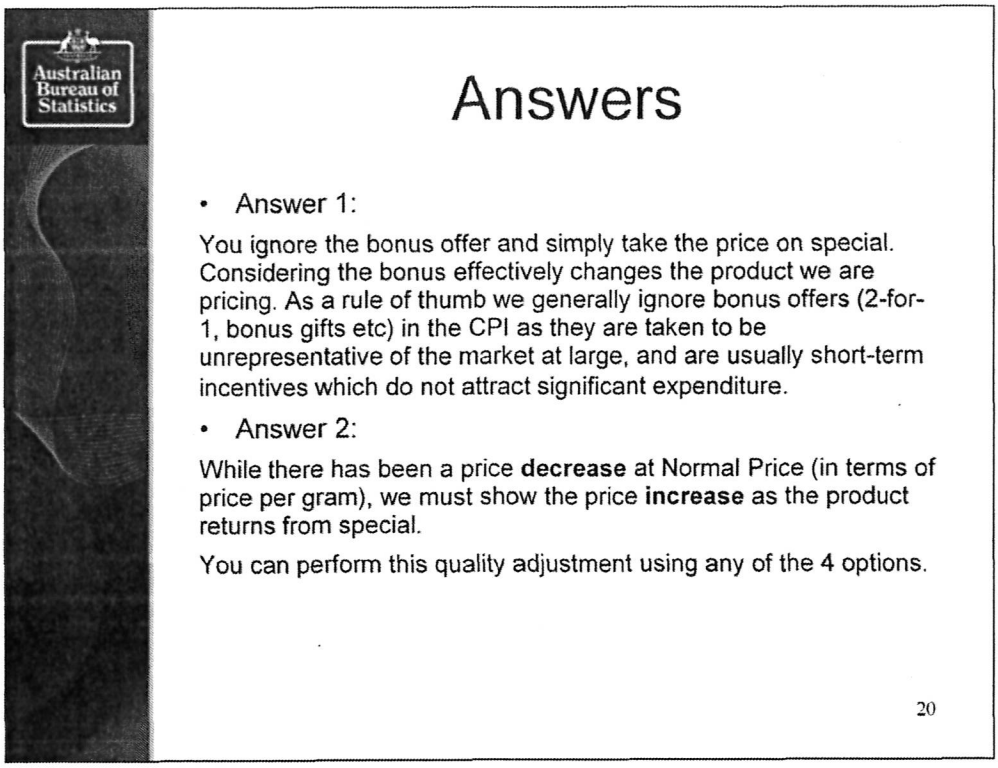
The [redacted] in JQ12 sold for $20000, and is no longer available in SQ12. The respondent provides data for the [redacted] at a price of $22000 in SQ12 and we subsequently find the [redacted] sold for $21000 in JQ12.

Question 8

The price received for a red [redacted] in JQ12 was $20000. In SQ12, the price collected was $20200, however the colour of the car being manufactured is now green.

Question 9

The price received for a 500g jar of coffee in JQ12 was $5. In SQ12, the price received is $6 with a note stating the jar size has increased to 750g.



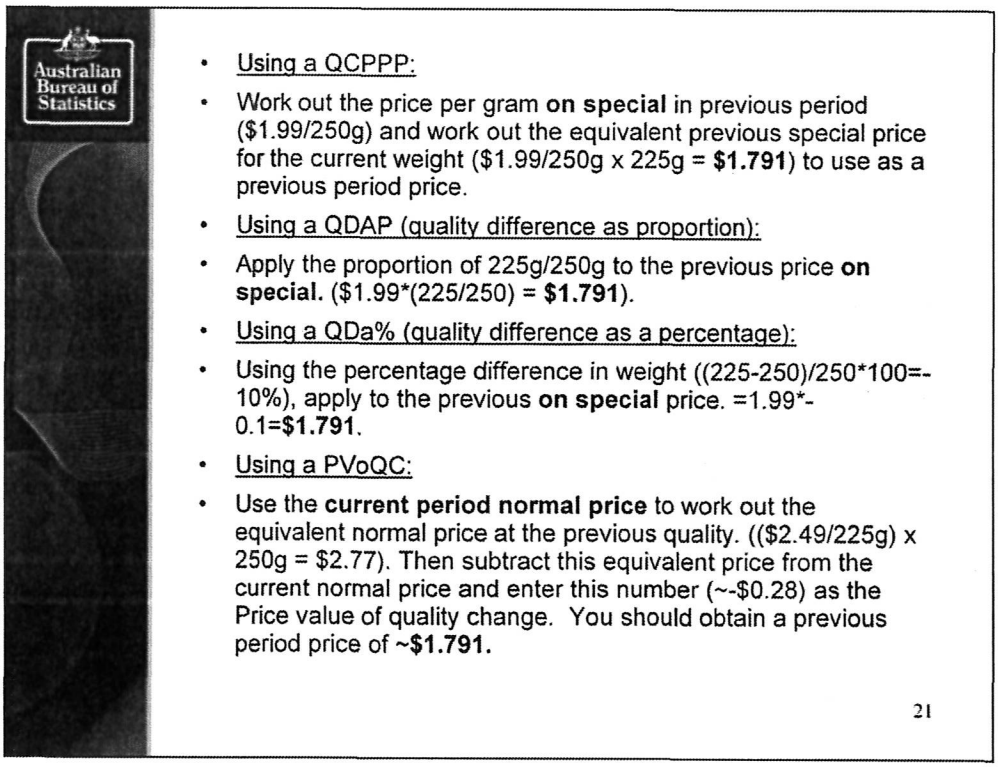
Given the following information what action would you take?

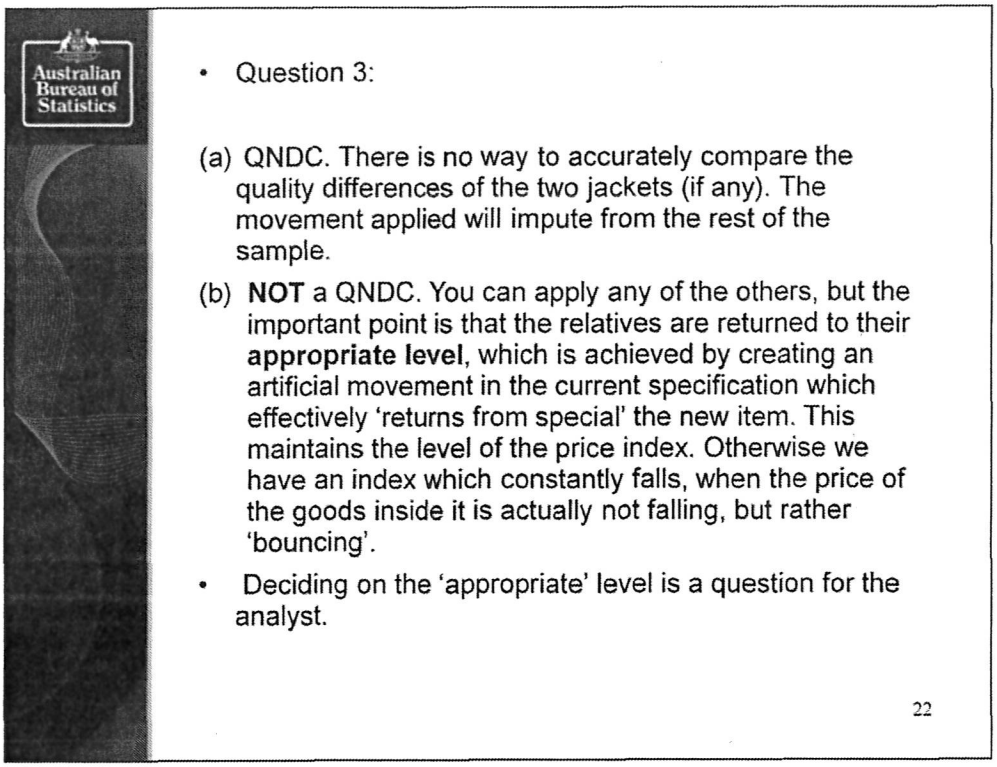
Question 1:

A 2 Litre bottle of motor oil which was $25.99 last period is now **on special**, and comes with a bonus 1 litre bottle of the same oil. The 1 litre bottle normally sells for $13.99.

Question 2:

The weight of a product has **decreased** from 250g to 225g. Product was **on special** last period at $1.99. Normal price for 250g is $2.87. The product is now **off special** and costs $2.49.


Australian Bureau of Statistics
• Using a QCPPP:
• Work out the price per gram **on special** in previous period ($1.99/250g) and work out the equivalent previous special price for the current weight ($1.99/250g x 225g = **$1.791**) to use as a previous period price.
• Using a QDAP (quality difference as proportion):
• Apply the proportion of 225g/250g to the previous price **on special.** ($1.99*(225/250) = **$1.791**).
• Using a QDa% (quality difference as a percentage):
• Using the percentage difference in weight ((225-250)/250*100=-10%), apply to the previous **on special** price. =1.99*-0.1=**$1.791**.
• Using a PVoQC:
• Use the **current period normal price** to work out the equivalent normal price at the previous quality. (($2.49/225g) x 250g = $2.77). Then subtract this equivalent price from the current normal price and enter this number (~-$0.28) as the Price value of quality change. You should obtain a previous period price of **~$1.791.**
21



Question 3:

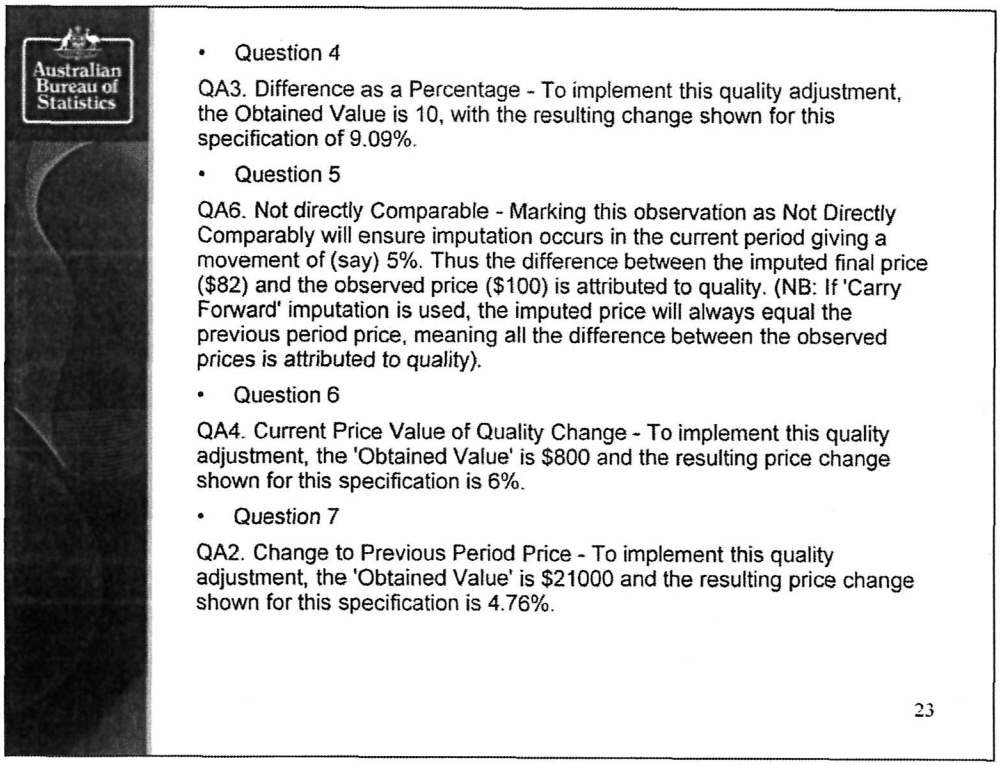
(a) A women's jacket in period 1 is $81.33, but is unavailable next period. The store manager informs the field officer that the jacket will not be available again, so a temporary OOS should not be used. The alternative jacket of the same brand is $105.72.

(b) The first jacket was **on special** last period (normally $97.60). What quality adjustment should you apply?

(a) QNDC. There is no way to accurately compare the quality differences of the two jackets (if any). The movement applied will impute from the rest of the sample.

(b) **NOT** a QNDC. You can apply any of the others, but the important point is that the relatives are returned to their appropriate level, which is achieved by creating an artificial movement in the current specification which effectively 'returns from special' the new item. This maintains the level of the price index. Otherwise we have an index which constantly falls, when the price of the goods inside it is actually not falling, but rather 'bouncing'.

What the 'appropriate' level is is open to debate.

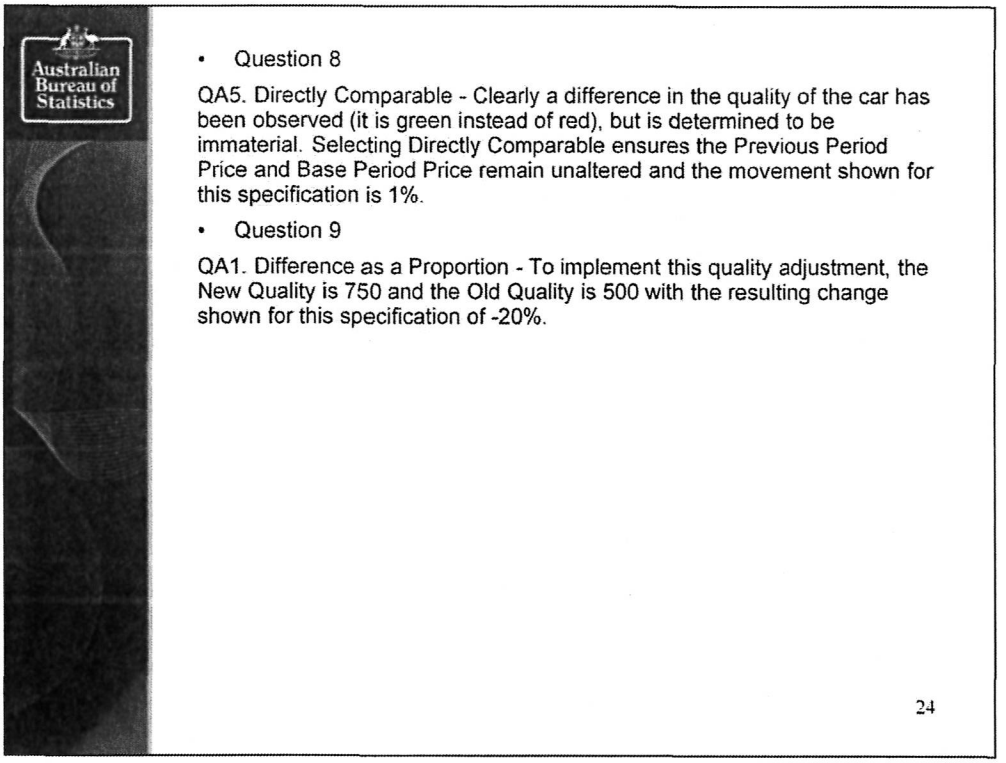


Question 4. The price received for a 500g jar of coffee in JQ12 was $5. In SQ12, the price received is $6 with a note stating the jar size has increased by 10%. To implement this quality adjustment, the Obtained Value is 10, with the resulting change shown for this specification of 9.09%.

Question 5. The price received for [redacted] Model A shoes is $80 in JQ12. In SQ12, a price of $100 is provided with a note stating Model B shoes are now being produced. At the conclusion of editing, the conclusion is the new shoes have an additional shock absorption technology, however the valuation of this (significant) quality change cannot be quantified. Marking this observation as Not Directly Comparably will ensure imputation occurs in the current period giving a movement of (say) 5%. Thus the difference between the imputed final price ($82) and the observed price ($100) is attributed to quality. (NB: If 'Carry Forward' imputation is used, the imputed price will always equal the previous period price, meaning all the difference between the observed prices is attributed to quality).

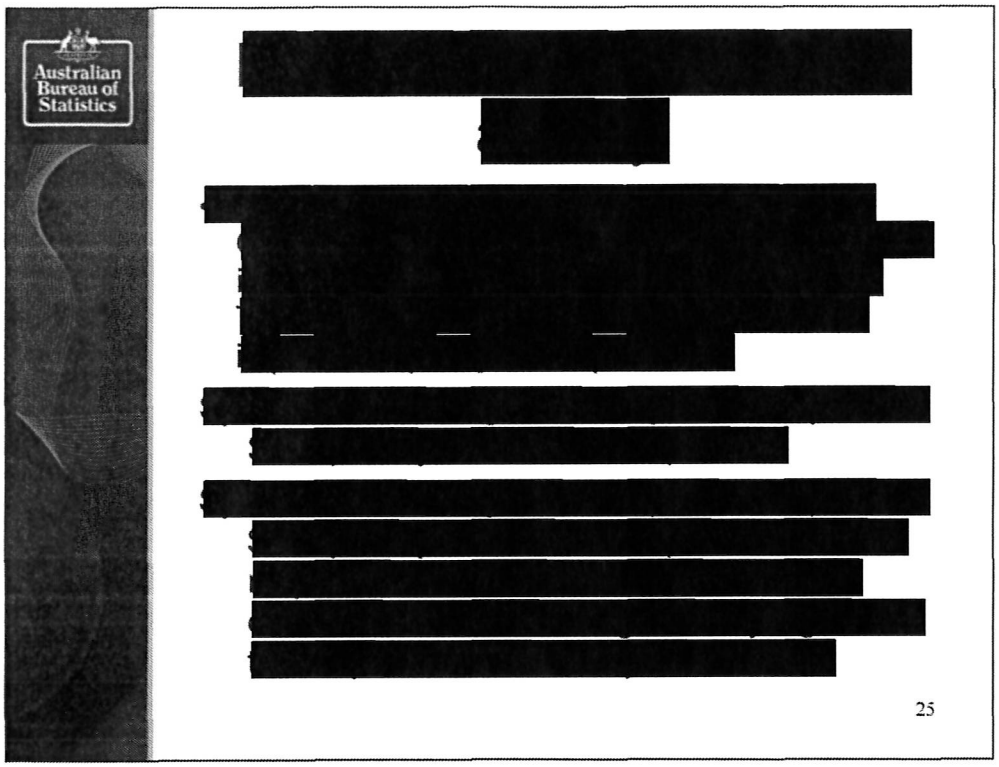
Question 6. The [redacted] in JQ12 sold for $20000, and is no longer available in SQ12. The respondent provides data for the [redacted] at a price of $22000 in SQ12 and notes on the form the only difference between these two models is that the [redacted] has leather seats valued at $800 in SQ12. To implement this quality adjustment, the 'Obtained Value' is $800 and the resulting price change shown for this specification is 6%.

Question 7. The [redacted] in JQ12 sold for $20000, and is no longer available in SQ12. The respondent provides data for the [redacted] at a price of $22000 in SQ12 and we subsequently find the [redacted] sold for $21000 in JQ12. To implement this quality adjustment, the 'Obtained Value' is $21000 and the resulting price change shown for this specification is 4.76%.

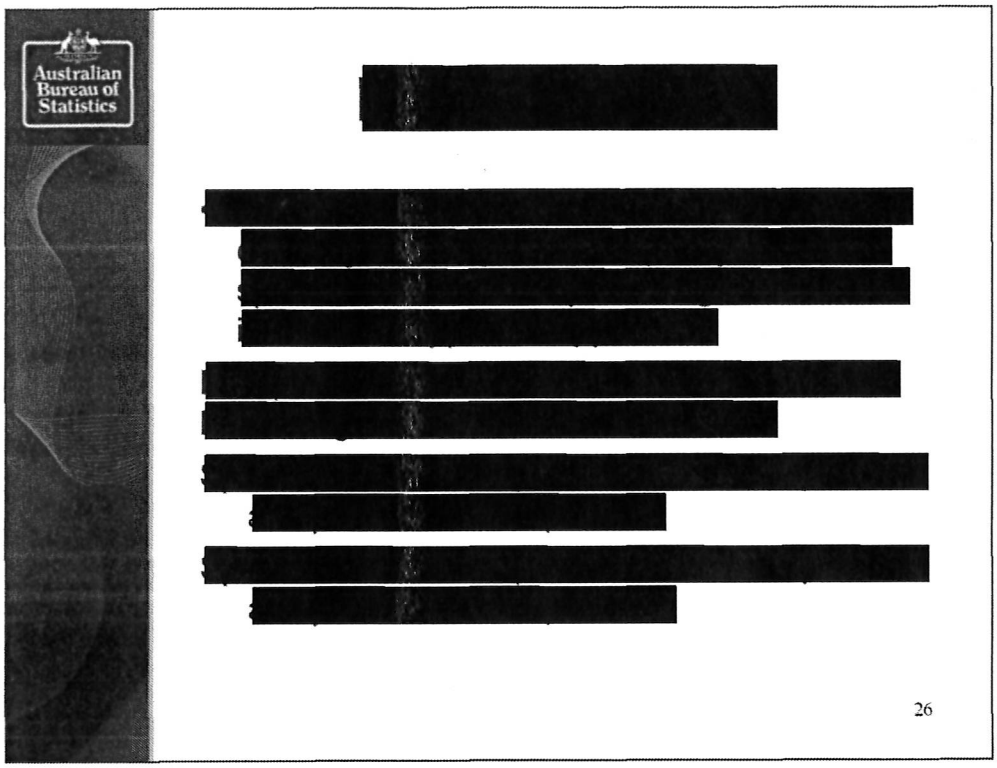


Question 8. The price received for a red [redacted] in JQ12 was $20000. In SQ12, the price collected was $20200, however the colour of the car being manufactured is now green. Clearly a difference in the quality of the car has been observed (it is green instead of red), but is determined to be immaterial. Selecting Directly Comparable ensures the Previous Period Price and Base Period Price remain unaltered and the movement shown for this specification is 1%.

Question 9. The price received for a 500g jar of coffee in JQ12 was $5. In SQ12, the price received is $6 with a note stating the jar size has increased to 750g. To implement this quality adjustment, the New Quality is 750 and the Old Quality is 500 with the resulting change shown for this specification of -20%.


Australian Bureau of Statistics
25

[redacted]

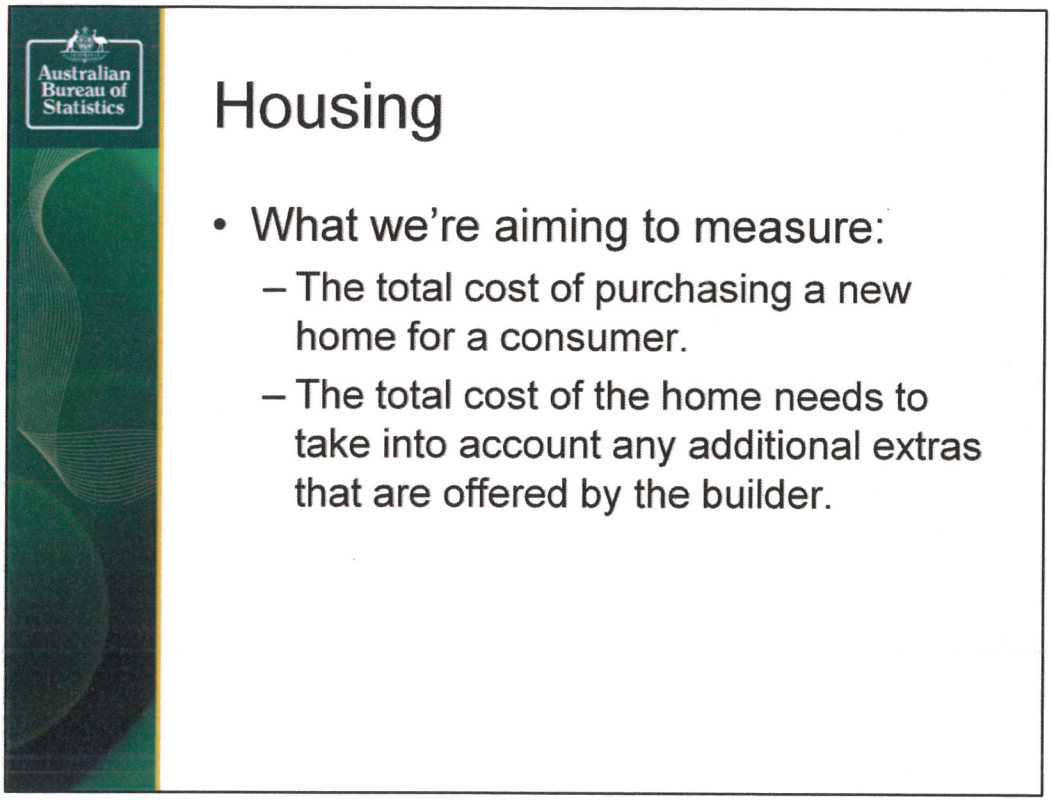


[redacted]

[redacted]

[redacted]

[redacted]



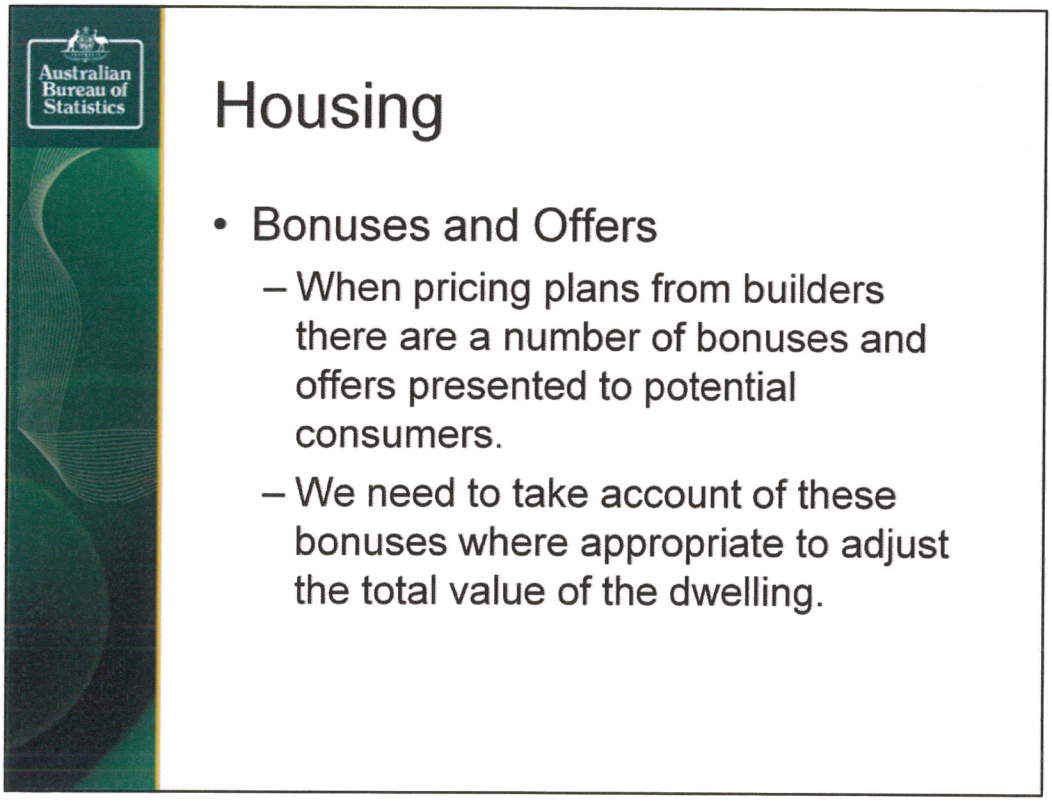
Discussion point: Why are we only looking at new homes within the CPI? I.e. most of the homes we would typically purchase are second-hand homes

Conceptually its difficult to price second hand products to a consistent quality. For example consider two cars that are the same make and model and have the same mileage:

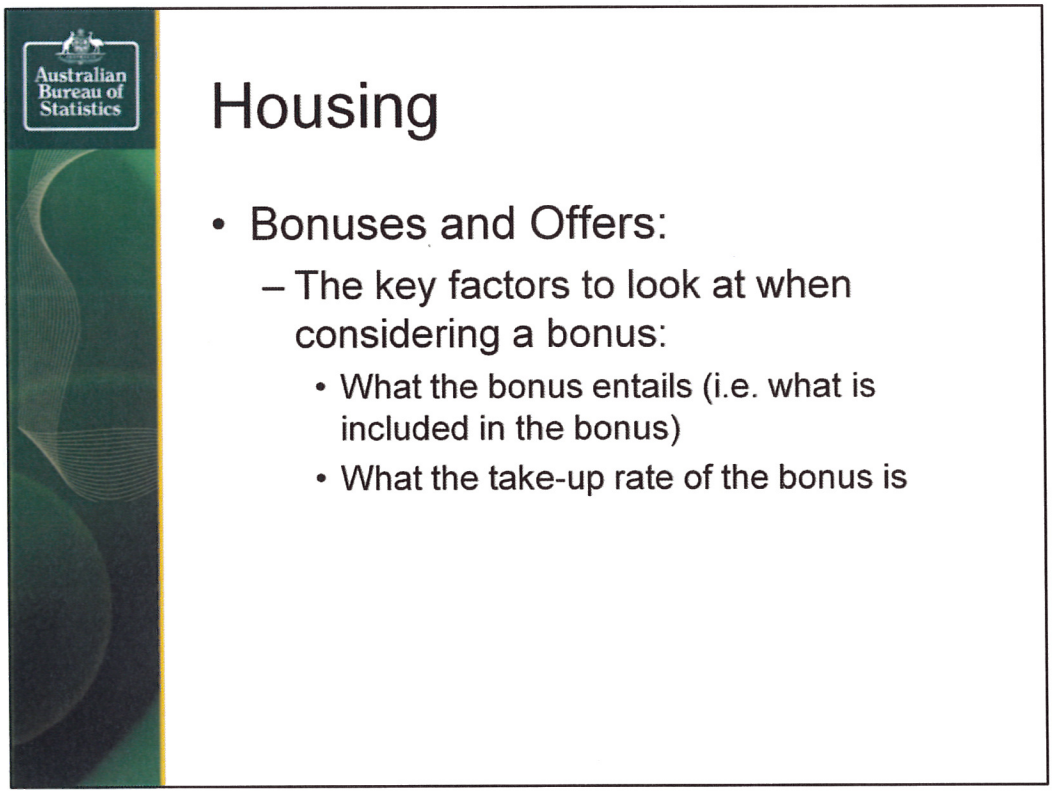
- One owner only drives his car in metropolitan areas
- The second owner drives the car through rough dirt roads

The two cars would not be considered comparable even though on the surface they appear so.

The same principle is applied to housing and to land (putting the investment aspect aside), no one house or piece of land can be considered comparable to another as it is too hard to judge what is considered a comparable quality.

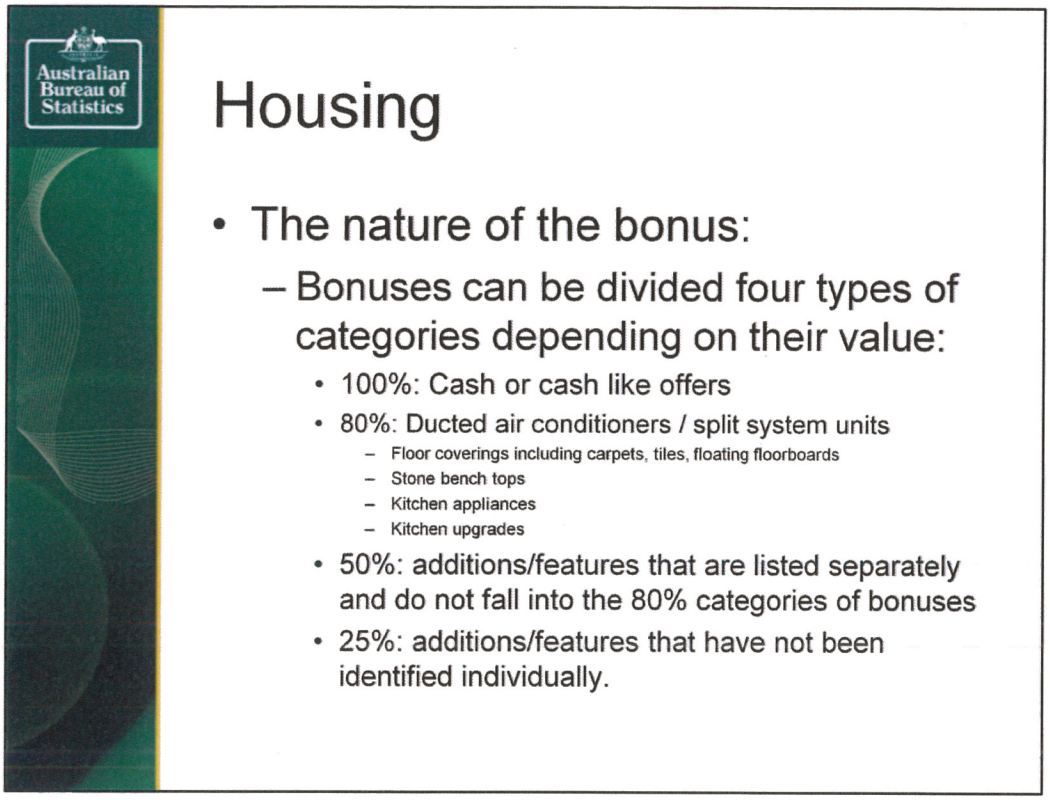


Bonus often offer a number of different additional features. It is imperative that we accurately record exactly what features are being offered and what the acceptable market value is for these features. This in turn allows us to calculate the appropriate "value" that can be attributed to each of these bonuses.



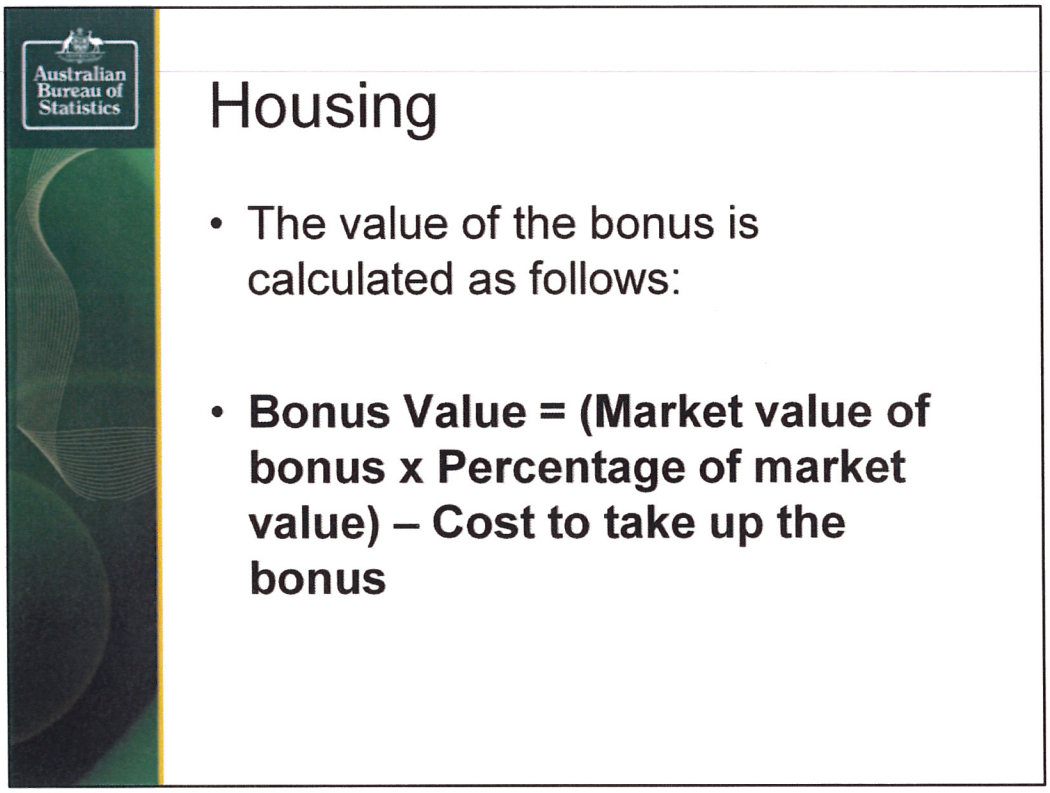
The crucial factors to look at when evaluating a bonus:

- What is included in the bonus (are there items explicitly listed?)
- What is the take up rate of the bonus (i.e. how many people are typically willing to take up the bonus offer)
- Are there any additional costs to taking up the bonus that fall outside the cost of the house?



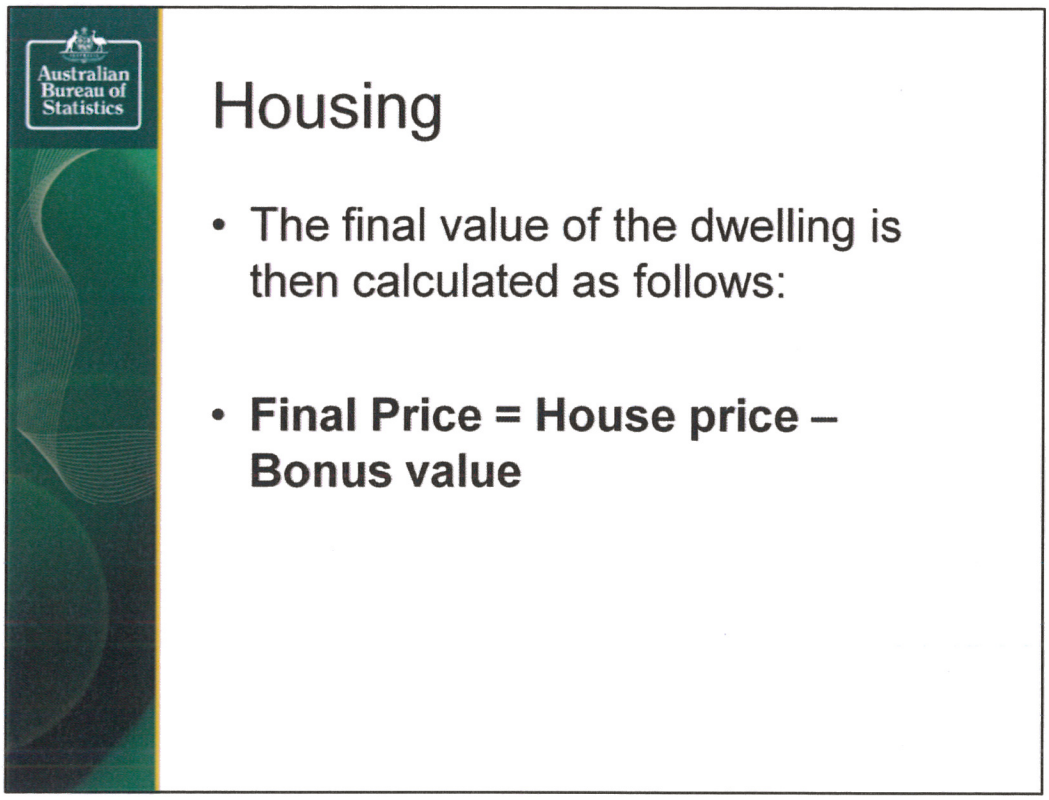
Depending on the type of bonus the market share calculated for that particular bonus will differ. Broadly bonuses are divided into four categories:

- 100% Value: These are typically cash or cash like offer (i.e. 10,000 cash back)
- 80% Value: These are ducted air conditioner/split systems, floor coverings, stone bench tops, kitchen appliances and kitchen upgrades.
- 50% Value: Additions and features that are listed separately but do not fall into any of the 80% categories (i.e. wallpaper)
- 25% Value: Additions and features that have not been listed separately (i.e. $10,000 worth of additional builder's choice features)



The manner in which the bonus value is calculated is outlined on the slide.

Effectively we assign each bonus a % of the market value at which we would value that bonus. The aim of this is to provide a true reflection of the cost of that bonus i.e. cash or cash like offers are given a 100% value because its like receiving a partial refund on the house on the opposite end additional features are valued at 25% as their true value is often 25% of the price which has been advertised to the consumer.



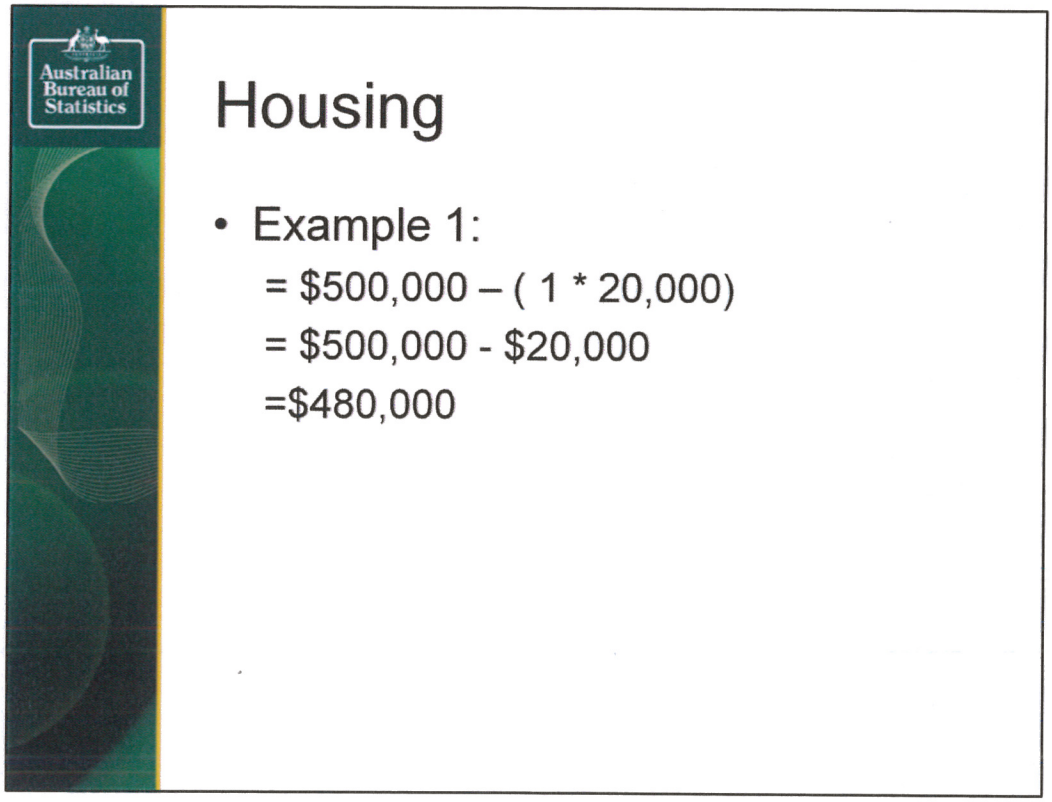
The final price of the house is the house price minus any bonus which is applicable to that house. This provides the net cost of the house paid by the consumer. If the state/territory has a first home owners grant it will be applied to here to gain the net price.

However for the purposes of this presentation we will not be considering the first home owners grant.

Australian Bureau of Statistics

Housing

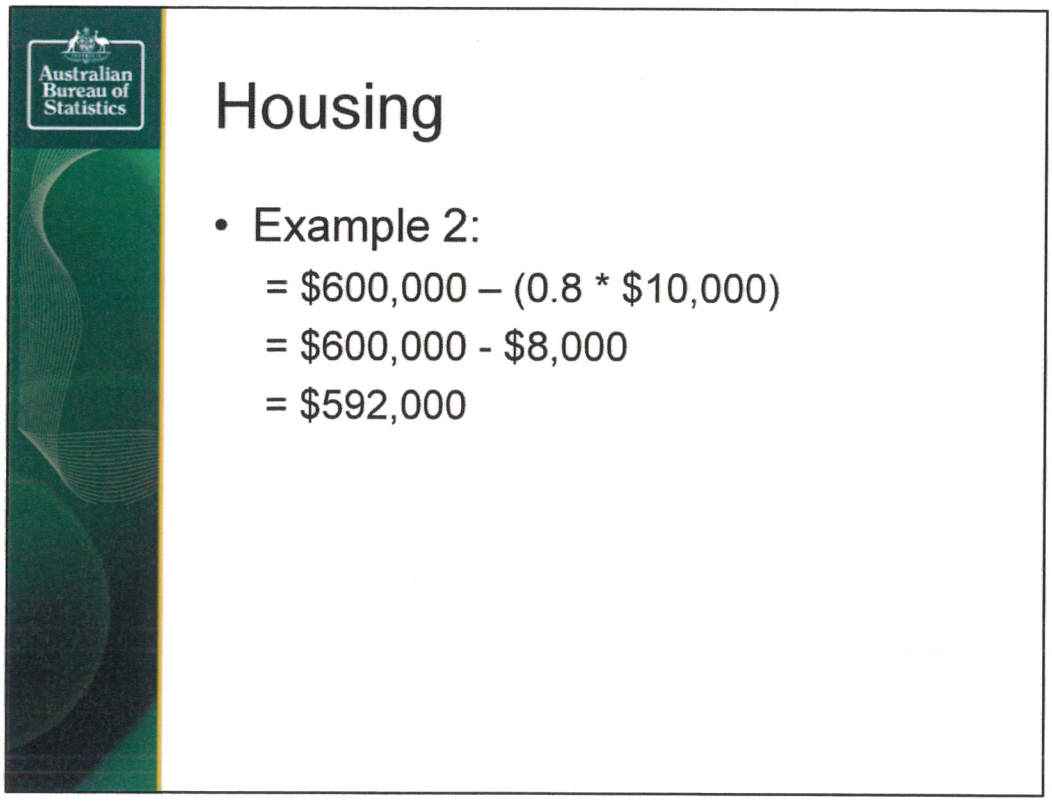
- Example 1:
  - A house valued at 500,000 comes with $20,000 cashback. The builder advised you that all of his customers have taken up this offer.
  - How would you calculate this?


Australian Bureau of Statistics
Housing
• Example 1:
= $500,000 – (1 * 20,000)
= $500,000 - $20,000
=$480,000

Australian Bureau of Statistics

Housing

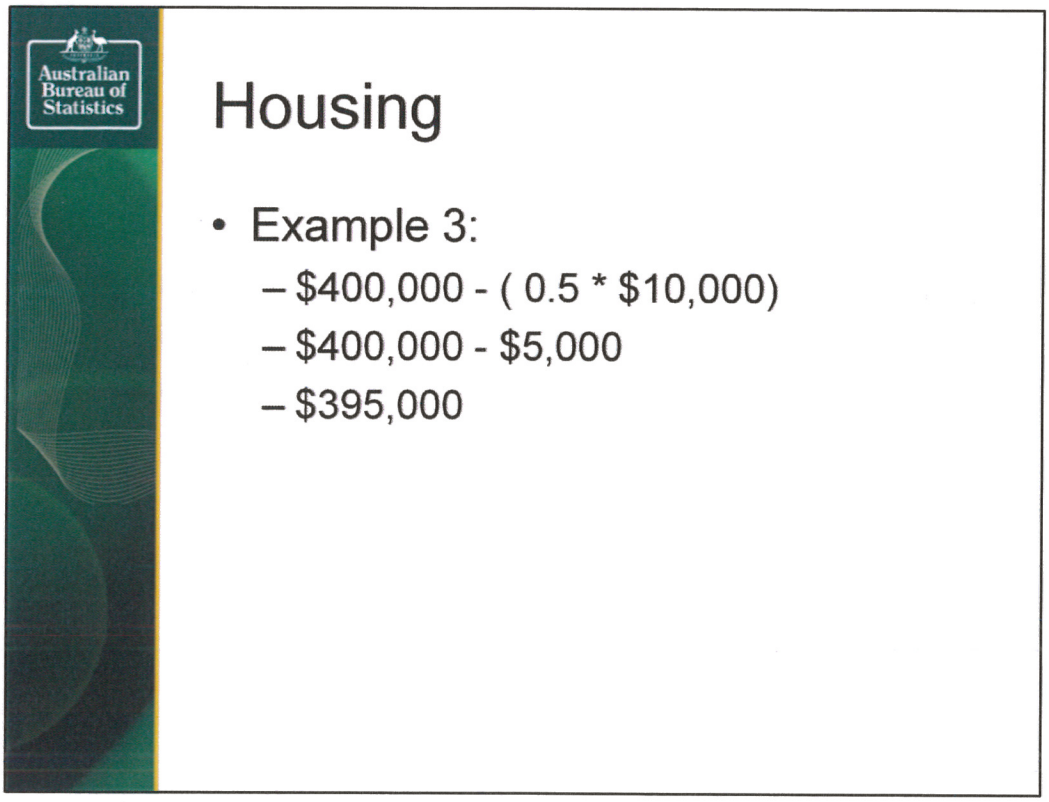
- Example 2:
  - A house valued at $600,000 comes with air-conditioning which has been valued at $10,000.
  - How would you calculate this?

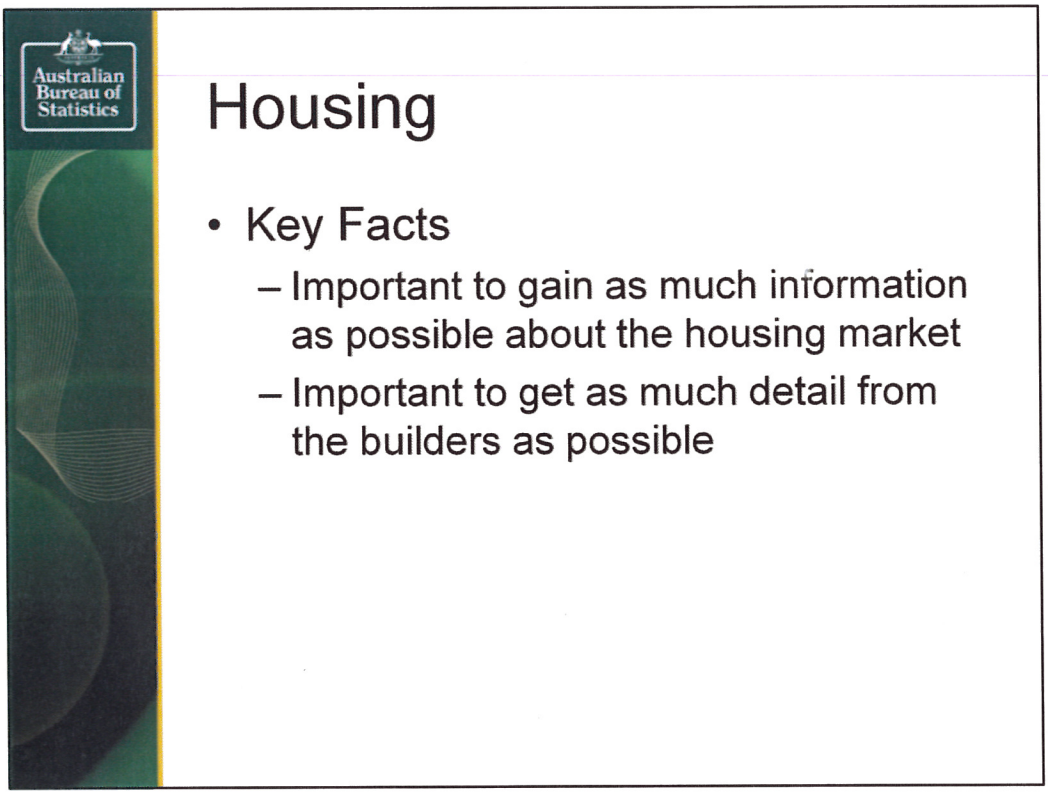

Australian Bureau of Statistics
Housing
• Example 2:
= $600,000 – (0.8 * $10,000)
= $600,000 - $8,000
= $592,000

Australian Bureau of Statistics

Housing

- Example 3:
  - A house valued at $400,000 where the builder provides $10,000 of wallpaper.
  - What would you calculate for this?


Australian Bureau of Statistics
Housing
• Example 3:
– $400,000 - (0.5 * $10,000)
– $400,000 - $5,000
– $395,000



This detail is crucial in order to correctly calculate the net price of the house.