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# *PRODUCER PRICE INDICES*
# *SESSION 3: Quality Adjustment and*
# *Fitness for Use*


# THE DEVELOPMENT OF A CORPORATE
# SERVICES PRICE INDEX  FOR
# BUSINESS RAIL FARES IN THE UK


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**THE DEVELOPMENT OF A CORPORATE SERVICES PRICE INDEX (CSPI)
FOR BUSINESS RAIL FARES IN THE UK**


**Introduction**

The UK's CSPI project aims to produce price indices for all business-to-business services. Indices have so far been developed for about 50 per cent of the corporate services sector. For most industries a quarterly sample survey of prices is established. In some cases alternative, external sources of relevant data are used.

For rail fares a government regulatory body, the Strategic Rail Authority, collects and processes a large amount of data and publishes detailed price indices. Section 1 of this paper describes how these data have been used to construct a price index for business rail fares, currently published by the ONS as an experimental series.

As part of the production of a price index for rail fares, as for many service industries, there must be an assessment of the importance of adjusting for changes in quality. Section 2 outlines a number of considerations regarding possible quality adjustment of a rail fares price index (which may be equally applicable to the consumer price index). No solutions or ways forward have yet been decided though and the considerations are presented at this stage to stimulate further discussion in advance of any exploratory analyses.


# Section 1: Construction of CSPI for business rail fares


### 1.1 The Strategic Rail Authority (SRA)

The SRA is a government-funded organisation responsible for providing overall strategic direction and leadership for Britain's railway. Its roles and responsibilities have been defined following privatisation of the national rail industry in the mid-1990s. The SRA lets and manages passenger franchises, develops and sponsors major infrastructure projects, manages freight grants, publishes an annual Strategic Plan, and is responsible for aspects of consumer protection.  Its Strategic Plan sets out the priorities for Britain's railway over the next ten years and these include the Government's key targets of 50% growth in passenger kilometres, 80% growth in freight moved and an improvement in punctuality and reliability.

The SRA manages the collection, analysis and publication of a wide range of statistical information on the rail industry. The main indicators are published in a quarterly bulletin ("National Rail Trends") which consists of statistics on rail usage, rail performance, fares, rail freight and other topics. For more information see **www.sra.gov.uk/publications**

## 1.2 Methodology for the SRA's rail fares price index

A full description of the methodology used to produce the rail fares price indices published by the SRA is attached at Annex 1. Key points to note are:

- Data are extracted from an automated ticket sales system used by all the rail service operators, representing over 90% of all transactions made;

- Price relatives are calculated for each fares category (ticket type) for each of the 25 Train Operating Companies in Great Britain;

- The "basket" of tickets/journeys is fixed for one year at a time and the index is annually chain-linked, i.e. it gives an indication of what the same set of tickets would cost in one year compared to the next; and

- Indices have been constructed from 1995 onwards and are annual (the vast majority of fares change only in January).

The published indices are shown in Table 1:

## Table 1  Rail fares indices for Great Britain, 1995-2003, by type of operator

Average change in price of rail fares, 1995-2003, at January
(1995 = 100)

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|
| **London and South-East operators** | | | | | | | | | |
| First class | 100.0 | 103.2 | 105.2 | 109.2 | 113.1 | 115.4 | 118.8 | 118.7 | 122.4 |
| Standard class | 100.0 | 103.6 | 105.9 | 109.9 | 112.4 | 113.6 | 115.7 | 115.6 | 118.5 |
| All tickets | 100.0 | 103.6 | 105.9 | 109.8 | 112.5 | 113.7 | 115.8 | 115.7 | 118.6 |
| **Long distance operators** | | | | | | | | | |
| First class | 100.0 | 101.9 | 104.7 | 109.5 | 121.8 | 136.7 | 145.8 | 156.8 | 166.2 |
| Standard class | 100.0 | 101.7 | 104.6 | 108.6 | 114.4 | 120.1 | 122.3 | 127.6 | 132.4 |
| All tickets | 100.0 | 101.7 | 104.6 | 108.8 | 115.6 | 123.5 | 127.3 | 133.8 | 139.6 |
| **Regional operators** | | | | | | | | | |
| First class | 100.0 | 104.0 | 105.8 | 110.8 | 113.9 | 120.8 | 126.5 | 132.5 | 136.7 |
| Standard class | 100.0 | 101.3 | 104.5 | 107.9 | 111.6 | 113.7 | 116.6 | 118.8 | 120.8 |
| All tickets | 100.0 | 101.4 | 104.6 | 108.0 | 111.6 | 113.9 | 116.9 | 119.3 | 121.3 |
| **All operators** | | | | | | | | | |
| First class | 100.0 | 102.3 | 104.9 | 109.5 | 119.4 | 131.5 | 139.2 | 147.6 | 155.6 |
| Standard class | 100.0 | 102.7 | 105.3 | 109.2 | 112.9 | 115.6 | 117.8 | 119.6 | 122.9 |
| **All tickets** | **100.0** | **102.6** | **105.2** | **109.2** | **113.5** | **117.2** | **120.1** | **122.5** | **126.3** |

*Source: Strategic Rail Authority*

## 1.3 Usefulness of the SRA's rail fares indices as they are

Results for <u>standard class</u> rail fares, as shown above, are being used in the UK's Consumer Price Index (CPI), as produced by the Office for National Statistics. The index for first class fares is not used in the CPI because of the relatively high incidence of business travel in this class and also because the CPI excludes the top 4 per cent of households in terms of income. (The assumption is that the highest-income households are more likely to use first class travel.)

From the fares data collected by the SRA it is not possible to produce indices for business travel directly. The purpose of journey is rarely related to the type of ticket. It was originally considered that the index for first class travel could be used as an reasonable approximation for a CSPI for business rail fares. However, survey evidence suggests that a significant amount of business travel is in standard class therefore the approximation would be inappropriate. This is especially so when one considers the radically different price trend for first class compared to standard class since 1998, as indicated in Table 1. The most promising way forward therefore seemed to be a weighted combination of the indices for standard class and first class.

## 1.4 Approach taken

It was decided that data on the purpose of journey collected in the SRA's National Passenger Survey (NPS) could be combined with revenue data by ticket type (collected as part of the fares data). Both sets of data are produced for the same categories of ticket types, enabling an estimate of revenue from business travel to be produced for each ticket type. The estimated proportion of revenue attributed to business travel could then be derived for each class of travel, thereby enabling a weighted combination of the first class and standard class fares indices.

The National Passenger Survey is carried out twice a year by the SRA, primarily to measure passenger satisfaction. Self-completion questionnaires are distributed at almost 1,000 railway stations across the country. Results are based on responses from over 20,000 passengers per survey. Information on the purpose of journey is collected as a means of achieving a representative sample – as well as providing additional analyses. The information on passenger satisfaction may possibly be useful in assessing changes in the quality of services provided (see section 2). Table 2 shows the percentage of journeys for each ticket type recorded as being on business:

**Table 2 National Passenger Survey data: purpose of journey** (2000-01)

|  | % of journeys on company business (or own if self-employed) |
|---|---|
| All ticket types | 13% |
| 1st class single/return | 58% |
| 1st class season | 6% |
| Standard single/return | 23% |
| Cheap day single/return | 12% |
| Saver/supersaver | 18% |
| Awaybreak/Stayaway | 6% |
| Apex/superapex | 10% |
| One day travelcard | 22% |
| Standard weekly/monthly/annual season ticket | 2% |
| Other | 5% |

The results show that just over a half of passengers in first class were travelling on business. Some significant proportions of travellers in standard class were also on business.

Table 3 shows the number of journeys and revenue for each ticket type in the year 2000. The patterns for 2001 and 2002 are not shown but are very similar. The table shows that first class rail travel in 2000 represented 1% of all journeys and about 8% of all revenue.

**Table 3  Journeys and Revenue by ticket type, 2000**

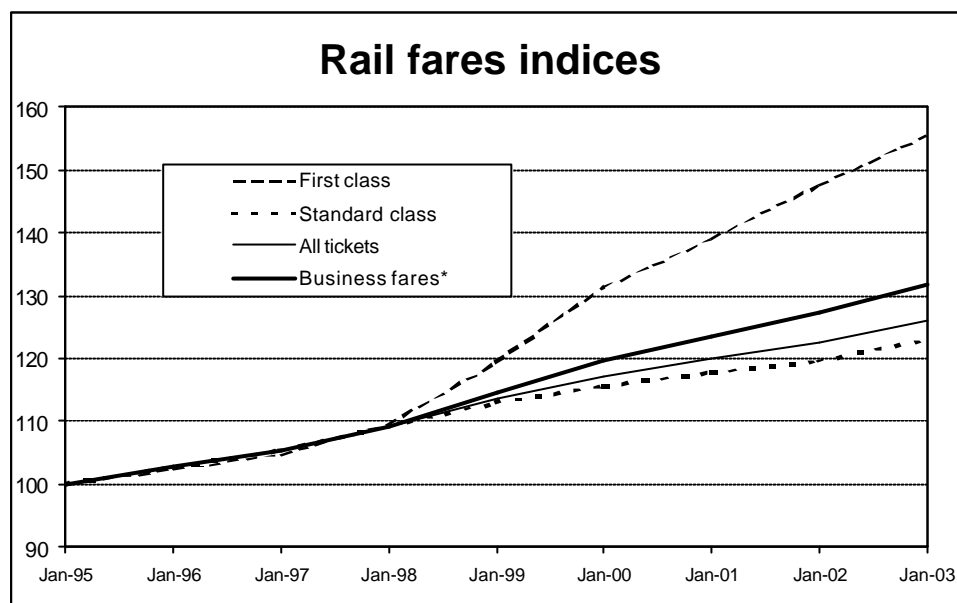| | Journeys | | Earnings | |
|---|---|---|---|---|
| | Number (millions) | Percentage share | £ million | Percentage share |
| 1st class single / return | 5.6 | 0.6% | 229.3 | 6.6% |
| 1st class season | 4.6 | 0.5% | 37.2 | 1.1% |
| Standard single / return | 152.9 | 15.8% | 555.2 | 16.0% |
| Cheap day single / return | 154.3 | 16.0% | 332.3 | 9.6% |
| Saver / supersaver | 44.1 | 4.6% | 506.8 | 14.7% |
| Awaybreak / Stayaway | 10.0 | 1.0% | 70.1 | 2.0% |
| Apex / Superapex | 9.5 | 1.0% | 97.2 | 2.8% |
| One Day Travelcard | 120.3 | 12.5% | 199.7 | 5.8% |
| Standard weekly / monthly / annual season ticket | 422.3 | 43.8% | 933.5 | 27.0% |
| Other | 40.9 | 4.2% | 497.9 | 14.4% |
| Total | 964.4 | 100.0% | 3,459.2 | 100.0% |

Source: Strategic Rail Authority

The purpose of journey data can be combined with the revenue data to estimate the revenue from business travel for each ticket type, as shown in Table 4.

Table 4

| | % of journeys on company business (or own if self-employed) | Revenue in 2000 | | Estimated revenue from business travellers | |
|---|---|---|---|---|---|
| | | (£m) | As % of total | (£m) | As % of total |
| | (1) | (2) | (3) | (4)=(1)*(2) | (5) |
| Total | 13% | 3,459.2 | 100.0% | 496.7 | 100.0% |
| 1st class single/return | 58% | 229.3 | 6.6% | 133.0 | 26.8% |
| 1st class season | 6% | 37.2 | 1.1% | 2.2 | 0.4% |
| Standard single/return | 23% | 555.2 | 16.0% | 127.7 | 25.7% |
| Cheap day single/return | 12% | 332.3 | 9.6% | 39.9 | 8.0% |
| Saver/supersaver | 18% | 506.8 | 14.7% | 91.2 | 18.4% |
| Awaybreak/Stayaway | 6% | 70.1 | 2.0% | 4.2 | 0.8% |
| Apex/superapex | 10% | 97.2 | 2.8% | 9.7 | 2.0% |
| One day travelcard | 22% | 199.7 | 5.8% | 43.9 | 8.8% |
| Standard weekly/monthly/annual season ticket | 2% | 933.5 | 27.0% | 18.7 | 3.8% |
| Other | 5% | 497.9 | 14.4% | 26.1 | 5.3% |
| **1st class** | | **266.5** | **7.7%** | **135.2** | **27.2%** |
| **Standard** | | **3,192.7** | **92.3%** | **361.4** | **72.8%** |

Consequently weightings of 27% for first class and 73% for standard class were applied to the SRA's published rail fares indices to produce a CSPI for business rail fares. Note that weightings derived from revenue data for 2001 and 2002 varied little from the estimates derived for 2000. The results are illustrated in the following chart:

**Rail fares indices**



## 1.5 Commentary

The chosen approach combines detailed data taken from ticket sales systems with well-established survey data with commonly defined categories (ticket types). The estimation of revenue from business travel is based on proportions of journeys undertaken and takes no account of the distances of the journeys taken within each ticket type. If business travellers were more likely to take longer journeys than other passengers then the revenue could be underestimated. There is insufficient data to test this, however. The fact that the data are separated into detailed ticket type categories may alleviate some concerns in this respect as length of journey can be a determinant for some ticket types.

Results are currently produced once a year. This is because nearly all changes in rail fares occur in January each year, mainly due to the rules associated with the rail operator franchises currently in place. These restrictions may be lifted in the future and the SRA may compelled to calculate and indices on more frequent basis. This may not happen in a significant way for several years yet. Nevertheless, there may be some in-year price changes that may need to be reflected in the CSPI. Additional price collection has been set up that collects rail fares data from train operators' internet sites, for the most popular journeys. If price changes are detected then, if significant enough, the information collected should perhaps be used to adjust the price indices as published by the SRA.

The UK Consumer Price Index is using the SRA indices for standard class journeys. There is therefore consistency between CPI and CSPI and there may be an extension of this consistency to national accounts. The output measure of GDP currently uses passenger kilometres as the output indicator. However, detailed revenue data and appropriate price indices may provide a viable alternative.


## Section 2: Quality adjustment

<u>Introduction</u>

Changes in quality of rail services would appear to be a significant issue in the development of a price index for rail fares. Different types of quality change may be relevant, e.g.:

- Changes in the number and range of on-board facilities and services;
- Changes in performance/punctuality,

Any approach to adjusting for these changes in quality is likely to require the collection additional data and using it in an appropriate way. This section considers what things may be relevant and describes some existing and potential sources of data. Little significant research has yet been undertaken. It is currently viewed that more general discussion of the importance and possibilities in the case of rail fares will help to decide the way forward.

<u>Discussion</u>

The rail fares indices published by the SRA relate to the prices of actual tickets sold for journeys undertaken. Account is also taken of different qualities of product through the collection of data by detailed ticket type and for which the weights are updated annually. New ticket types are incorporated into the indices every year. No direct account is taken of changes in the *quality* of the services provided i.e. after the transaction has been made.

Railways are a relative rarity in the service sector in that there exists a number of possible objective quality measures, such as delays, frequency, timetabled time taken and cancellations. Following the serious crash at Hatfield in the UK in October 2000 there was a long period of serious delays to the railways as tracks were checked for faults. However, the delays caused by this work are not reflected in the price indices, despite the obvious short term decline in quality from the perspective of rail users.

But quality adjustment for rail travel is not a simple conceptual issue. Some aspects of quality are unknown at the time the ticket is purchased. Consumers make the decision to travel by train based on a personal expectation of possible delays, cancellations etc. Overall quality may only be assessable after the service has effectively been consumed (i.e. the journey completed). This may rule out quality adjustment processes used for
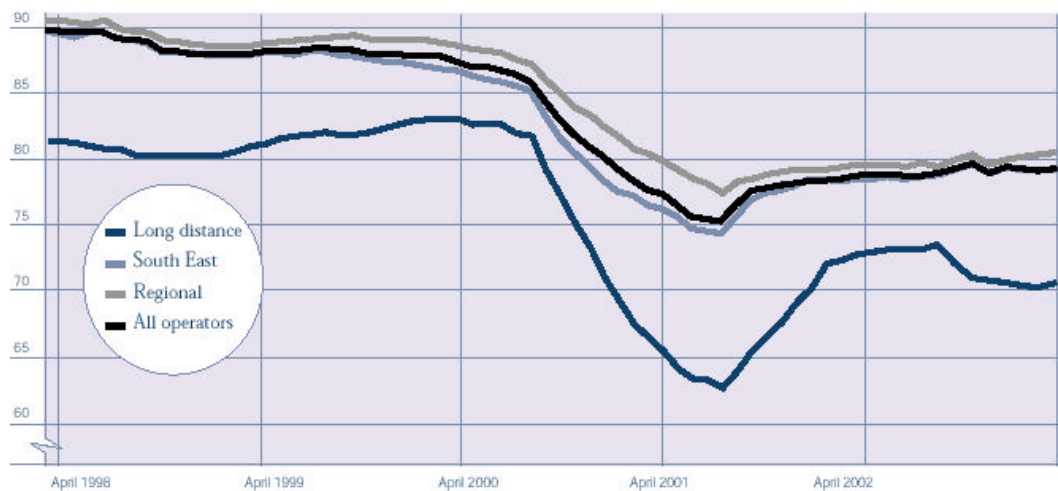
goods such as hedonic methods as quality is, to some extent, a random variable at the time of purchase, not a quantifiable factor in the consumption decision.

One possible approach is to adjust for delays and cancellations by valuing the time lost. We could then value the extra time added to their journey caused by delays, and use a "willingness to pay" to convert this time into a monetary value, a similar approach to that outlined by Utsunomiya (2002) for dealing with speed improvements in the Japanese rail network. One way to implement this approach may be to combine real time train delay data with prices, and adjust the actual fares before they are fed into the weighted index.

Potential data sources

The SRA collates data from an automated monitoring system which logs performance of individual trains, usually using signalling equipment. Arrivals at destinations are compared to the timetables in use at the time. Using these data a quarterly "Public Performance Measure" is produced that combines measures for punctuality and reliability into a single performance measure, as illustrated in the chart below:

**Public performance measure: moving annual average of percentage of trains arriving on time 1998-99 to 2002-03**



As the graph shows, performance for all train operators has fallen from about 90 per cent in 1998 to less than 80 per cent in 2002. The biggest effects are on long-distance operators, as might be expected.

Another potential source of information on which some form of quality adjustment process may be developed is the SRA's National Passenger Survey (NPS), mentioned earlier. Analysis of the results of the autumn 1999 to autumn 2002 surveys shows that the top 10 factors affecting passengers' satisfaction are:

1. Punctuality/reliability
2. Handling of delays
3. Length of scheduled journey time
4. How station staff deal with requests for help or information
5. Ease of getting on and off the train
6. Amount of seats/standing space on the train
7. The station providing an adequate environment to catch the train
8. Frequency of trains
9. Train cleanliness
10. Comfort of seating area on the train

Passengers' views on all the above plus other indicators are collected regularly for all train operators and may be available for different kinds of journeys, (and so may be related to the ticket type). The fact that punctuality and delays are the most important factors may suggest that any quality adjustment approach ought to focus on these things first.

Other aspects of quality may be assessable at the point of purchase and may be easier to identify from the service provider's perspective (like for most PPIs),e.g:

- journey time improvements caused by electrification/faster trains;
- changes to the entitlement to complimentary drinks:
- comfort improvements provided by the introduction of new carriages; and
- provision of lap-top docking points etc.

Such characteristics may be regarded as relating to the *facilities* or *services* associated with the journey. It may be possible that passengers' perceptions of changes to the facilities provided may be a good indication of the actual changes made (and which may or may not be reflected in actual price changes). Therefore there may be scope to use the NPS observations in some way to adjust for the changes in the quality of the facilities and performance.

Further considerations

The chosen approach may have to be applied differently for business rail fares compared to non-business fares. There are some distinctions between first and standard class in terms of the facilities provided (newspapers etc), and therefore some changes in quality may have a different impact on business travellers than other changes.

By comparison, with PPIs for manufactured goods there is not normally any consideration of changes in the reliability of the goods produced, e.g. in terms of the

percentage that are faulty. This is mainly because such an adjustment is not possible and, in most cases, is unlikely to be have a significant effect on price.

**Summary**

In the short term it appears that an approach to quality adjustment should focus on performance and reliability, following a more detailed assessment of their significance and their impact on price. The issue is being considered by ONS' consumer price index division as well as that of the CSPI.

**SRA Fares Price Index**

**Background**

**Aims of the Index**

The SRA's duties include the promotion of efficiency and economy by railway service providers, protecting the interests of users of railway services, ensuring taxpayers' contributions achieve value for money and keeping under review the level of rail fares. Critical to the effective delivery of these objectives is reliable, comprehensive and robust data on fares and changes in fare prices. Specifically, the SRA will use such data for the following:

(i)     To monitor Operators and their pricing policies and monitor changes in unregulated fares.

(ii)    To monitor the success of SRA policies and to use the information to help form future SRA policy.

(iii)   To assess the impact of changes in the level and the structure of fares by allowing analysis of historical demand trends

(iv)   For wider statistical briefing, including provision of the rail component of the official Retail Price Index (RPI), calculated by the Office for National Statistics.

**What the Fares Price Index measures**

The Rail Fares Price Index provides a measure of the change in the prices charged by Train Operating Companies (TOCs) to rail passengers. The Fares Price Index takes into account the range of price changes experienced by passengers and presents the average change in prices taken from the millions of transactions that take place each year. Essentially, the Index gives an indication of what we would need to spend in order to purchase the same set of tickets we chose to buy in a previous year. Some passengers will have experienced greater or lesser fares changes than shown by the average changes calculated.

**Coverage of the Fares Price Index**

It has been our aim to represent all rail travel in England, Scotland and Wales in the index.  We have therefore sought, as far as is practically possible, to construct the index so that it covers the costs of travel only. This is done by excluding fares which include 'extras' in order not to distort the index. Where the purchase of a 'rail' ticket includes additional services such as multi-modal tickets for urban areas, bus tickets, entrance fees to attractions etc. they have been excluded from the Index. An exception to this is the London Travelcard. We have included these in the index because such tickets are so important in the earnings of train operators and purchases by rail passengers. In addition, Train Operators influence price changes associated with these tickets. We are, however, able to recalculate the index excluding Travelcards if required. Other exceptions are set out later in this note.

**Frequency**

We are constructing annual indices which reflect the change in price from one January to the next. This means that the latest index is able to take account of the most important price changes, conventionally taking place in early January. As a result, the indices are comparing two snapshots of prices and do not take account of intermediate temporary changes such as limited special offers. In addition, because the index is based on comparing two annual price observations, there is an inevitable lag in taking account of some changes in the pattern of ticket purchases. For example, if an Operator introduces a new ticket type during the year that encourages passengers to switch from an existing ticket, the index will only properly take account of this from the following January.  This does not distract from the provision of an accurate picture of price changes between the two reference dates and, over a longer period, a measure of price change trends.

Although most changes to permanent fares take place in January, operators are permitted to make changes at other times. The case to construct the indices more frequently will be given further consideration if there is a significant move to price changes at other times.

**Method**

**Price Index Construction**

The method we have chosen to use for constructing this Price Index is a variant of the base weighted (Laspeyres) Index. A base weighted index takes the expenditure weights from the base year. The weights and items being measured – 'the basket of goods' - are then held constant throughout the period of comparison. The main advantage of this approach is that it allows like with like comparisons over time, and reveals changes only in price. In its purest form, however, the further away from the base year we move, the less relevant the weights, as the Laspeyres Index assumes a frozen pattern of consumption. As a result this type of index does not reflect the introduction of new products or changes in the relative importance of ticket types over time.

We have used a chain-linked Index in order to avoid this weakness. Each year a separate index based on the preceding year's weights is produced, and each year's indices are then chained together to produce an index covering several years. For example, price comparisons between Year 1 and Y2 use weights reflecting purchasing patterns in Year 1; comparisons between Y2 and Y3 use weights reflecting purchasing patterns in Year 2 and so on. In other words, each paired year comparison is based on an identical set of tickets/journeys. The main advantage of this methodology is that it allows updated weights to be used (ensuring the index's relevance) and comparisons to be made over any time period.

**Weighting the Index**

More is spent on some tickets/routes than on others and we would expect, for example, that a change in the price of tickets on a popular commuting route to have a considerably greater impact on the index than, say, a quiet rural route. The components of the index (i.e. each flow or route/ticket type combination) are therefore weighted (by flow earnings as a proxy for expenditure) to ensure that the index carefully reflects their importance. The latest weights (used for the comparison of January 2001 and January 2002 prices) are set out in the accompanying table.

The weights for the index are derived from the CAPRI ticket sales system (the system used by operators to record ticket sales and apportion revenue). From this system we are able to extract detailed information on how much a particular route and ticket type have been used over the period in question.

**Ensuring the index is kept up to date**

It is important that the index is representative and kept up-to-date. The comprehensive 'basket' of tickets/journeys with their associated weights is fixed for a year at a time and then revised as necessary to reflect changing patterns of ticket purchase. It should be remembered, though, that each paired year comparison is based on an identical set of fares.

**Calculating the Fares Price Index**

The price and weighting information are combined together. Changes in price are measured by comparing them to their levels in the previous year; they are then weighted together to produce an overall average price change. This process is undertaken separately for each broad fares category within each Train Operating Company. The calculation, a weighted average, is as follows:

$$I_{t,0} = \frac{\sum_i \left( P_{it} \big/ P_{i0} \right) . W_i}{}$$

$$\sum_{i} W_i$$

where: $P_{it}$ = price for ticket $i$ at time t
$P_{i0}$ = price for ticket $i$ at base date
$W_i$ = earnings from ticket $i$ in the base period

so, for example, the change in prices between 1998 and 1997 for a given ticket type in a given TOC would be:

$$I_{98/97} = \frac{\sum_{i} \left( P_{i98} \middle/ P_{i97} \right) . Wi_{97}}{\sum_{i} W_{i97}}$$

where: $P_{i\,98}$ = price for ticket $i$ in 1998
$P_{i\,97}$ = price for ticket $i$ in 1997
$W_{i97}$ = earnings from ticket $i$ in 1997

Higher level indices (e.g. Overall National Index) are calculated using the weighted average of the constituent indices (weights here being the total earnings in the respective component).

**Multi-year comparisons**

The final stage is to link the average price changes with the figures for earlier years. This 'chain-linking' allows the index to both account for changes in the profile of tickets and provide comparisons between different years.

So, to compare 1998 prices with, say, 1995, the calculation would be:

$I_{98/95} = I_{98/97}$ x $I_{97/96}$ x $I_{96/95}$

each component being based on weights calculated for the respective base year.


**Exclusions**

The Rail Fares Index is, for practical reasons, unable to cover every single transaction in a given year. Earlier we explained that rail tickets sold as an element of a packet of services were excluded. The other exclusions are listed below. However, as the index is based on millions of transactions covering over 90 per cent of the total earnings from fares, the omissions are considered to have a negligible impact on the aggregate indices.

- Newly introduced tickets are not properly accounted for in their first year as the index's price information is based on snapshots from January Year 1 and Year 2
- The index does not include short-term temporary fares/promotions
- The index does not take immediate (within year) account of passengers 'switching' ticket types following the introduction/deletion of certain tickets
- The index includes rail tickets with a London Transport 'Travelcard' add-on but excludes all other multi-modal tickets

- Coverage is limited to transactions recorded in the CAPRI system (although we believe there to be only a negligible amount of activity that escapes CAPRI)
- The index excludes flows whose total annual earnings are below specific thresholds. This is to reduce the volume of data and excludes only those flows which generate minimal earnings (typically a maximum of £50 per annum).
- The index excludes flows for which we were unable to find price information for either of the two reference years, for example a ticket type that is introduced after the first reference date.


**Extending the indices**

Currently, the indices go back to 1999. The SRA is currently exploring the availability of detailed historic data that would permit the Rail Fares Index to be extended backwards. Subject to data availability, it our intention to construct indices for each year back to 1996. This work would be carried out during the current calendar year and results added to those in this edition of National Rail Trends.