Scotland-wide Older and Disabled Persons Concessionary Bus Scheme – Further Reimbursement Research

Final Report for Transport Scotland

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Context

Under the Scotland-wide Older and Disabled Persons Concessionary Bus Scheme, qualified Scottish residents may travel anywhere in Scotland at any time on local buses at no charge. Transport Scotland is responsible for compensating bus operators for carrying these passengers. It has the objective that bus operators should be financially "no better off and no worse off" because of their participation in the scheme, requiring it to identify a "counterfactual" situation against which to measure:

- the revenue that would have been earned by the operator if passholders were not able to travel for free ("revenue forgone"); and
- any additional costs that the operator might have incurred as a consequence of providing free travel, in particular through carrying passengers who would not otherwise have travelled.

In 2012-13, nearly 150 million free concessionary passenger journeys are expected to be made, at a cost to the Scottish Government (and therefore taxpayers) of £187 million in reimbursement payments under current arrangements.

Reimbursement payments are calculated by applying a National Rate to the adult cash single fare that would have been paid for individual concessionary journeys. The National Rate was initially fixed at 73.6% in 2006, but was reduced to 67% with effect from April 2010. However, the budget for the National Concessionary Travel Scheme is capped to £187m in both the 2012-13 and 2013-14 financial years.

Although reimbursement rates have been informed by various research studies, Transport Scotland has not had a systematic method for updating the Reimbursement Rate to reflect changes in commercial fares and relevant cost measures. The objective of the current study was to provide Transport Scotland with an appropriate mechanism for doing so.

Given the hypothetical nature of the counter-factual, and the large sums of money involved, determining appropriate reimbursement levels is inevitably a matter of considerable debate between the authorities responsible for paying it and the operators who receive it.

This study has been carried out with the active co-operation of the Confederation of Passenger Transport – Scotland (CPT) on behalf of Scottish bus operators, with CPT's advisers Steer Davies Gleave (SDG). For brevity throughout this Report we use 'CPT' as shorthand for the combination of CPT and SDG. We are most grateful for their participation.

Although the data and analysis methods that we and CPT have used are largely identical, there remains room for alternative interpretations and assumptions. Although our focus is on the results that we believe are most robust, where relevant we also identify our understanding of the alternative conclusions that CPT have reached, and quote compromise values for key parameters that recognise the uncertainties associated with the analysis.

Average fares

One of the key factors in determining "no better off and no worse off" reimbursement is the average fare that would be paid in the absence of the concession. Reimbursement is calculated by reference to the "shadow fare", that is, the adult cash single fare that would have been charged for individual passholder concessionary journeys. However, if there was no concession, passholders are likely to use some combination of the different tickets promoted by bus operators, including day tickets and weekly tickets. Typically these will enable journeys to be made more cheaply than using cash single fares, and consequently a discount factor needs to be applied to convert the "shadow fare" to a better approximation to the average fare per journey that would have been paid in the counter-factual.

CPT has provided access to data from bus operators on commercial ticket sales and revenues of non-concessionary passengers, and estimates of the passenger journeys made using these tickets. The average fare paid by non-concessionary passengers can therefore be calculated, and by making assumptions about how their travel patterns would differ from those of concessionary passengers, the average fare that would be paid by concessionary passholders can be estimated.

It has been possible to confirm the general scale of the CPT assumptions about the journeys made per ticket using Transport Scotland data, and we are content that the resulting estimate of the discount factor is reasonably robust. Our analysis suggests that the discount factor should be 19.25% (i.e. that the average fare that would be paid by passholders in the counterfactual is about 81% of the average shadow fare), which contrasts to the value incorporated into the current National Rate of 7.3%[1] . The new analysis therefore suggests a significant increase in the amount of discount applied, leading to reduced reimbursement payments, other things being equal. CPT's conclusion from analysis of the same data is that the discount factor should be 18%. A compromise value for the discount factor is 18.6%.

The methodology leading to these values relies upon data that has been collected voluntarily by CPT from its members. We recommend that future updating of the discount factor estimate is driven by data collected from bus operators through a more formal process which gives Transport Scotland more assurance about the quality and completeness of the information provided. We have also developed a methodology that could be used to avoid dependence upon arbitrary assumptions in this updating process.

Reimbursement Factors and Elasticities

A central feature of the calculation of "no better off and no worse off" reimbursement is the concept of "generation", which is that a proportion of concessionary journeys would not have been made by passholders in the absence of the zero fare. The Reimbursement Factor is used to measure the scale of generated journeys, and to infer the number of concessionary journeys that would have been made in the counter-factual. If the fare that would have been paid in the absence of the scheme increases in real terms, then counter-factual journeys could be expected to reduce, and, correspondingly, the proportion of generated concessionary journeys to increase.

[1] The often quoted value for the current "discount factor" is 4.5%, but this is after it has been multiplied by the 61.5% Reimbursement Factor.

The sensitivity of demand to fares is usually measured in terms of elasticities. The Reimbursement Factor in the current National Reimbursement Rate was established in 2006 from predecessor schemes, but the evidence base that supports the current implicit elasticities is weak. Elasticities are most easily identified when a large change in fare allows the resulting change in journeys to be measured. To provide a robust basis for reimbursement arrangements going forward, we have estimated new concessionary travel elasticity values for Scotland by using data from before and after October 2002, when statutory free concessionary travel was introduced in Scotland.

Our analysis has drawn on a wide range of data to ensure that comparisons of journeys are on a like-for-like basis, but there are challenges in assembling the necessary information from ten years ago. The most complete and precise information is available for the Strathclyde area, but we have had to make a variety of assumptions to enable Scotland-wide estimates to be made. There is room for alternative interpretations of the available data, and CPT has developed their own elasticity estimates.

Our preferred values (which give a point elasticity at 2001-2 fares and prices[2] of -0.32) are based on long-run analysis of all-Scotland data, and are larger in absolute terms than the values implied by the current Reimbursement Factor as derived from fares in 2006-7 (-0.29). CPT's estimates give a point elasticity of -0.27, slightly larger in absolute terms than those implied by the current Reimbursement Factor and current fare levels. A compromise value gives a point elasticity of -0.29 at 2001-2 fares and prices.

The 2012-13 Reimbursement Factor implied by our preferred elasticity value (for illustrative purposes, assuming the "compromise" discount factor) is 58.2%, which is somewhat lower than the 61.5% in the current Net Reimbursement Rate. The equivalent Reimbursement Factor implied by the CPT estimate is 62.4%, which is slightly higher than the current Reimbursement Factor. The compromise elasticity implies a Reimbursement Factor of 60.3%.

In calculating Reimbursement Factors on an on-going basis, it is necessary to remove general price inflation from changes in fare levels. Usually the Retail Price Index (RPI) or Consumer Price Index (CPI) is used, but we have also looked at alternatives which reflect the significance of petrol prices in determining passholder mode choice. We recommend a combined index which gives additional weight to the Petrol and Oil component within the RPI. We have used survey data which quantified the extent to which the concession encourages switch of mode from car to bus to derive a 22% weighting for the Petrol and Oil component.

Additional Costs

A previous study by ITS[3], reporting in 2010, undertook detailed analysis of the additional costs likely to be incurred by operators in providing the concession. We have largely taken the conclusions from the previous work as a sound basis for future reimbursement, reflected in the ITS recommendation that reimbursement for additional costs is calculated on the basis of a cost rate per generated concessionary passenger.

[2] The elasticity parameters estimated are for two parameters which between them allow calculation of the Reimbursement Factor at a given commercial fare. The elasticity values quoted above are point elasticities at a fare of £0.859 at 2001-2 prices.

[3] The Institute for Transport Studies at the University of Leeds.

However, we have examined a number of issues raised by CPT regarding the way in which differences in operating costs levels between Scottish bus operators and the rest of Great Britain were handled by the ITS Study. A detailed reconstruction of the ITS analysis is not possible within the available time and resources, but we have concluded that there is justification for increasing the base cost rate recommended by ITS from £0.344 per generated passenger to £0.428 in 2009-10 prices. We understand that CPT believe that there is a case for further increasing this rate to £0.459 in 2009-10 prices, but we do not think there are grounds for doing so. A compromise value is £0.443 per generated passenger at 2009-10 prices.

In applying the additional cost rate, it is necessary to update values to reflect changes in prices and costs actually experienced by Scottish bus operators. CPT publishes a well-established index of bus and coach industry operating costs which includes separate values for Scottish operators. We recommend that this index is used for updating the base cost from 2009-10 prices to the period for which future reimbursement calculations are being made.

Implications of reimbursement parameters

The work summarised above has led to the identification of a set of reimbursement parameters (our "preferred" values) which in our view represent the most robust basis for calculating future reimbursement payments. Overall, our conclusion is that the evidence suggests that the reimbursement arrangements of the current National scheme are over-generous to bus operators and should be reduced.

In some cases, different values have been identified by CPT, reflecting different judgements about some of the assumptions and alternative interpretations of evidence, and suggesting that somewhat higher levels of reimbursement are justified relative to our preferred values. As noted above, we have also identified a set of "compromise" parameters that are simply a straight average of our preferred estimates and CPT's estimates where these differ. Both our preferred and compromise set of reimbursement parameters imply reduced levels of reimbursement payment compared to the current National Scheme.

The table below summarises the three main alternative sets of reimbursement parameters, and illustrates their implications for reimbursement payments, using predicted values of 2012-13 concessionary journeys and the average shadow fare, based on the first 9 periods of 2012-13.

Reimbursement Parameters	MVA/Minnerva Preferred Values	CPT	Compromise values
Reimbursement Year	2012-13	2012-13	2012-13
Concessionary journeys, (m) Reimbursement Year	146.568	146.568	146.568
Average concessionary (shadow) adult cash single fare, Reimbursement Year prices	£2.041	£2.041	£2.041
Discount Factor relative to Shadow Fare	19.25%	17.96%	18.60%
Average fare that would have been paid in the absence of the scheme (2001-2 prices)	£1.10	£1.12	£1.11
Lambda	0.703	0.673	0.688
Beta (Deindexed, at 2001-2 prices)	-0.503	-0.439	-0.471
Illustrative point elasticity at 2002 fare of £0.859	-0.318	-0.267	-0.292
Reimbursement Factor	58.4%	62.3%	60.3%
Revenue forgone			
Reimbursement for revenue forgone (m)	**£141.05**	**£152.87**	**£146.82**
Additional costs			
Base marginal operating and capacity cost per generated passenger, 2009-10 prices	£0.428	£0.459	£0.443
CPT Cost index relative to 2009-10	117.0	117.0	117.0
Cost per generated passenger in the reimbursement year	£0.500	£0.537	£0.518
Generated journeys (m)	60.985	55.274	58.194
Reimbursement for additional costs (m)	**£30.49**	**£29.67**	**£30.17**
Total reimbursement calculated (uncapped) (m)	**£171.5**	**£182.5**	**£177.0**
Net Reimbursement Rate (as % of journeys * shadow fare)	**57.3%**	**61.0%**	**59.2%**
2012-13 Predicted Reimbursement Payment	***£187.0***	***£187.0***	***£187.0***
Reimbursement parameters as defined in current "scheme"			
"Generation Factor" G	58.4%	62.3%	60.3%
"Discount Factor" D	11.2%	11.2%	11.2%
"Additional Cost rate" C	10.2%	9.9%	10.1%

The table shows how the different parameter choices lead to different estimates of reimbursement payments, which vary from £171.5m to £182.5m in 2012-13. The Net Reimbursement Rate similarly varies from 57.3% to 61.0%; these values contrast with the current Rate of 67%, although the impact of the £187 million cap on the total payment reduces the effective rate to 62.8%.

Reimbursement Calculations for 2013-14 and 2014-15

Whatever reimbursement parameters are decided upon, the framework we have used to calculate reimbursement provides a valuable on-going tool which Transport Scotland can use to update reimbursement calculations as and when required. For example, with forecasts of future trends in cash single fare scales, it is possible to calculate the Net Reimbursement Rate that might be applied to reimbursement payments in 2013-14 and 2014-15. With

forecasts of trends in concessionary journeys, total reimbursement payments can also be calculated.

The table below summarises the results of these calculations for the different reimbursement parameters, using the predicted 2012-13 outturn figures and assumptions that:

- there will be no change in concessionary numbers to 2013-14 and 2014-5;
- the average adult cash single fare will increase by 5% per year in current prices; and
- prices generally, including petrol prices, and bus operating costs, will increase by 2.5% per year.

Illustrative forecasts of reimbursement payments and Net Reimbursement Rates	MVA/Minnerva Preferred Values	CPT	Compromise values
2012-13			
Concessionary journeys (m)	146.568		
Average adult cash single fare (current prices)	£2.041		
Total reimbursement calculated (uncapped) (m)	£171.5	£182.5	£177.0
Net Reimbursement Rate (as % of journeys * shadow fare)	57.3%	61.0%	59.2%
2013-14			
Concessionary journeys (m)	146.568		
Average adult cash single fare (current prices)	£2.143		
Total reimbursement calculated (uncapped) (m)	£178.4	£190.1	£184.2
Net Reimbursement Rate (as % of journeys * shadow fare)	56.8%	60.5%	58.6%
2014-15			
Concessionary journeys (m)	146.568		
Average adult cash single fare (current prices)	£2.250		
Total reimbursement calculated (uncapped) (m)	£185.5	£197.9	£191.6
Net Reimbursement Rate (as % of journeys * shadow fare)	56.2%	60.0%	58.1%

It can be seen that with these assumptions, the Net Reimbursement Rate calculated from our Preferred reimbursement parameters falls from 57.3% to 56.2%, whereas with the compromise values, the Rate falls to 58.1%.

In determining future levels of the Net Reimbursement Rate, Transport Scotland should review trends in fares and concessionary journey numbers to ensure that inputs into the calculations are based on reasonable assumptions.

Longer Term Issues

We recommend Transport Scotland considers the option of moving away from the use of a single national reimbursement rate to determine the reimbursement payments for individual operators.

In our view, operator payments calculated from a single national rate which is the same for all operators gives rise to a number of issues. At the individual operator level, it may not leave each individual bus operator no better off, and no worse off (i.e. some bus operators

will be better off, and others will be worse off), even if it satisfies this objective at an All-Scotland, operator-wide level.

Since reimbursement is largely driven by the cash single fare, a national rate provides a strong commercial incentive for individual bus operators to increase their cash single fares at a greater rate than they would do otherwise. This incentive is greatly increased by the existence of the cap on payments, which gives a direct inducement for operators to increase fares sooner rather than later to maximise their own share of the available pot in any given financial year.

In our view the fact that the cash single fare has risen as rapidly as it has between 2006-7 and 2012-13 is almost certainly a consequence of this weakness.

We therefore recommend that Transport Scotland reviews options for change from the standard national rate, so as to better reflect "no better, no worse off" objectives at the individual operator level, and reduce the incentive for operators to introduce increases to the fares used to calculate reimbursement payments. There are a variety of options available, which reflect different balances between theoretical and practical issues. However, adoption of a different methodology could risk significant unintended consequences for the bus industry, and an important part of an assessment of options should be the evaluation of these risks, alongside the potential benefits.

1 Introduction

1.1 This study

1.1.1 This document is the Final Report of the work carried out by Minnerva Ltd and MVA Consultancy for Transport Scotland, commissioned in April 2012. The objective is to help Transport Scotland further improve and update the evidence base underpinning reimbursement payments to bus operators for carrying concessionary passengers.

1.2 The All-Scotland free concessionary travel scheme

1.2.1 Transport Scotland is responsible for compensating bus operators for carrying older and disabled bus passengers for no charge. The all-Scotland free concessionary travel scheme, which allows free bus travel anywhere in Scotland at any time for passholders, has been in place since 1 April 2006. Prior to the national scheme, individual local authorities[4] had been responsible for providing free local bus use, on a statutory basis from 1 October 2002. Since the all-Scotland scheme was put in place, Transport Scotland payments to operators have risen from around £153 million in 2006-7 to £180 million in 2011-12.

1.2.2 Under UK and EC legislation, the basis on which bus operators are reimbursed should have the objective of leaving the operators financially no better off and no worse off in financial terms. This requires Transport Scotland to identify a counterfactual '*No Concessionary Travel Scheme*' situation against which to estimate:

- the revenue that would have been earned ("revenue forgone") by the operator if passholders were not able to travel for free; and
- any additional costs that have been incurred as a consequence of providing free travel, in particular through carrying passengers who would not otherwise have travelled.

1.2.3 Given the hypothetical nature of the counter-factual, and the sums of money involved, determining appropriate reimbursement levels is inevitably a matter of considerable debate between the organisations responsible for paying it and the operators who receive it.

1.2.4 The arrangements for calculating reimbursement for the all-Scotland scheme were originally agreed in negotiations between the Scottish Government and the Confederation of Passenger Transport Scotland (CPT) on behalf of bus operators. These arrangements were renewed, but with a reduced payment rate, with effect from 1 April 2010, in an agreement that expires on 31 March 2013. The research reported here is intended to inform Transport Scotland decision-making with regard to changes in reimbursement arrangements that might be put in place from 1 April 2013.

1.2.5 Since 2006, reimbursement payments have been calculated through the application of a fixed reimbursement rate. There has not been a systematic method for updating the reimbursement rate, except through the negotiations which led to the agreed rates payable from 2006 and 2010. Transport Scotland commissioned the Institute for Transport Studies at the University of Leeds (ITS) to improve the evidence base for determining

[4] Some of which had joint schemes, most significantly in Strathclyde.

reimbursement payments in work that reported in 2010[5]. The results from this research informed the negotiations that led to the Reimbursement Rates operative from April 2010.

1.2.6 The principal objectives of the current work is to provide updated values for the component elements of the reimbursement calculation, building on the ITS research, but also identifying a mechanism for regular updating of the reimbursement rate, while maintaining compliance with the over-arching "no better off, no worse off" objective.

1.2.7 Concessionary travel reimbursement is an exceedingly complicated area, with substantial scope for confusion over concepts, terminology and interpretation of evidence. The function of this document is to provide an accessible summary of the main findings of the research. Appendix A introduces the key concepts, and Appendix B contains a glossary of terms (generally indicated by italics in the text where they are initially introduced). Appendix C sets out the results from various sensitivity tests of key findings.

1.3 This report

1.3.1 The remainder of the report covers:

- current reimbursement arrangements and background trends (Chapter 2);
- calculation of the appropriate average fare that should be used in calculating reimbursement payments (Chapter 3);
- estimates of the extent to which concessionary journeys are generated by the free concession (Chapter 4);
- additional costs that might be incurred by bus operators (Chapter 5);
- the reimbursement implications of combinations of the findings in each of these areas (Chapter 6); and
- mechanisms that could be used to regularly update reimbursement rates, and discussion of longer term issues (Chapter 7).

1.3.2 The work has been greatly facilitated by the support and resources of Transport Scotland, together with the active co-operation of CPT-Scotland and its advisers Steer Davies Gleave (SDG). For simplicity, in this report we refer throughout to "CPT", which might mean CPT itself, or SDG, or CPT and SDG in combination.

1.3.3 As will become apparent, although there is firm evidence in some areas, the hypothetical nature of the counter-factual situation leads to an unavoidable reliance on assumption and judgement in other areas. Views on some of these judgements are likely to differ, especially since alternative positions can have significant implications for reimbursement payments. In the report we have sought to identify key areas where, in our view, some level of arbitrary judgement has been required. While not attempting to speak for CPT, we have highlighted those areas where we understand that CPT may take a different view to ourselves. The overall conclusions reached are, however, entirely the responsibility of MVA Consultancy and Minnerva Ltd.

[5] "Improving the evidence for setting the reimbursement rate for operators under the Scotland-wide older and disabled persons concessionary bus scheme", Institute for Transport Studies, published by Scottish Government Social Research 2010

2 Current Reimbursement Arrangements and Background Trends

2.1 Background to the current concessionary reimbursement arrangement

2.1.1 Payments to individual operators are currently calculated by applying a fixed Reimbursement Rate to the adult cash single fare that would have been charged for each concessionary journey. The latter is known as the "shadow fare".

2.1.2 The Reimbursement Rate was initially set at 73.6% in 2006-7, and was revised downward to 67.0% with effect from 2010-11. However, the agreements reached with CPT included provision for the Scottish Government to limit total payments to specific reimbursement "caps" within each financial year, based on forecast changes in the main factors that should influence payments. Reimbursement caps had little impact initially, but have significantly reduced payments in 2011-12 relative to what would otherwise have been paid, and are likely to have a larger impact in 2012-13.

2.1.3 For the vast majority of bus operators in Scotland, concessionary journeys and the associated shadow fares are now recorded using smartcard technology, allowing a reimbursement payment to be calculated for each concessionary journey made. Identical quantities of reimbursement would be calculated by applying the reimbursement rate to aggregate data for an individual operator, e.g. to the total number of concessionary journeys made, and the average shadow fare. Since many reimbursement concepts make little sense when thought of relative to individual concessionary journeys, in this report we generally talk about reimbursement payments, for individual operators or for bus operators as a whole, calculated in aggregate terms, i.e. relative to the total number of concessionary journeys, and an overall average fare.

2.1.4 Appendix A introduces key reimbursement concepts and terminology and shows how the Scottish reimbursement rate is built up from different components. The main elements are as follows:

- *Discount*: this measures the extent to which the fare that would be paid by concessionary passholders, in the absence of the scheme, would be less than the adult cash single fare recorded as the "shadow" fare for each concessionary journey. The current Reimbursement Rate incorporates an assumption that the average fare that would be paid in the absence of the concession is about 7.3% less than the shadow fare[6];
- *Generation*: a measure of how many concessionary journeys have been generated by the availability of free travel, relative to the journeys that would have been made if there was no concession. The current Reimbursement Rate assumes that if there was no concession, 61.5% of current concessionary journeys would continue to be made, and 38.5% of concessionary journeys would no longer be made (i.e. are generated by the concession); and

[6] Note that because the Reimbursement Rate as currently formulated is constructed by adding together the different components, the most quoted value for the discount rate is 4.5%. But this is after it has been multiplied by the Reimbursement Factor ("post-degeneration") i.e. after allowing for generation, which in principle is itself dependent upon the average fare forgone. This circularity provides scope for confusion, and is one reason why we recommend changes to this way of presenting the reimbursement formula.

- *Additional costs*: additional operating costs incurred as a result of the additional journeys generated by the concession. The current Reimbursement Rate assumes that additional costs are equal to about 10% of the shadow fare.

2.1.5 The single, fixed Scottish Reimbursement Rate provides a simple and transparent mechanism for calculating payments to operators. However, the concepts set out above are quite distinct, and combining them in a single figure obscures much of the underlying logic. In particular, the use of a single reimbursement rate makes it is less obvious how the different components, and hence the overall reimbursement rate, should change over time.

2.2 Recent Trends in Scottish Concessionary Travel

2.2.1 Relevant recent trends in concessionary travel are summarised in Figure 2.1.

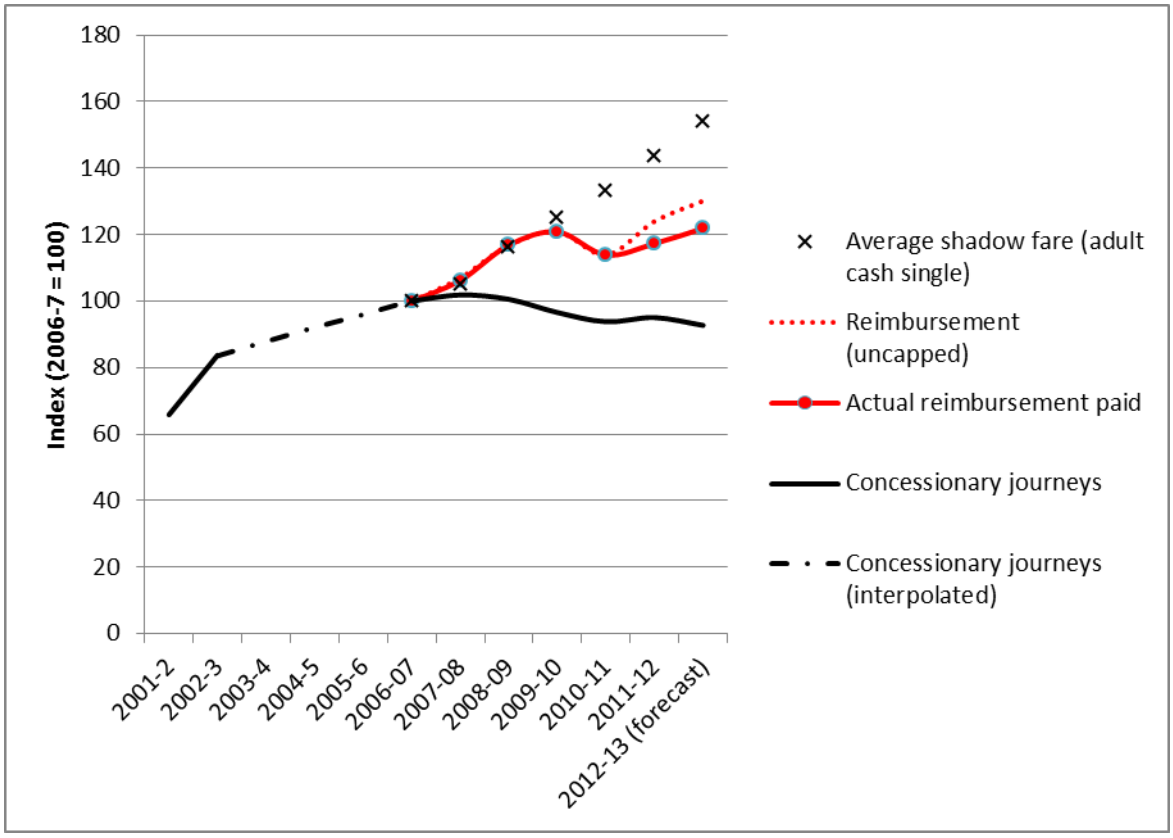


Figure 2.1 Scottish trends in concessionary journeys, fares and reimbursement, indexed to 2006-7

Source: Transport Scotland from 2006-, except data supplied by CPT for journeys in 2002-3

2.2.2 Consistent time-series data on older and disabled concessionary journeys is not available before 2006-7, but data from 2002-3, initially collated by the Association of Transport Coordinating Officers (*ATCO*) and copied to us by CPT, has been used to show in approximate terms the impact on concessionary journeys of local free travel in October 2002. Overall, the change from the previous mixture of flat fare, half fare and two free schemes led to an increase in Scottish concessionary journeys of about 30%. Journey numbers continued to grow, up to and including the introduction of the National concessionary scheme in 2006-7. From 2007-8, overall numbers of concessionary journeys have declined.

2.2.3 Under the national scheme, reimbursement payments are driven by the combination of journey numbers and the average adult cash single fare. The latter has increased very substantially, and is forecast to be 53% higher in current prices in 2012-13 than it was in 2006-7 (27% higher in real terms, after allowing for inflation as measured by the Consumer Price Index (CPI)). As a result, reimbursement payments have also increased substantially over this period, despite the reduction in the reimbursement rate with effect from 2010-11. In 2011-12 and the current year, the reimbursement caps have had a significant impact, and in 2012-13 are likely to reduce expenditure by about £13 million relative to what would have been paid without the cap.

2.2.4 The adult cash single fare which is used to determine concessionary reimbursement has risen substantially more than other measures of the fare charged by operators to non-concessionary fare-paying passengers. These have generally increased at about half the rate of the fare used to calculate reimbursement. There are a number of reasons why this might be so, but as noted in the final Chapter of this report, the current national reimbursement arrangements, with a fixed rate which is the same for all operators, are likely to have created incentives for bus operators to increase the adult cash single fare more than they would otherwise have done.

2.2.5 The implementation of a systematic updating mechanism for reimbursement calculations will reduce these incentives to some degree, but more radical changes should also be considered, as is discussed in the final Chapter.

3 Discount Factors and the Average Fare

3.1 Revenue forgone by operators due to the free scheme

3.1.1 "No better off and no worse off" reimbursement needs to compensate operators for the revenue forgone, i.e. the revenue that would have been earned by the bus operator from the passenger journey that would have been made if passholders had paid fares rather than travelled for free.

3.1.2 To calculate this, estimates are needed of both the number of journeys that would have been made by passholders if they had to pay the commercial fare, and the commercial fare that would have been paid for "non-generated" concessionary journeys. The greater the commercial fare, the more journeys can be expected to be generated; put another way, a smaller proportion of the journeys would continue to be made, in the absence of the scheme, if the commercial fare is larger rather than smaller.

3.1.3 The "average fare that would be paid by concessionary passholders in the absence of the concession", or more succinctly, "the *Average Fare Forgone*" (AFF) cannot be directly observed. Instead, it has to be derived from some other measure of the fares charged by an individual operator which is able to reflect changes in fare levels as well as travel patterns. We refer to this as the "*reference fare*".

3.1.4 The reference fare used by the Scottish Scheme is the "*shadow fare*", which is recorded for individual concessionary journeys through the Scotland-wide smartcard-based ticketing system. In principle, on boarding the bus each concessionary passenger states his or her destination, from which the driver is able to record the fare that a non-concessionary adult passenger would pay for the same journey made with a cash single ticket. There are various concerns that have been raised regarding the accuracy of this process, but for the present it is assumed that the shadow fare remains the mechanism through which reimbursement calculations are informed about a given operator's fare level.

3.1.5 However, operators offer a variety of tickets, including day returns, multi-journey tickets and *period tickets* (which allow unlimited use during a given period of validity, e.g. daily, weekly, 4-weekly etc). Generally, the cash single fare will be the most expensive way of purchasing bus travel unless passengers make few and irregular journeys. The majority of journeys made by non-concessionary fare-paying passengers in Scotland currently use these other ticket types rather than buying a cash single fare. It would be expected that in the absence of the concession, passholders would also make some use of discounted tickets as well as paying cash single fares, so that overall the average fare per journey would be less than the average shadow fare. Consequently, a "*Discount Factor*" needs to be calculated that reflects the extent to which the average fare forgone (that is, the average fare that would be paid by passholders in the absence of the scheme, after taking account of discounted tickets) would be less than the average shadow fare.

3.2 Principles involved in calculating the average fare forgone

3.2.1 The fares paid for individual journeys, or per journey when a period ticket is purchased, obviously vary greatly. The overall average fare per non-concessionary journey paid to a particular operator can, in theory, be calculated by taking the total revenue received and

dividing by the total number of journeys made. Alternatively, it could be calculated as a weighted average of the fares paid for each type of ticket, with the weights reflecting the number of journeys made on each ticket type. In order to calculate the average fare forgone by concessionary passholders in the absence of the scheme, we therefore have to estimate the share of journeys that would be made on each of the available ticket types, and the average fare per journey on each ticket type.

3.2.2 The individual passenger will make a choice of ticket type based on a number of factors, but one significant influence is bound to be the relative prices of each of the ticket types that are available. So if a passenger expects to make a given number of bus journeys in a forthcoming period, he or she will tend to choose the combination of ticket types that will enable these journeys to be made at the lowest price. This might involve some combination of single cash fares, day tickets or possibly a week ticket. The relative attractiveness of the period tickets will therefore be determined partly by whether they are more or less expensive compared to alternatives, and in particular compared with making the same journeys by buying cash single tickets. Consequently, the relative price will influence both the share of journeys made on each ticket types, and the average number of journeys made per ticket purchased (and hence the average fare per journey).

3.2.3 The average fare forgone by concessionary passengers cannot be directly observed, but in the past has been inferred from the observed use of different ticket types by equivalent non-concessionary passengers. This was very largely the basis of the recommendations on discount factors made by the ITS team. There are two drawbacks to this method, referred to here as "Method (a)":

- first, bus operators are generally not able to accurately count the number of journeys made using period tickets[7]. Journey estimates are typically made by applying a "rule of thumb" to the number of tickets sold e.g. 2.5 journeys per day ticket. But as noted, the number of journeys made per ticket will depend upon the relative prices of each, so in addition to relying upon assumptions about the journey numbers, this method cannot be used to distinguish between operators offering very different price structures. This may not be an important consideration with the current National scheme, but could become a significant drawback if there was any move away from a single National reimbursement rate; and
- second, assumptions are then needed about how the travel patterns of non-concessionary passengers might be different to those of concessionary passengers, taking into account differences in characteristics such as level of employment, car ownership and the journey purpose mix.

3.2.4 An alternative to using data on non-concessionary ticket sales is to use observed data on concessionary journey frequencies ("Method (b)"). This was not practicable until relatively recently when smartcard data started to become available. Smartcard systems make it possible to record complete information about concessionary journeys (including those made by infrequent travellers, as well as very frequent travellers). Method (b) using concessionary smartcard data is now the basis of the method incorporated in the UK Department for Transport (DfT) average fare forgone calculator. With information available about, for example, the number of days in which more than X journeys were made, it is possible to

[7] Even if passenger journeys that do not involve a ticket purchase are recorded, they are unlikely to be accurately assigned to the specific type of ticket used.

directly infer on how many days a day ticket priced at "X" times the cash fare would be financially advantageous. However, the disadvantage of this method is that assumptions are then required about how the frequencies of observed (free) concessionary journeys would change if the passholders had to pay for their journeys.

3.2.5 The previous work on discount factors by ITS largely used "Method (a)", and the discussion set out here is predominantly also concerned with updating discount factors derived by this method i.e. from observed ticket sales by non-concessionary passengers. However, there are severe limitations to this method in terms of its ability to respond to changing commercial strategies by operators. In contrast, Method (b) demonstrates that differences in commercial strategies (i.e. the relative pricing of cash and different types of period ticket) could have significant implications for the discount factor over time, and for differences between individual operators.

3.3 Data for Method (a) and implications for non-concessionary average fares

3.3.1 Method (a) is very largely dependent upon data provided by bus operators. CPT has been extremely helpful in collating information on ticket sales and revenues in 2011, which has been provided voluntarily by 17 bus operators who between them operate about 85% of the total bus miles in Scotland. The data provided by CPT is summarised in Table 3.1 below.

Table 3.1 Operator data on adult non-concessionary ticket sales in Scotland, 2011

2011 full calender year figures	CPT data for 2011 updated by SDG 07-01-2013		Implied values	
2011 data supplied to current study, adult non-concessionary passengers	Tickets in Circulation	Revenue	*Cost per ticket*	*Price ratio*
Adult singles	67,931,437	£106,583,720	*£1.569*	*1.00*
Adult returns	5,530,148	£23,250,545	*£4.204*	*2.68*
Ten Journey ticket	204,933	£3,920,100	*£19.129*	*12.19*
Day tickets	10,964,361	£39,519,459	*£3.604*	*2.30*
Weekly seasons	2,044,755	£26,943,823	*£13.177*	*8.40*
4 weekly seasons	563,840	£24,974,052	*£44.293*	*28.23*
Annual seasons	1,236	£817,912	*£661.741*	*157.40*
Total all ticket types		£226,009,611		

Source: CPT, as supplied by SDG on 7/1/2013

3.3.2 The supplied data was categorised into seven generic ticket types:

- the first three are tickets which can only be used by the purchaser for a finite number of journeys, i.e. one journey for a single, two for a return and ten for the ten journey carnet[8]; and
- the second four are period tickets which can be used for any number of journeys within the period of validity. It is the journeys associated with these tickets about which there is most uncertainty.

3.3.3 The cost per ticket can be calculated from the revenues and ticket sales. The price ratios are the ratio of the price of the ticket compared to an adult cash single fare; it therefore provides an indicator of how many journeys a passenger needs to make in a day, a week or a four-week period to justify purchase of the respective period ticket, as an alternative to buying single tickets.

3.3.4 In order to calculate the overall average fare, assumptions are then necessary about the number of journeys made per ticket sold. It is possible to infer logical lower limits to these assumptions (based on the price ratios) but not higher limits. The assumptions proposed by CPT are shown in Table 3.2.

Table 3.2 CPT Assumptions on journeys, adult non-concessionary passengers

2011 full calender year figures	**CPT data for 2011**			**Implied values**		
2011 data supplied to current study, adult non-concessionary passengers	Tickets in Circulation	*CPT Estimates of Passengers*	Revenue	*Cost per ticket*	*Price ratio*	*CPT journeys per ticket*
Adult singles	67,931,437	*67,931,437*	£106,583,720	*£1.569*	*1.00*	*1.000*
Adult returns	5,530,148	*11,060,296*	£23,250,545	*£4.204*	*2.68*	*2.000*
Ten Journey ticket	204,933	*2,049,330*	£3,920,100	*£19.129*	*12.19*	*10.000*
Day tickets	10,964,361	*30,854,711*	£39,519,459	*£3.604*	*2.30*	*2.814*
Weekly seasons	2,044,755	*23,685,387*	£26,943,823	*£13.177*	*8.40*	*11.583*
4 weekly seasons	563,840	*30,013,263*	£24,974,052	*£44.293*	*28.23*	*53.230*
Annual seasons	1,236	*812,392*	£817,912	*£661.741*	*157.40*	*657.275*
Total all ticket types		*166,406,817*	£226,009,611			
Overall average per journey			***£1.358***			

3.3.5 Thus overall, the CPT data suggests that for the sample of operators for whom data has been provided, about 180 million journeys were made, for revenues paid of £223 million, giving an overall average fare of £1.358 per journey paid by adult non-concessionary passengers.

3.3.6 There is little hard evidence to support the CPT assumptions about journeys for each of the different ticket types, and no systematic process is available for changing these assumptions when relative ticket prices change. Operators typically will not have accurate counts of the number of journeys made with each type of discount ticket. The most reliable sources for estimating journeys per ticket are the continuous monitoring surveys conducted by some of the English PTEs, which demonstrate (as would be expected) substantial variation in journey rates both between operators and between areas, but there is no equivalent data for Scotland. The journeys per ticket implied by CPT's own data have varied for no obvious

[8] Note that on the basis of this data, return tickets and carnets are priced at more than the equivalent single ticket. This almost certainly reflects a pricing structure in which single tickets tend to be used most for shorter journeys and returns and carnets for longer journeys. Outside Scotland, returns and carnets are usually priced at less than a single ticket.

reason, and there can be little confidence that the assumptions made by participating operators are either on a consistent basis or are fully representative of Scotland as a whole.

3.3.7 However, it is possible to compare the overall average fare shown in Table 3.2 against an equivalent value calculated from Transport Scotland national data on total bus operator revenues and journeys. This is not directly comparable with the CPT data shown above, but using data supplied by CPT we have been able to allow for the main elements that will be included in the Transport Scotland data but excluded from the CPT data, namely children, students, bus company employees and their families.

3.3.8 The national data implies that the average revenue per adult non-concessionary journey in 2011 is about £1.32, i.e. 2.6% below the value calculated from the CPT assumptions. To match the Transport Scotland data it is necessary to increase the CPT assumptions for journeys per ticket for period tickets by about 5%. The resulting values for adult non-concessionary journeys are summarised in Table 3.3.

Table 3.3 Revised estimates of journeys, adult non-concessionary passengers

2011 full calender year figures	**CPT data for 2011**		**Adjusted journeys/ticket to give TS 2011 average fare**			
2011 data supplied to current study, adult non-concessionary passengers	Tickets in Circulation	Revenue	Adjusted Jneys/ticket	Cost per journey	Revised journeys	Adjusted fare per journey
Adult singles	67,931,437	£106,583,720	1.000	£1.569	67,931,437	£1.57
Adult returns	5,530,148	£23,250,545	2.000	£2.102	11,060,296	£2.102
Ten Journey ticket	204,933	£3,920,100	10.000	£1.913	2,049,330	£1.913
Day tickets	10,964,361	£39,519,459	2.962	£1.217	32,472,328	£1.217
Weekly seasons	2,044,755	£26,943,823	12.191	£1.081	24,927,139	£1.081
4 weekly seasons	563,840	£24,974,052	56.021	£0.791	31,586,766	£0.791
Annual seasons	1,236	£817,912	691.734	£0.957	854,983	£0.957
Total all ticket types		£226,009,611			170,882,279	
Overall average per journey		***£1.358***				**£1.323**

3.4 Assumptions about use of tickets by concessionary passholders

3.4.1 In order to use this data to infer the average fare that would be paid by concessionary passengers, it is then necessary to make assumptions about the extent to which concessionary passholders, in the absence of the concession, would mirror the use of discounted tickets by non-concessionary passengers demonstrated in Table 3.3

3.4.2 One issue on which there has been general agreement[9], in the absence of clear evidence, is that concessionary passholders are less likely than non-concessionary passengers to commit to the purchase of four-weekly or longer period season tickets. The rationale is that a) the majority of passholders are not in full-time employment and b) the primary reason for purchase of these ticket types is to travel to and from work. This is an oversimplification, and there is some evidence of concessionary passholders purchasing four-weekly period tickets prior to free travel in some circumstances[10]. However, we propose that four-weekly

[9] For example, as in the DfT approach to average fare estimation.

[10] CPT quoted data from a major bus operator in Glasgow who, prior to the introduction of the free concessionary travel scheme offered passholders a 4-weekly ticket for £8.50 which entitled purchasers to use the bus for a fare of £0.05, in contrast to the standard SPT

tickets continue to be excluded from the discount factor calculations. Including them would potentially significantly lower the average fare forgone and increase the discount factor.

3.4.3 The other ticket type on which a similar issue arises is the weekly ticket. It is probable that the use of weekly tickets by passholders would be substantially less than of other adults, because of the lower proportion of journeys to work. National data assembled by CPT suggests that only 12.5% of the concessionary age group are in employment. CPT therefore initially proposed that the number of weekly tickets which would be purchased by passholders in the absence of the concessionary scheme should be reduced to 12.5% of those made by the non-concessionary fare-paying passengers.

3.4.4 In our view, this reduction is excessive, because it implies that all weekly tickets are only purchased by people in employment, and only used for work journeys. The 12.5% suggested by CPT will therefore be at the bottom end of the range of plausible values and we suggest that a value of 20% should be used in the current calculations. In our view even this higher value is somewhat conservative (i.e. will tend to favour a lower discount factor and hence higher levels of reimbursement) but CPT is likely to have a different view.

3.4.5 Questions could be raised about the relevance of ten-journey carnet tickets to concessionary passholders (using similar arguments about employment). More generally, it is apparent from the relatively expensive pricing of these tickets, which are significantly more expensive per journey than single tickets, that they are targeted at a different market segment to cash singles. On balance, we recommend including them, which would tend to lower the average fare forgone and hence increase the discount factor.

3.5 Concessionary journey length and the average cash fare

3.5.1 The average adult cash single fare that can be calculated from CPT data for adult fare-paying passengers is less than the average adult cash single fare that would be paid by concessionary passengers (as would be measured by the shadow fare, for example). Data provided by CPT for a sample of eight, predominantly large, Scottish bus operators shows that the average concessionary shadow fare is about 19% more than the average (non-concessionary) adult single cash fare paid. Although this may partly reflect possible over-recording of destinations, it is consistent with evidence from a number of sources that the introduction of free travel led to longer journeys by passholders.

3.5.2 It is therefore logical to presume that in the absence of the concession, journey lengths by passholders would reduce, and there is no strong evidence that in the absence of the concession the journey length characteristics of journeys by passholders would not be similar to those of adult non-concessionary passholders. Consequently, it is appropriate to calculate the average fare forgone using the same average fare per journey as implied by the "adjusted" CPT data, as shown in Table 3.3.

3.5.3 However, the discount factor needs to be calculated relative to the reference fare to which it will be applied i.e. the shadow fare, which could be expected to be 19% higher than the average adult cash single fare. So the process to calculate the discount factor involves, first,

concessionary fare of £0.40 for each journey. Approximately 40% of concessionary journeys were made using this 4-weekly ticket offer, suggesting a substantial willingness on the part of concessionary passholders to invest in longer-period tickets. However, this is an isolated piece of data which will have been influenced by a number of local factors.

calculating the average fare forgone (using the non-concessionary average adult cash single fare), and then estimating the discount factor from the average fare forgone relative to the adult cash single fare increased by 19% i.e. £1.867.

3.5.4 This is shown in Table 3.4, which draws on CPT's most recent 2011 data and the various assumptions discussed above.

Table 3.4 Concessionary average fare forgone, (MVA/Minnerva assumptions)

	Adult non-concessionary passengers			Concessionary passengers		
	Adult ticket sales	Adjusted Jneys/ticket	Cost per journey	Use of ticket type by passholders?	Journeys	Revenues using adult cash single fare
Adult cash single fare	67,931,437	1.000	£1.569	100.0%	67,931,437	£106,583,720
Adult returns	5,530,148	2.000	£2.102	100.0%	11,060,296	£23,250,545
Ten Journey ticket	204,933	10.000	£1.913	100.0%	2,049,330	£3,920,100
Day tickets	10,964,361	2.962	£1.217	100.0%	32,472,328	£39,519,459
Weekly seasons	2,044,755	12.191	£1.081	20.0%	4,985,428	£5,388,765
4 weekly seasons	563,840	56.021	£0.791	0.0%	-	£0
Annual seasons	1,236	691.734	£0.957	0.0%	-	£0
Total all ticket types					118,498,819	£178,662,589
					Average fare	£1.508
	Discount compared to average concessionary shadow fare of £1.867					19.2%

3.5.5 The "hard data" in the table is the information on ticket sales of non-concessionary adult tickets as provided by CPT. The "adjusted journeys per ticket" are largely based on CPT's assumptions, but modified to more closely reflect the average adult non-concessionary fare implied by Transport Scotland national data. The column labelled "use of ticket type by passholders" reflects the assumptions made about the extent to which concessionary passholders would purchase the same tickets as adult non-concessionary passengers. In the table, identical numbers are assumed for all ticket types except that it is assumed that 20% of the weekly tickets purchases by non-concessionary passengers would be made by concessionary passengers, and none of the 4 weekly or annual tickets. The implied number of journeys and associated revenues can then be calculated.

3.5.6 The average fare that is the result of this calculation is £1.508, which represents a 19.2% discount relative to the equivalent average shadow fare of £1.867. This represents our best estimate of the discount factor, based on CPT's 2011 data on ticket sales and revenues.

3.5.7 As discussed above, this value is based on a "compromise" 20% assumption about the use of weekly tickets by concessionary passholders. The other potential area of contention between ourselves and CPT is the need to adjust CPT journeys per ticket assumptions. In our view, this is a necessary check on what would otherwise be unvalidated assumptions. If the calculations were carried out without this adjustment, then the average fare per journey would be calculated to be £1.532, leading to an estimated discount factor of 18.0%.

3.5.8 Both of these estimated discount factors are significantly larger than the value implicit in the current National Scheme Reimbursement Rate, which is about 7.3%[11].

3.6 Commentary on methods for calculating the average fare forgone

3.6.1 *Reliance on assumed journey rates per ticket sold*: the fundamental weakness of the method used to calculate discount factors set out above is that it provides no systematic process through which the discount factor can be updated to reflect changes in the relative price of cash and discount tickets over time, or differences in discount factors between bus operators. At a national level, it is probable that relative ticket prices will only change slowly, and values could be updated simply by replicating these calculations on a year-by-year basis. However, it is unlikely that reported data on journeys will properly reflect the journeys made, and at best, updated discount factors will respond to trends in relative ticket prices on an arbitrary and difficult-to-validate basis.

3.6.2 The only systematic method for inferring the consequences of changes in ticket prices draws on observed data on concessionary journey frequencies. This is the basis of the average fare estimates in the Department for Transport Reimbursement Calculator, as widely adopted in England. An equivalent method has been developed for Scotland, although this method also relies upon various assumptions. The greatest benefit from the alternative method would arise from its application to individual bus operators, where variation in discount factors is likely to be greatest. It can be easily demonstrated using this method that the appropriate discount factor will vary substantially from one operator to another. This suggests that on these grounds alone, a single National Reimbursement Rate incorporating a national "average" discount factor is unlikely to satisfy "no better, no worse off" objectives at an individual operator level (as required by EC Regulations).

3.6.3 It is recognised that at present the Scottish Government is committed to retaining a single All-Scotland Reimbursement Rate. Elsewhere in this report we recommend that consideration is given to alternative approaches, in which case the development of discount factor calculations drawing on these principles is likely to provide the most sensible way forward. This could also provide a transparent mechanism for updating the value of overall Discount Factor estimated above on an on-going basis.

3.6.4 *Data provision*: even if the basis for the journey number assumptions in the data set out above could be more clearly established, the calculations set out above depend entirely on ticket sales and revenue data which has been provided voluntarily by bus operators, collated by CPT. The cooperation of the bus industry in making this information available is gratefully acknowledged. However, given its central role in determining the discount factor, there are possible criticisms of this process in terms of good governance:

- since it is offered voluntarily, Government has no right of audit, nor a power to compel cooperation;

[11] As noted in Chapter 2, the National Scheme quotes a value of 4.5% but this is applied additively to the Reimbursement Rate and implicitly includes the 61.5% Reimbursement Factor. The value that is equivalent to those quoted in this Chapter is 0.045/0.615 = 7.317%.

- the definition and the specification of the information to be provided is entirely the responsibility of CPT, which, since it represents the best interests of its members, could be argued has a vested interest in the outcomes; and
- it is not straightforward to fully reconcile the data with other information collected more formally by Government.

3.6.5 Consequently **it is recommended that the acquisition of data on commercial ticket sales and revenues is put on a more systematic and formal basis**. It should be noted that in England, Regulations provide for local authorities to request operators to supply information on ticket sales and revenues, which can be generated from standard accounting systems and can be readily audited.

3.6.6 *The shadow fare*: the reference fare specified in the National Scheme is the shadow fare, determined for individual concessionary journeys by reference to the passenger's stated destination. Outside Scotland, other methods are used. The shadow fare mechanism used in Scotland gives rise to a number of issues, including the accuracy with which destinations are reported by passengers and recorded by drivers. In addition, the longer transaction times add to bus journey time, both inconveniencing passengers and increasing operating costs.

3.6.7 The alternative method used by a number of English Travel Concession Authorities is to use the average non-concessionary adult cash fare per journey as the reference fare, in other words to assume that the average cash fare paid by non-concessionary passengers is a reasonable proxy for the average cash fare that concessionary passengers would pay in the absence of the concession. The mechanism for collecting this information is usually through periodic returns submitted by each bus operator summarising the number of adult single (and often return) tickets sold, and the associated revenues. These have the advantage of being readily derived from accounting systems and easily audited.

3.6.8 Were the system to move away from using the shadow fare, it would be important to also change the discount factor so that rather than being calculated relative to the average shadow fare (or an estimate of it), it was calculated relative to the average non-concessionary cash fare, or whatever reference fare was adopted.

3.6.9 **It is recommended that Transport Scotland examine other methods of identifying the reference fare as an alternative to the Shadow fare**.

3.7 Conclusions with regard to Discount Factors

3.7.1 Discount factors provide a way to convert the shadow fare, representing the adult cash single fare that would have been paid for the concessionary journeys actually carried by an individual operator, into an estimate of the average fare forgone associated with those journeys. Discount factors reflect the likelihood that in the counter-factual, concessionary passholders would purchase a variety of ticket types, including period tickets, rather than just cash single tickets.

3.7.2 Period tickets allow unlimited travel within specified constraints. The average number of journeys made per ticket purchased, and hence the average price per journey, depends upon the relative prices of the ticket types that are available, and the frequency with which passengers make journeys.

3.7.3 The most common method for taking account of period tickets in calculating the average fare forgone uses actual ticket sales data for non-concessionary passengers ("method (a)"). Although data on actual ticket sales and revenues should (in principle) be readily available and auditable, assumptions are needed about the number of journeys made per ticket, and also about how concessionary ticket purchase would differ from non-concessionary passengers.

3.7.4 The estimates described above of the average all-Scotland Discount Factor are based on the data collated by CPT and their advisors, and largely relies on their assumptions about the number of journeys made per period ticket. This would be a major weakness had it not been possible to confirm the overall plausibility of the CPT assumptions about the journeys made per period ticket sale by checking against Transport Scotland data.

3.7.5 **Based on the data provided by CPT shown in Table 3.2, our preferred value for the discount factor is 19.2%; a compromise value which is an average of our preferred value and that obtained by CPT is 18.6%.**

3.7.6 In the longer term, the fundamental weakness of method (a) is that it relies on unsubstantiated assumptions about the number of journeys made by commercial passengers for each period ticket purchased. These assumptions are fundamental to the calculation of the discount factor. As relative ticket prices change, there is no systematic method for adjusting these assumptions despite the fact that logically, they are bound to vary.

3.7.7 Method (b), which uses observed frequency of concessionary journeys by passholders, provides an alternative which does not suffer from this fundamental weakness, although it also requires some assumptions for which there is little established evidence base. **The possibility of moving to a "method (b)" approach should be kept under review by Transport Scotland, especially if a move away from a single all-Scotland Reimbursement Rate were to be contemplated**.

4 Reimbursement Factors and Elasticities

4.1 Concepts and terminology

4.1.1 The number of bus journeys made by passholders depends at least in part on the fare that is paid. Some bus journeys would be made by passholders even if the full "commercial" fare had to paid, but more will be made if journeys can be made for free. The concessionary journeys that would not be made without the concession are regarded as being *generated* by the concessionary fare.

4.1.2 Reimbursement for revenue forgone is the product of the number of non-generated concessionary journeys and the average fare forgone. Since the number of non-generated journeys cannot be directly observed, it has to be estimated by reference to the observed number of concessionary journeys. This is calculated using the *Reimbursement Factor* – the ratio of non-generated journeys to the total number of concessionary journeys i.e. non-generated / (non-generated + generated).

4.1.3 The volume of journeys generated by the concession will depend upon the level of the commercial fare – or more precisely on the average fare forgone (that is, the average fare per journey that would be paid by passholders in the absence of the concession). Just as higher fares lead to fewer commercial passengers, higher fares will also reduce the number of journeys that would be made by concessionary passholders in the counter-factual. Since higher commercial fares will not influence the observed number of concessionary passengers travelling for free, higher fares imply higher levels of generation, and should be associated with lower Reimbursement Factors i.e. the proportion of observed concessionary journeys that would have continued to use the bus in the absence of the free scheme will decrease.

4.1.4 For a given increase in fares, the change in the number of non-generated journeys will depend upon the overall relationship between the demand for bus services and the price of using them. This relationship is simulated by a "*demand curve*" – a mathematical expression which determines the number of bus passenger journeys as a function of the fare, and associated parameters. The sensitivity of demand to changes in fare is often described in terms of the *elasticity* of demand with regard to fares. Elasticity values are frequently expressed as the ratio of a percentage change in demand to a percentage change in fares: so if a 10% change in fares leads to a 3% reduction in bus journeys, the elasticity would be calculated as -0.3. Since journeys generally decrease as fares go up, the fare elasticity is usually a negative number, but it is often convenient to discuss comparisons of elasticities in absolute terms, so it might be said that an elasticity of -0.4 is "larger" than an elasticity of -0.3.

4.1.5 Different forms of demand curve imply different relationships between the elasticity at particular points on the curve (the "*point elasticity*") and the fare at which it is measured. Unfortunately the one form of demand curve in which the point elasticity is constant cannot be used for calculating concessionary travel reimbursement factors[12]. Various alternative forms have been considered and that used most widely, known as the "*damped exponential model*", has been adopted here. The key characteristic of this form of model is that the point elasticity rises (in absolute terms) with the fare, but less than proportionately. It requires

[12] Because this particular mathematical expression is not defined at zero fares.

two parameters, labelled here as *Beta* and *Lambda*, which jointly determine the point elasticity at any given fare.

4.1.6 One issue is whether *short run* or *long run* elasticities should be used to calculate reimbursement factors. It is generally accepted that some changes in travel behaviour arising from changes in fares will not happen instantly and may take time to occur; for example, changes in car ownership levels or the places individuals travel to and from. Short run elasticities are intended to reflect the short-term consequences of a change in fares, and long run elasticities are generally regarded as reflecting all associated changes, at a new "*equilibrium*" level. To some degree differences between short and long run fare elasticities can be identified by examining changes in journeys immediately after a change in fare (e.g. in the year following a major change), and comparing them to changes over longer time periods such as three to five years. The length of time that has now passed since free local authority-wide travel was introduced in Scotland in 2002 is such that all significant long run reactions to the change can now be considered to be reflected in observed concessionary journey patterns.

4.1.7 Some practitioners have argued that short term elasticities are appropriate for concessionary travel reimbursement, because they will best represent a counter-factual of a sudden withdrawal of the concession. However, in our view it is more logical to base reimbursement on a counter-factual which represents an equivalent equilibrium position as the observed concessionary passengers. This appears to be the position adopted by the DfT, in that the elasticity values recommended to English Travel Concession Authorities (TCAs) reflects the position three years after free travel was implemented. Long run elasticities would also be consistent with the calculation of additional costs that include substantial allowance for the cost of additional capacity and peak vehicles. Our view is that in principle long run elasticities are the most appropriate basis for calculating "no better off, no worse off" reimbursement.

4.1.8 An additional issue in calculating the Reimbursement Factor is the price base that should be used to relate fare levels in a given reimbursement period (e.g. 2012-13), to the price level at the time when elasticities were established (e.g. 2002). Passenger responses to changes in fares will clearly be influenced by general perceptions of consumer prices, but there are different options for measuring price levels which are discussed in the final section of this Chapter.

4.2 Sources of elasticity parameters

4.2.1 The Reimbursement Factor incorporated in the All-Scotland National reimbursement rate was set at 61.5% at the time the All-Scotland concession was introduced in 2006-7, and has remained unchanged ever since. The value was calculated by combining information on the Reimbursement Factors used by individual Scottish Local Authorities prior to free travel being introduced (in October 2002), with data on the change in concessionary journeys in the year before and after free travel. The origins of the pre-free Reimbursement Factors are not known, and any analytical basis for them is largely un-documented. However, the 61.5% (together with other components of the reimbursement calculation) provided an acceptable basis for the Scottish Government and Scottish bus operators to successfully establish the National Scheme.

4.2.2 Although not calculated from explicit elasticity assumptions, it is possible to work backwards from the commercial fare in 2006-7 to identify the elasticity values implied by the 61.5% figure. This approach was taken in Scottish Government analysis of reimbursement arrangements in 2009 which concluded that the 61.5% rate was consistent with a point elasticity of -0.348 at 2007-8 prices[13].

4.2.3 Since the Reimbursement Factor in the National Scheme has not changed, similar calculations can also be carried out at more recent fare levels, such as the projected 2012-13 average shadow fare.

4.2.4 In making comparisons across years, it is important to properly take account of changing levels of prices. The discussion above about higher fares leading to lower demand presumes that fares are measured in "real" or "constant" prices, i.e. after allowing for general inflation of price levels. To aid comparability, and for reasons discussed later, the elasticities implied by the current National Scheme Reimbursement Factor of 61.5% have been calculated in terms of 2001-2 prices, as measured by the All-Items Retail Price Index. These values are summarised in Table 4.1.

Table 4.1 Point elasticities implied by current Reimbursement Factor assumption

Elasticities implied by Current Scheme Reimbursement Factor of 61.5%	Using fares in	
	2006-7	2012-13
Reimbursement Factor	61.50%	61.50%
Average adult (shadow) cash single fare	£1.339	£2.064
Pre-degeneration Discount factor	5.37%	7.32%
Average fare forgone (current prices)	£1.267	£1.913
Retail Price Index, 2001-2=100	115.2	140.4
Average fare forgone, 2001-2 prices	£1.100	£1.363
Assumed Lambda	0.703	0.703
Implied Beta at 2001-2 prices (RPI)	-0.455	-0.391
Illustrative 2001-2 Full Fare	£0.859	£0.859
Illustrative point elasticity at 2001-2 Full Fare	-0.287	-0.247

4.2.5 The Table shows how the average shadow fare in 2006-7 and 2012-13 respectively is used to derive the average fare forgone, which is then converted to 2001-2 prices (in this instance using the Retail Price Index). For the purposes of this illustration, a Lambda value has been selected from estimated All-Scotland Long Run elasticity calculations. These allow a Beta value to be calculated, set at 2001-2 prices.

4.2.6 "Full fare" elasticities have been calculated relative to the estimated All-Scotland average commercial fare of 2001-2. These suggest point elasticities of -0.287 and -0.247, but (as with all the point elasticities quoted here) are intended only to illustrate relative elasticity values, and not for direct calculation of reimbursement.

[13] "Review of the Scotland Wide Free Bus Travel Scheme", Part 11 Annexe C, May 2009.

4.3 Evidence on concessionary fare elasticities from outside Scotland

4.3.1 Short run fare elasticities (i.e. elasticities reflecting short term changes in travel patterns arising from a change in fares) for all bus passengers as a whole are typically quoted as being of the order of -0.4. The DfT-sponsored collaborative study on elasticity evidence[14] reported elasticity values for the elderly ranging from -0.35 to nearly -1.0, with a mean value of -0.5, although the -1.0 figure is a topic of some debate.

4.3.2 The collaborative study also revealed that there was little firm evidence on the differences between short and long run bus fare elasticities, although such long run elasticities as were found were substantially higher than accepted short run values. One reading of the evidence, reported in the DfT Study discussed below[15], suggested that the long-run uplift to concessionary elasticities in moving from the short run was in the range of 30% to 50%. The DfT assumption at the time was that a 50% uplift was appropriate.

4.3.3 All of the research reported on by the collaborative study predated analysis of the impact of free concessionary travel in the UK on travel volumes. Greater certainty about concessionary travel elasticities has now been achieved, to some extent, with the analysis of the impacts of the introduction of free travel in the UK, although, so far as we know, only one contemporary study at a national level was carried out, in Wales from 2001 to 2003[16] . Although focussed on reimbursement rates rather than elasticity values, the Study derived a point elasticity at full fare (assumed at the time to be £1.00) of -0.365, in 2002 approximately.

4.3.4 Following the introduction of statutory free travel in England in 2006, there were a very large number of disputes between TCAs and bus operators regarding reimbursement. In order to address the issues raised, the DfT sponsored a major research study in 2009-10 which included a substantial amount of work on elasticity values, and which created a comprehensive framework for updating reimbursement calculations. The current project for Transport Scotland is partly in response to the availability of the fresh evidence exposed by the DfT work[17].

4.3.5 Strands of the DfT research included development of ideas about the shape of the demand curve, which have informed the adoption of the damped exponential demand model as discussed above. Elasticity values were explored in a number of separate workstreams which generated a "zone of reasonableness" for elasticity values. However, the precise values that were recommended by ITS, and then adopted by the DfT, were based on analysis of concessionary journey data before-and-after the introduction of free fares in England in 2006, from four PTE areas and seven non-PTE areas. These areas were selected principally because they offered most likelihood of access to the detailed data necessary for reliable before-and-after analysis, including information on the pre-free concessionary scheme, passholder numbers, and other confounding factors.

[14] "The demand for public transport: a practical guide", TRL Report 593, TRL, 2004.

[15] E.g. "Report 4 Shape of the Demand Curve" by Phil Goodwin and Andrew Last.

[16] "All-Wales Concessionary Fares Reimbursement Study", MVA Ltd, 2003.

[17] "The DfT study was commissioned from the Institute for Transport Studies (ITS) at the University of Leeds (in association with Minnerva Ltd and Professor Phil Goodwin). To avoid confusion with the research commissioned by Transport Scotland from ITS, but, in 2009, it is referred to here as "the DfT Study".

4.3.6 The DfT default values are summarised in Table 4.2, together with the point elasticity at an illustrative 2001-2 fare of £0.859.

Table 4.2 Default DfT elasticities

DfT Default Elasticities	PTE	Non-PTE
Lambda	0.723	0.641
Deindexed Beta (2001-2 prices)	-0.665	-0.795
Illustrative point elasticity at 2001-2 All-Scotland fare of £0.859	-0.431	-0.462

4.3.7 It can be seen that the point elasticities are significantly greater than those implied by the current All-Scotland Scheme Reimbursement Factor. This is partly, but not completely, accounted for by the fact that they were derived by comparisons between 2005-6 (the year before free travel was introduced in England) and 2008-9, three years afterwards; they therefore reflect longer-run changes in travel behaviour following the change in the concessionary fare, although the extent to which all longer-run responses have been captured is difficult to judge.

4.3.8 There are reasons for expecting that concessionary passholder elasticities in Scotland would be lower than in England, principally lower levels of car availability in Scotland, and a larger proportion of the elderly population living in rural areas. One of the strands of the DfT study was the development of an econometric model using *NTS* (National Travel Survey) data covering the period from 1995 to 2008. Although based on English data, the model can be used both to derive elasticities for Scotland directly, and to estimate the impact of differences in characteristics on elasticities in Scotland and England. The direct estimate of the elasticity in Scotland (drawing on the econometric model parameters, but using Scottish values of the independent variables) is a full fare point elasticity of -0.62 in 2002. This appears rather high, but there are some uncertainties about the precise interpretation of these elasticities, in particular the extent to which the analysis will have captured short run or long run elasticities.

4.3.9 However, of the variables included in the econometric model, the most significant differences between England and Scotland are in car availability (lower in Scotland), and the proportion of the elderly population living in rural areas (higher in Scotland). In combination, these are estimated to reduce the magnitude of elasticities by about 25%, implying that the DfT default elasticities adjusted for Scottish characteristics would be equivalent to point elasticities in 2001-2 (at the 2001-2 full fare) of -0.32 and -0.35.

4.4 Deriving Elasticities from Scottish 2002-3 Data

4.4.1 The current study has reviewed the literature to ascertain whether there were robust estimates of Scottish concessionary fares elasticities that could be used to underpin the reimbursement formula in Scotland. It concluded that with one exception in Strathclyde, discussed below, there were not existing estimates, and that estimation of Scotland specific elasticities was required. New research has therefore been undertaken to estimate Scotland specific fares elasticities, by revisiting Scottish data from 2002 and 2003, around the time when free travel was introduced on 1st October 2002.

4.4.2 In general, the most reliable way to estimate fare elasticities for concessionary travel reimbursement is to draw on evidence of passenger reaction to a major change in fares. The introduction of free travel provided a unique opportunity to do so, by comparing travel volumes "before" and "after" the change. However, to ensure a proper like-with-like comparison, information about the "before" situation needs to be as robust and comprehensive as for the "after" situation. This is difficult to achieve on a retrospective basis, since the information required is much more than simply the change in concessionary journeys. Other information needed includes:

- the average concessionary fare charged in the period immediately before free travel;
- the characteristics of the pre-free and post-free concessionary schemes for each of the local schemes[18];
- the number of passholders and how this changed when free travel was introduced; and
- information on any other "confounding factors" that need to be taken into account so that only the effect of the change in fare on journey numbers is identified.

4.4.3 Achieving certainty on all of these fronts is difficult, and becomes much more so with the passage of time since free travel was introduced. Moreover, local authorities ceased responsibility for concessionary travel in April 2006, when administration was taken over by Scottish Government, and therefore there is no continuity of organisation or personnel to allow historical data to be retrieved or sense-checked.

4.4.4 The exception to the general lack of evidence on Scottish concessionary elasticities is Strathclyde. In 2003, four bus operators applied to Scottish Ministers ("appealed") for a modification of the Strathclyde Passenger Transport (SPT) reimbursement arrangements. The person appointed to determine this application, on behalf of Scottish Ministers is one of the authors of the current report, and is therefore uniquely well placed to draw upon this experience. As part of the formal Determination process, it was necessary to obtain sufficient information to enable elasticity estimates to be derived, leading to the conclusion that at the then commercial fare in Strathclyde of £0.905, a point elasticity of -0.523 could be justified. However, the methodology used during the Determination predated various technical developments (in particular, with regard to the shape of the demand curve), and the value just quoted is not necessarily consistent in terms of definition with others quoted in this report.

4.4.5 However, of great relevance to the current study is the fact that the Determinations led to the collection of a considerable archive of data (the "*Determination archive*"), to which the current study team have had access. The archive was created in 2004 and therefore was close to the time of the introduction of free travel, is of known provenance, and was subject to close scrutiny by the interested parties at the time. The archive includes data on all the factors listed above, often documented in terms of its originator and the date provided, as well as other incidental information that has helped provide a more complete picture of the situation in Strathclyde before and after free travel was introduced.

[18] Prior to the National Concession implemented in 2006, concessionary travel was administered by the individual Scottish local authorities, apart from the area within Strathclyde Passenger Transport and Lothian. There were therefore 13 different schemes, each potentially having more generous concessions than the statutory minimum, but with local variations about how these were specified.

4.4.6 Since the current National Concessionary Scheme operates on the basis of a single Reimbursement Rate, it should ideally be informed by a single set of elasticity parameters that fully reflect "average" characteristics of Scotland as a whole. However, the evidence base for the rest of Scotland is somewhat weaker than that for Strathclyde, although extensive efforts have been made to reduce areas of uncertainty. Moreover, the SPT Scheme was the largest in Scotland contributing over half of all Scottish concessionary passengers in 2002. Where necessary, Strathclyde data has been used as a proxy for the rest of Scotland, allowing Scotland-wide elasticity estimates to be made.

4.4.7 The scope of analysis has been limited to comparisons between annual data for the following:

- year ending 30 September 2002, just before free travel was introduced;
- year beginning 1 October 2002, just after free travel was introduced (short run impact); and
- year ending 31 March 2007, the year just after the National Concession was introduced, and administration was taken over by the Scottish Government (long run impact).

4.4.8 The comparison of the pre-free year and 2006-7 will pick up both long run impacts from the 2002 change, and also the short run impacts of the extension of the concession associated with the National Scheme, i.e. national travel (as opposed to just resident local authority-wide travel), and the removal of the morning peak restriction. It is therefore more appropriate for elasticities that reflect the full change to the current concession. However, the greater gap between 2002 and 2006-7 introduces more scope for debate about various "confounding factors" i.e. other contextual changes that could influence the number of concessionary journeys made. The comparison which is most robust in this respect is with the year immediately following free travel.

4.4.9 Where data is limited, it is recognised that there is scope for different interpretations of the information that is available, as well as about assumptions where it is necessary to make them.

4.5 Data sources

4.5.1 *Concessionary journeys*: for the local authorities outside Strathclyde, in 2002 and 2003, the only source of information of which we are aware is a spreadsheet file that was provided to us by CPT (the "*CPT concessionary journey data*"). CPT has said that it was passed to them by Transport Scotland, having been initially compiled by ATCO (the Association of Transport Coordinating Officers) as part of the process to inform the implementation of free travel in the 2002-3 period. We have no reason to doubt the accuracy of this data for outside Strathclyde, although equally we have nothing with which to independently corroborate it.

4.5.2 The CPT data also includes figures for Strathclyde, where the Determination archive offers an alternative source of information. In both cases, the information will originally have been supplied by Strathclyde Passenger Transport (*SPT*), since only SPT will have been in a position to compile the information from operator reports. However, whereas the Determination archive data was supplied direct to the Determination by SPT, as part of the

semi-judicial Determination process, at known dates, it is not known when SPT passed the data reported by CPT to ATCO.

4.5.3 This issue is of importance because the Determination data and the CPT data for concessionary journeys in Strathclyde show significant differences. CPT data gives higher journey numbers in the year before free travel and lower journey numbers in the year after, and consequently implies that free travel had a smaller impact on the concessionary journeys than the Determination data. The alternative sets of figures are set out in Table 4.3, which shows quarterly older and disabled concessionary journeys.

Table 4.3 Alternative Data on Strathclyde Concessionary Journeys, 2001-2004

Quarter			Concessionary journeys, provided by SPT October 2004 (the "Determination data")		Concessionary journeys, reported by CPT August 2012 ("CPT concessionary journey data")	
From	To	Calendar Year	Quarterly Total	Annual Total	Quarterly Total	Annual Total
01-Oct	31-Dec	2001	13,420,885	52,876,661	13,254,000	53,690,000
01-Jan	31-Mar	2002	12,951,221		13,846,000	
01-Apr	30-Jun	2002	13,203,075		13,244,000	
01-Jul	30-Sep	2002	13,301,480		13,346,000	
01-Oct	31-Dec	2002	17,177,412	71,915,833	17,142,000	69,482,000
01-Jan	31-Mar	2003	16,539,965		15,240,000	
01-Apr	30-Jun	2003	18,679,925		18,300,000	
01-Jul	30-Sep	2003	19,518,531		18,800,000	
Annual increase, y/e Sep '02 to y/e Sep '03				36.0%		29.4%

4.5.4 The higher growth in journey numbers shown in the Determination data will imply larger elasticities, and lower reimbursement totals, than the CPT data, all other things being equal.

4.5.5 We believe that the reason for this discrepancy is that the data reported by CPT reflects preliminary estimates of quarterly data that were widely circulated by SPT in its consultations about post-free travel reimbursement arrangements in 2002 and 2003. Similar but not identical data was submitted by SPT in the initial stages of the Determination process. However, in October 2004 SPT explained that errors had been found in the initial dataset, and corrected data was provided. The corrected data was used to make the Determination, and we regard it as the best available estimate of journeys in Strathclyde, in the absence of more detailed information about the provenance of the CPT data.

4.5.6 There is some scope for comparison of the Determination data with concessionary journeys data published by Transport Scotland. The latter is only available in financial years (and therefore straddles the period when free travel was introduced), and does not distinguish between local authorities that already provided free travel prior to October 2002. However, it quotes separate data for Strathclyde, which because the Determination data is available on a quarterly basis, can be related to the Transport Scotland financial year totals. For consistency, and at the suggestion of CPT, we have adjusted the Determination concessionary journey numbers to align with the Transport Scotland data, involving an 0.1%

increase to the Determination data that fell into the 2001-2 Financial Year, and adjustments of -0.5% and -1.1% for the 2002-3[19] and 2003-4 financial years respectively.

4.5.7 We have no equivalent checks on the data provided by CPT for concessionary journeys in Scotland outside Strathclyde in the 2002-3 period, and have therefore accepted them at face value.

4.5.8 With regard to 2006-7 concessionary journeys, Transport Scotland's Scottish Transport Statistics 2011 clearly identifies an all-Scotland value for free concessionary journeys of 155.71 million which can be corroborated by reference to the detailed data held by the Transport Scotland Concessionary Travel and Integrated Ticketing Unit ("CT&ITU"). However, this information is not available by local authority area, and consequently there is not a Strathclyde figure that can be contrasted directly with the values quoted above.

4.5.9 When contrasting the "before" and "after" data, one further complication is that Fife, and Dumfries and Galloway Councils already provided a free travel concession on a discretionary basis. Consequently, analysis of "All-Scotland" elasticities needs to be on the basis of excluding data for these areas, which in the case of concessionary journeys is based on the CPT data on concessionary journeys. It has been assumed that the Transport Scotland data on concessionary journeys for 2006-7, which is only available at an All-Scotland level, can be factored down to exclude journeys made in Fife, Dumfries and Galloway using the same proportions as applied in the year ending 30 September 2003. Since it is our view that the Determination data on Strathclyde is more robust that that provided by CPT for Strathclyde, the proportion is based on the Determination data for Strathclyde.

4.5.10 These considerations lead to the estimated "before" and "after" concessionary journeys summarised in Table 4.4.

Table 4.4 Concessionary Journeys in the years ending September 2002 and 2003, and March 2007

Older and Disabled Concessionary Journeys	Strathclyde		Scotland excluding Fife, Dumfries and Galloway	
	Transport Scotland adjusted Determination data	CPT data	% based on Determination data	CPT data
Year ending Sep '02	52.911	53.690	91.525	92.305
Year ending Sep '03	71.208	69.482	121.209	119.483
Year ending Mar ' 07			142.918	142.679

4.5.11 It should be noted that the absence of distinct concessionary journey data for Strathclyde in the year ending March 2007 means that it is not possible to identify a separate long-run elasticity for Strathclyde which could be contrasted with the short run value that can be estimated.

[19] To be conservative, we have assumed that all of the correction for 2002-3 should be applied to the two quarters following the introduction of free travel. The adjustments were therefore 0%, 0%, -0.8% and -0.8% for each of the four quarters in the 2002-3 financial year.

4.5.12 *The pre-free concessionary fare*: elasticities are estimated by comparing the change in journeys with the change in fare, and consequently it is necessary to estimate how much concessionary passengers paid for their concessionary journeys prior to free travel being introduced. The situation varied between local authorities, depending on the local view taken as to the appropriate level of concessionary fare within the statutory minimum concession of half the commercial fare.

4.5.13 In Strathclyde, the "standard" concessionary fare adopted by SPT was a £0.40 flat fare, but for concessionary journeys of more than 10 miles, a higher fare was charged based on the sum of £0.40 for the first 10 miles and then an additional element based on the commercial fare increment between 10 miles and the length of the concessionary journey. In addition, in Glasgow some bus operators offered passholders cheaper fares than the "standard" concessionary fare of £0.40, in one case by offering a four-weekly period pass that entitled the purchaser to then make journeys at a flat fare of £0.05 per journey. The estimation of the average concessionary fare paid in Strathclyde has required access to a number of sources of data, some from the Determination archive, some provided through CPT, and some from analysis of Scottish Household Survey data. The end result is an estimated average concessionary fare paid by passholders in Strathclyde in the year ending September 2002 of £0.443.

4.5.14 We are reliant on data provided by CPT for all information on the concessionary fares in Scotland outside Strathclyde, and have also used the estimates made by CPT, for both an average commercial fare in Scotland to which percentage concessions can be applied, and a weighted average fare for the Lothian councils. These values are summarised in Table 4.5.

Table 4.5 Summary of non-zero concessionary fares charged in Scotland in year ending September 2002

All-Scotland pre-free average concessionary fare	Concessionary journeys in year ending Sep '02 (a), (b)	"Flat" fare where provided (c), (d)	% of commercial fare (c)	Scotland-wide average commercial fare (e)	Implied concessionary fare
Assumed commercial fare				**£0.859**	
Aberdeen City	4,551,755		50%		£0.429
Aberdeenshire & Moray	1,440,309		50%		£0.429
Angus	1,256,937		25%		£0.215
Borders	555,420		50%		£0.429
Central Region (old)	3,226,304		25%		£0.215
Dundee	3,848,470	£0.350			£0.350
Highland	782,063		50%		£0.429
Lothians (exc.West)	19,987,267	£0.320			£0.320
Perth & Kinross	1,244,107		50%		£0.429
Strathclyde	52,910,584	£0.443	50%		£0.443
West Lothian	1,722,000	£0.320			£0.320
Total/average of non-free schemes	91,525,216				**£0.397**

4.5.15 Note that the journeys shown for Strathclyde (necessary to calculate an overall Scottish weighted average concessionary fare) are based upon the Determination estimate, giving an

All-Scotland average concessionary fare of £0.397. A slightly higher value of £0.398 is derived if the CPT estimate of Strathclyde journeys is substituted.

4.5.16 *Passholder numbers:* changes in the number of passholders stimulated by the introduction of free travel can have a profound impact on the interpretation of data on concessionary journeys. However, data on passholder numbers is often unreliable, because it is difficult to ensure that records are updated when individual passholders die or move away. This is exacerbated if passholders are not required to renew their pass at regular intervals eg every few years.

4.5.17 There is relatively robust data on passholder numbers in Strathclyde, because SPT policy required passholders to renew their passes every four years. SPT data on passholder numbers was the subject of specific inquiries during the Strathclyde Determination. Elsewhere in Scotland, there is some information on changes in passholding in Edinburgh, but this is not regarded as reliable because passes were issued "for life", and figures for the absolute number of passes "on issue" exceeded the eligible population by a substantial margin. It is therefore difficult to interpret the available figures for Edinburgh with any confidence. There is some data for passholder numbers in other local authority areas in 2003, after the introduction of free travel, but we are aware of no equivalent data for the period before free travel.

4.5.18 Consequently, the approach that we have adopted is to assume that the change of passholder numbers that can be inferred from the Strathclyde data should be taken as representative of that for Scotland as a whole. In fact, even the Strathclyde data requires some interpretation, because of a backlog in the processing of pass applications in the period immediately following the introduction of free travel, and the most robust numbers are regarded as those representing the passes issued at 31/3/2002 (336,969) and at 31/3/2004 (386,578).

4.5.19 Transport Scotland has published data on concessionary passes issued by individual local authorities since the National concession was established, and this provides a means through which SPT's data from 2002-3 can be compared with later years. The available data is summarised in Table 4.6. The data selected for use in the elasticity analysis is also identified, with the year of which it is assumed to be representative.

Table 4.6 Strathclyde Passholder data (excluding Ferry passes)

Year for Elasticity Estimates	y/e Sep '02	y/e Sep '03	y/e Mar '06	y/e Mar'07
Reference date	31/03/02	31/03/04	1/6/'05?	31/01/07
Total Passholders	336,969	386,578	409,779	427,347
Passholder eligible by age	278,527	326,058	345,799	351,492
Disabled Passholders	58,442	60,520	63,980	75,855

4.5.20 The first two columns reproduce data provided to the Determination by SPT. CPT has noted the likelihood that SPT may have classified male passholders aged between 60 and 64 newly eligible for the pass through the extension of the age of entitlement as "non-elderly", and have estimated that these may have accounted for about 26,000 of the total as at 31/3/2004. The data shown in Table 4.6 has reclassified these passholders as "eligible by age" i.e. reflecting the actual eligibility criteria at the time, although in practice the distinction between the two groups of passholders is not relevant to elasticity estimates beyond the initial year.

4.5.21 For the year ending March 2006, we have used data reported in a Scottish Executive research report[20] published in 2006, but it is unclear precisely to what period it refers, and there are some indications that it may not be defined consistently with the other figures shown here. For the year ending March 2007, we have drawn on data published in "Bus and Coach Statistics" by Transport Scotland[21]. The value shown is calculated from the sum of passholder numbers recorded by the individual local authorities in the former Strathclyde Passenger Transport area, including all of Argyll and Bute. Transport Scotland's published Strathclyde total excluded Argyll and Bute, which is only partially in the Strathclyde Regional Partnership area, whereas prior to April 2006 it was fully included in the SPT area.

4.5.22 Note that since no passholder data is available on a consistent basis for Scotland outside Strathclyde prior to the National Scheme, any allowance for passholder growth in the elasticity estimation process is reliant upon the assumption that Strathclyde is reasonably representative of Scotland as a whole.

4.5.23 *Age equalisation:* a major complication in the interpretation of data from 2003 is that in April of that year, the minimum age of eligibility for the elderly concession was extended to men aged between 60 and 64, having previously been set at 65. This change ("*age equalisation*") will have increased the number of concessionary bus journeys included in the data from that time, representing both a transfer to the concession of journeys previously made by bus but paying a fare, and also through additional bus journeys generated by access to free travel. Ideally, to allow for "before" and "after" comparisons of concessionary journeys on a like-for-like basis, the numbers of concessionary journeys by these newly eligible passholders should be subtracted from the "after" concessionary journeys, and an equivalent adjustment should be made to reflect the change in passholder numbers brought about by age equalisation.

4.5.24 Research was commissioned in 2003 by the Scottish Executive from Accent Marketing and Research ("*Accent*") to estimate the additional demand for concessionary travel. Accent conducted 900 telephone interviews just before the change came into effect, and reported on how much respondents would make use of the new concession. Results were expressed in terms of estimated additional concessionary journeys, categorised between those previously made on a fare-paying basis, those made previously by another mode, and journeys that were completely new. Overall, Accent estimated that age equalisation would result in about 443,000 additional concessionary bus journeys in a typical week.

4.5.25 In principle, the Accent work provides a useful starting point for making allowance for age equalisation. However, it is likely to overstate the scale of additional journeys – respondents are inclined to report intentions, some of which do not materialise. The likelihood of this is confirmed by considering that the average number of journeys that would be made per week, according to the stated intentions of respondents, would average about 3.64 per male aged 60-64, in contrast to the overall average (for example, in 2006-7) of 2.662[22]. Evidence from elsewhere suggests that average concessionary trip making by those aged 60 to 64 is

[20] "Improved Public Transport for Disabled People Volume 1 Report", Table 3.4, Scottish Executive Social Research, 2006

[21] Bus and Coach Statistics 2005-6, Table 32. The table quite explicitly states that the quoted passholder numbers are as at 31st January 2007.

[22] Based on total concessionary journeys divided by the eligible elderly population. The actual contrast is greater than this, since the journeys numbers will include those made by disabled passholders not included in the population figure.

lower than those of older concessionary passholders[23]. In addition, the growth in concessionary journeys for men aged 60 to 64 will be from a base position of no concession, whereas for other passholders, the movement is from at least a half fare scheme and in many instances a more generous flat fare concession.

4.5.26 Overall, these represent a complex series of interactions which cannot be fully allowed for with available evidence. CPT has proposed a pragmatic assumption that one third of those increases in concessionary journeys estimated by Accent associated with modal shift and "new" journeys should be allowed for in the estimated number of post-free concessionary journeys. In the absence of firmer evidence, we have adopted this assumption for illustrative purposes in the elasticity estimates that follow. However, in our view it is regarded, on the basis of anecdotal evidence from England, and also some Strathclyde data provided to the Determination by SPT, as more likely to overestimate this impact rather than an under-estimate, and therefore will favour lower elasticity values and higher levels of reimbursement.

4.5.27 *Trends in eligibility for disabled concessions*: over the period under consideration, the number of passes issued on grounds of disability has increased more rapidly than those for the elderly, reflecting amongst other trends an increase in the underlying number of people eligible for disabled benefits. Since there is good evidence that, on average, disabled concessionary passholders (e.g. those aged under 60) make more use of the concession than older passholders, this would suggest that in the counter-factual a larger increase in concessionary journeys would have occurred than if all passholders were assumed to have the same propensity to make concessionary journeys.

4.5.28 We have used data on the number of claimants for Disability Living Allowance (DLA) to provide a proxy measure of the trends in the number of people who are eligible for concessionary travel on grounds of disability. We have used the total caseload, all rates, of working-age applicants as the proxy measure of growth in disabled passholding and journeys.

4.5.29 *The underlying trend in concessionary journey volumes*: time-series analysis of concessionary travel in Strathclyde from 1993 to 2003 was carried out by MVA Ltd in research on trends in concessionary travel for the Passenger Transport Executive Group ("*pteg*"), of which SPT was a member. This identified an underlying long-term decline in concessionary journeys numbers of -0.75% per year, after allowing for a range of explanatory variables including concessionary fare changes, demographic change and increased car availability. Data on bus service levels in Strathclyde was not available to inform the analysis for pteg, but if the all-Scotland trends in bus-kms were representative of Strathclyde, then a larger trend decline would probably have been observed, with the consequence that elasticity estimates would have been modestly higher. The -0.75% pa trend decline has been assumed to apply to the year ending September 2003, and pro-rata to the fiscal year 2006-7.

4.5.30 For Scotland outside Strathclyde, no equivalent analysis is available, and the assumption has been adopted that there was no overall underlying trend. Determination data for concessionary journeys in the year ending September 2003 shows that Strathclyde represents 59.0% of journeys in Scotland excluding Fife, Dumfries and Galloway. The

[23] As shown in Report 3 of the DfT Study "Analysis of concessionary passholder data from Lancashire and Nottingham"

overall trend per year for Scotland excluding Fife, Dumfries and Galloway has therefore been assumed to be -0.443% (0.59*-0.75%) per annum.

4.5.31 *Demographic change*: even without age equalisation, the elderly population in Scotland is increasing by about 0.5% per year, so that if free travel had not been introduced, both passholders and concessionary journeys could be expected to have increased in similar proportions. General Register Office for Scotland data on the elderly population has been assembled for Scotland and Strathclyde, and used to adjust journey totals pro-rata on the basis that 75% of concessionary journeys are made by those qualified for a pass on grounds of age. Age equalisation added about 13% to the elderly eligible population in Scotland, and about 12% in Strathclyde.

4.5.32 *Changes in bus service levels*: vehicle kilometres on local bus services in Scotland increased from 2001-2 to 2006-7, and this is likely to have encouraged more concessionary journeys even if free travel had not been introduced. It has been assumed that 10% increase in bus kilometres will lead to a 6.6% increase in patronage[24]. Data has been taken from Transport Scotland's Bus and Coach Statistics. Separate data is not available for Strathclyde, and for the Strathclyde-specific elasticity estimates, it has been assumed that the All-Scotland figures apply.

4.5.33 *Impact of free bus travel on concessionary rail demand*: in Strathclyde, the introduction of free travel on buses probably led to some transfer to bus of concessionary passengers who had previously used trains (for which a £0.40 concessionary fare continued to be available). The scale of this impact was estimated during the Strathclyde Determination and has been included in our calculations.

4.5.34 *Other confounding factors*: in addition to the above, there are other influences on the volume of concessionary journeys that will affect the "before and after" comparisons. The most significant are probably changes in car availability amongst the older population, and increased proportions of accessible buses. The former is likely to have led to reduced concessionary journeys, the latter is likely to have increased concessionary journeys. However, evidence on the scale of these impacts is weak, and it is difficult to judge whether the net effect is positive or negative. In our view, the impact of increased car availability is likely to outweigh more accessible buses, but CPT has a different view. Our elasticity estimates have been based on an assumption that, overall, these other confounding factors have a neutral effect on the underlying demand for concessionary travel, but we recognise that these other influences add uncertainty to our conclusions.

4.6 Scottish Elasticity estimates

4.6.1 The various considerations set out above provide the inputs into the elasticity estimation process. Elasticities based upon the comparison between the years ending September 2002 and September 2003 are regarded as providing least scope for error through confounding factors but representative of short-run elasticities; those based upon the comparison of concessionary journeys in 2006-7 with the year ending September 2002 are regarded as long run elasticities.

[24] In other words we have assumed a service-km elasticity of 0.66, based on standard DfT assumptions.

4.6.2 Our elasticity estimates, and those drawn from other sources, are summarised in Table 4.7. The estimates are as follows:

- the elasticity parameters implied by the current National Scheme Reimbursement Factor of 61.5%, if measured at the average fare forgone assumed by the current National Scheme in 2006-7;
- the elasticity parameters implied by the current National Scheme Reimbursement Factor of 61.5%, if measured at the average fare forgone assumed by the current National Scheme in 2012-13 (note that the difference between these two elasticity parameters arises from the very different fares charged at these different times);
- our estimate of the short-run elasticity implied by contrasting the concessionary journeys in Strathclyde in the years ending September 2002 and September 2003 (just before and after the introduction of free travel);
- our estimate of the short run elasticity, derived from data for the same years as Strathclyde, but for all Scottish local authorities except those that were already providing free travel;
- our estimates of long run all-Scotland elasticities derived from contrasting data for the year ending September 2002 and March 2007;
- CPT's estimates of all-Scotland elasticities, based on contrasting data for the years ending March 2002 and March 2006 (Medium/long run);
- CPT's estimates of all-Scotland elasticities, based on contrasting data for the years ending March 2002 and March 2007 (Long run);
- parameters obtained from DfT's recommended values for PTE areas in England, adjusted for differences between English and Scottish characteristics; and
- parameters obtained from DfT's recommended values for Non-PTE areas in England, adjusted for differences between English and Scottish characteristics.

4.6.3 Table 4.7 shows the elasticity parameters (Lambda and Beta) and as a comparative measure, the point elasticity that would be derived from these parameters at an average fare forgone of £0.859 at 2001-2 prices.

Table 4.7 Summary of Scottish Elasticity Estimates from 2001-2 data

	Lambda	Beta	Point elasticity at 2001-2 commercial fare (£0.859)
Calculated from current Reimbursement Factor at 2006-7 fares	0.703	-0.455	*-0.287*
Calculated from current Reimbursement Factor at 2012-13 fares	0.703	-0.391	*-0.247*
Minnerva/MVA Strathclyde Short run	0.775	-0.426	*-0.293*
Minnerva/MVA Scotland Short run	0.773	-0.413	*-0.284*
Minnerva/MVA Scotland Long run	0.703	-0.503	-0.318
CPT Scotland Medium/long run (to 2005-6)	0.724	-0.403	-0.262
CPT Scotland Long run (to 2006-7)	0.673	-0.439	-0.267
DfT PTE values Scottish adjusted	0.723	-0.498	-0.323
DfT Non-PTE values Scottish-adjusted	0.641	-0.596	-0.347

4.6.4 The comparative point elasticities are plotted in Figure 4.1.

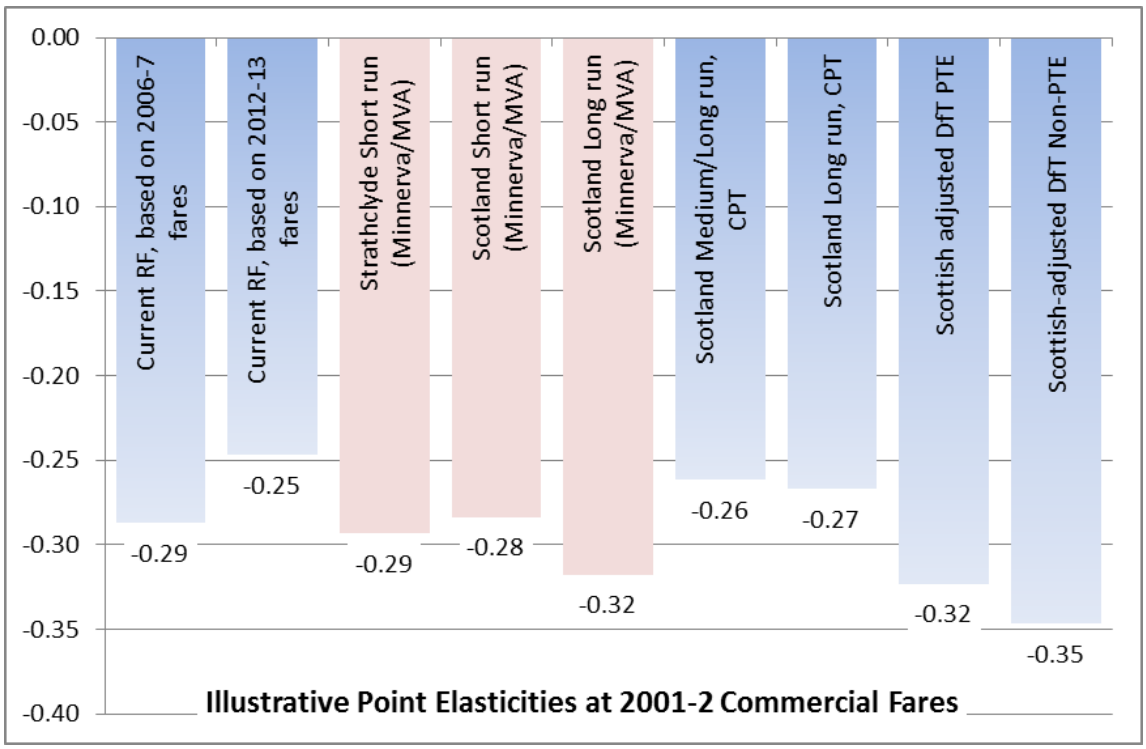


Figure 4.1 Comparisons of elasticity estimates

4.6.5 Our (Minnerva/MVA) estimates of Scottish elasticities, for Strathclyde and for Scotland, based on the analysis of the impact of the introduction of free travel in October 2002, are highlighted. It can be seen that the Strathclyde short run value is quite similar to the elasticities implied by the current Scheme Reimbursement Factor, if calculated at 2006-7 fare levels. Our estimate of the Scotland long-run elasticity is higher, and in fact is very similar to the value that would be calculated based on DfT recommended values for English PTE areas, if adjusted for Scottish car ownership and population characteristics.

4.6.6 The values estimated by CPT are lower than our values. Broadly, the CPT and MVA/Minnerva elasticity estimates are based on the same datasets using a largely identical methodology. The fact that there are non-negligible differences in the elasticity estimates, which imply significant differences in reimbursement payments, demonstrates the sensitivity of both the estimation process, and the reimbursement calculation. The principal reasons for differences in elasticity values are the choice of specific years for before and after analysis (and consequent differences in values for all relevant annual averages and indicators) and the values used for end-year passholder data. Our values are preferred because our choice of comparison years before and after the introduction of free travel is more likely to be free of confounding factors that would otherwise distort the analysis, and we have also used different, and we believe more accurate, data on passholder numbers.

4.7 Preferred elasticity values

4.7.1 In our view, the most robust of the various estimates of Scottish elasticities that have been discussed in this chapter is the Strathclyde short run estimate, which draws on a variety of data from sources of generally well known provenance. Most of these data were collected

close to the date of the introduction of free travel in connection with the Determination of bus operator appeals, and was subject to scrutiny by interested parties with a considerable stake in their outcomes. A particular strength of the Determination journey data is that the detailed quarterly figures allows Financial Year comparisons to be made exactly with equivalent data published by Transport Scotland, while permitting a choice of analysis years for elasticity estimation from the period immediately before and after the introduction of free travel. Overall, there are far fewer residual uncertainties associated with the Strathclyde estimates (e.g. associated with basic data and confounding factors) than with all-Scotland estimates.

4.7.2 However, the Strathclyde elasticities are not necessarily representative of Scotland as a whole, and are short run only, whereas longer run elasticities are more appropriate for reimbursement. The All-Scotland elasticities are therefore a better basis for an All-Scotland Reimbursement Rate.

4.7.3 There is scope for error arising from the difficulty of fully accounting for confounding factors with the longer run estimates, and our Scottish long run elasticity is only 12% larger than our short run elasticity. Long run increments of between 30% and 50% are commonly assumed, and overall, these Scottish elasticity values are lower than typical values from equivalent analysis of English data. We are aware of areas of uncertainty in which assumptions might err on the side of lower elasticity assumptions, but also know of others which will potentially go the other way. Overall, we are content that our elasticity values fairly represent the implications of the available data.

4.8 Application of Elasticity Estimates

4.8.1 All the parameter values quoted above are expressed relative to price levels in 2001-2: they are determined from the average concessionary fare paid in that year, and hence relative to consumer prices in that year. Prices in 2012-13 are between 30% and 40% higher than in 2001-2, depending upon whether measured by the Consumer Price Index (CPI) or the Retail Price Index (RPI). To calculate a Reimbursement Factor for a given Reimbursement Year such as 2012-13, it is necessary to apply an index to relate the average fare forgone in 2012-13 to prices in 2001-2.

4.8.2 The CPI and the RPI have different technical characteristics, and over the last ten years RPI has tended to increase at a faster rate than CPI. The UK DfT recommends the use of CPI, largely on the grounds that CPI is now the basis on which State Pensions are uplifted and will therefore better track passholder incomes. However, RPI was the basis for pension changes until 2011, and possibly would better reflect the general price changes experienced by older persons between 2001-2 (the year of the concessionary fare from which the elasticity was established) and the year for which reimbursement is being calculated. Since for the majority of the period from 2001-2 onwards RPI was used for pension settlements, it is proposed that this forms the basis of the price index used to apply 2001-2 based elasticity parameters, although it is recommended that Transport Scotland give further consideration to the choice of CPI or RPI in the future.

4.8.3 An additional consideration is that the index used for calculating the Reimbursement Factor (and hence generation) should take explicit account of changes in the costs of alternative modes. Petrol prices have risen particularly rapidly in real terms since 2004-5, and it has

been suggested that an index should be constructed as a weighted average of the RPI and the fuel price element of RPI.

4.8.4 Figure 4.2 shows the historic data on these different indices, including a forecast for 2012-13 based on continuation of the rate of change in September 2012. Also included is the motoring expenditure element of RPI, of which petrol forms one component, the others including various fixed costs as well as operating costs. It can be seen that in contrast to petrol and oil, overall motoring costs have tended to rise more slowly than other prices except in the last two years.

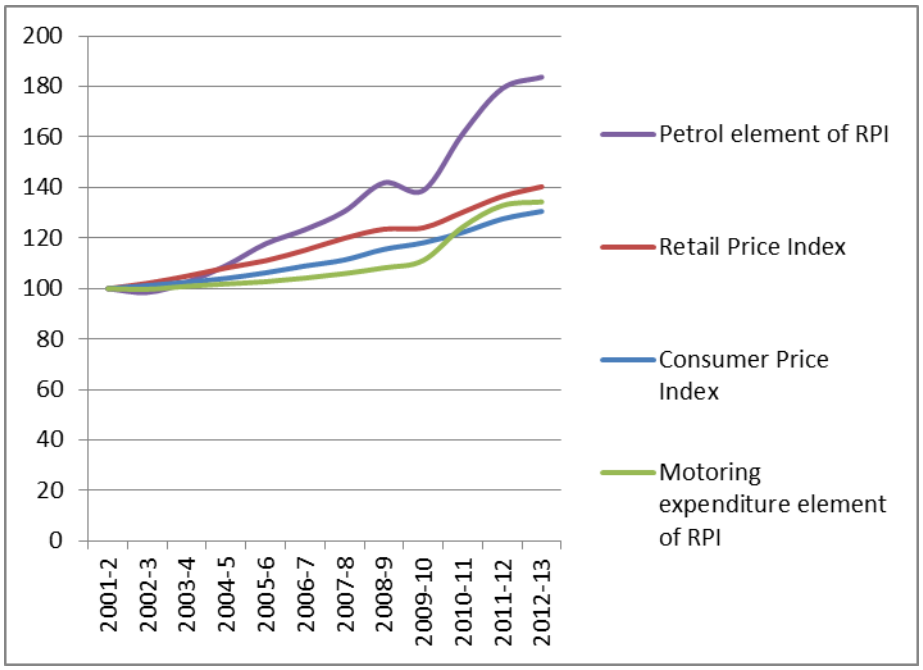


Figure 4.2 Potential indices for price adjustment of fare levels

4.8.5 Although not easy to estimate, there will be a proportion of concessionary bus journeys for which the passholder will consider the relative costs of car and bus modes. While the majority of older passholders now have access to a car, this probably does not reflect the availability of car as a viable alternative for concessionary bus journeys, because of the skewed nature of concessionary bus use. Car availability is likely to be much lower amongst frequent bus users than for infrequent bus users in the population of older people and passholders.

4.8.6 The extent to which the car represents a likely alternative mode to bus can be gauged from the stated intention data gathered by Accent during research on the impact of age equalisation in 2003. Respondents, who were all men aged 60 to 64, reported that of the journeys that they would make using the concession once it became available, 37.3% would otherwise have been made by other modes. We believe that this will overstate the extent to which cars are a real alternative to bus for the generality of passholders, for a variety of reasons including the tendency for stated intention surveys to lead to overstated responses. We have therefore proposed making use of the same assumption employed in the elasticity analysis, whereby only a third of the intended "mode shift" and "generated" journeys are assumed to be translated into concessionary journeys. That would imply that potential "mode shift" journeys are 22.0% of the overall number of concessionary bus journeys.

4.8.7 We therefore recommend that a combined index is used to relate Reimbursement Year prices to the 2001-2 price base of the elasticity parameters, with a 78% weight for the general RPI and a 22% weight for the petrol and oil component.

4.9 Conclusions with regard to elasticity values

4.9.1 Elasticity values are essential components of the reimbursement calculation. They reflect the sensitivity of concessionary passengers to changes in fares, and are therefore key both to establishing a Reimbursement Factor at a given point in time, and also to determining how that Reimbursement Factor should change over time if the average fare forgone changes in real terms.

4.9.2 The Reimbursement Factor of 61.5% incorporated in the current National Reimbursement Rate was not calculated explicitly from elasticity estimates. However, the elasticity estimates that would lead to 61.5% can be implied by working backwards from the fare at different points in time. Elasticity values are also available from research elsewhere in Great Britain, particularly that conducted by the DfT in 2009-10. Differences between Scottish characteristics, and those of passholders elsewhere in the UK, limit the direct applicability of this evidence, although we have produced estimates of elasticities based on the DfT results adapted to Scottish conditions.

4.9.3 There was little readily available evidence on All-Scotland elasticities suitable for calculating reimbursement on an All-Scotland basis. Substantial effort has been devoted to making new estimates of Scottish concessionary elasticities based on the change in concessionary journeys experienced in Scotland when free travel was introduced in October 2002. This analysis has relied upon a large volume of data assembled in 2004 for the Strathclyde area, in connection with Determinations of operator appeals, and also information collated by CPT.

4.9.4 Elasticity estimates require information on changes in passholders and various other factors that might influence change in concessionary journeys. Because of the passage of time between 2002-3 and the present day, the available data is limited and requires careful interpretation. Residual uncertainties leave room for debate, although in the case of Strathclyde, the availability of the Determination archive, and some Transport Scotland data, provided robust evidence on many key issues.

4.9.5 The elasticity analysis has resulted in the identification of a range of estimates for Strathclyde, for Scotland as a whole, and for the short and long run. Our preference is for reimbursement to be based on long-run elasticities derived for Scotland as a whole. There remain a number of residual uncertainties and alternative choices could be made, reflecting the nature of many of the judgements required, although on balance we believe that our preferred elasticity estimates fairly represent the elasticity implications of the available data.

4.9.6 The preferred elasticity parameters are summarised in Table 4.8 below, which also shows CPT's estimates, and the compromise values that are an average of these two. Our preferred values are derived from the concessionary journey numbers shown in Table 4.3 above and the passholder numbers shown in Table 4.6.

Table 4.8 Summary of key elasticity parameters

	Lambda	Beta	Point elasticity at 2001-2 commercial fare (£0.859)
Minnerva/MVA Scotland Long run	0.703	-0.503	-0.318
CPT Scotland Long run (to 2006-7)	0.673	-0.439	-0.267
Compromise values	0.688	-0.471	-0.292

4.9.7 In applying a given set of elasticity estimates, it is also necessary to choose a price index to allow fares to be expressed in constant prices. Various alternatives have been considered, and our preference is to use the RPI, with added weight given to the petrol and oil component, to reflect the likely significance of petrol prices in passholder mode choice.

5 Additional Costs

5.1 Additional operating costs of increased concessionary demand

5.1.1 The two reimbursement components discussed in the previous Chapters primarily affect the calculation of reimbursement for revenue forgone. Bus operators should also be reimbursed for additional costs incurred as a consequence of the concession, particularly with regard to additional operating costs associated with carrying generated concessionary passengers.

5.2 Base additional cost rates

5.2.1 The current study brief did not call for a clean-sheet analysis of additional costs, since this was the larger part of the ITS 2009 Study for Transport Scotland. The emphasis of the current work is therefore on changes over time, using the ITS results as a base.

5.2.2 The key conclusion from the ITS work was that reimbursement of bus operators for additional costs could be summarised in terms of a payment per generated passenger. ITS established a range of values. Those used as the basis of the negotiations between Scottish Government and CPT which led to the National Scheme arrangements that came into effect on 1 April 2010 were:

- £0.065 per generated passenger for marginal operating costs; and
- £0.279 per generated passenger for marginal capacity costs and other operator responses.

5.2.3 Both of these appear to be defined in terms of 2009-10 prices, although there are some questions about the price base which are discussed below. However, our starting point is the ITS conclusion that reimbursement payments should be £0.344 per generated passenger in 2009-10 prices.

5.2.4 In the current Study, CPT has made us aware that the ITS final report did not address a number of concerns and questions raised at the time. There is not scope within the timescale and resources of the current study to unpick the detailed analysis undertaken by ITS, but we have further examined some of these and other issues, which would lead to the possibility of the values quoted above being underestimated.

5.3 Relative labour costs

5.3.1 The ITS conclusions are largely (but not exclusively) based on econometric analysis of marginal cost rates, using STATS100 data from bus operators between 1999 and 2006. Most of this data is from operators in GB outside Scotland, and so although the analysis could be carried out separately for Scottish operators, the smaller volume of data for Scotland gives results which are less statistically robust. However, ITS was also able to identify from the GB econometric results, statistically sound "fixed" effects from which it was concluded that Scottish costs were 13.9% lower than the those for GB (outside London). The preferred econometric model marginal cost rates were therefore based on GB (outside London) values, which were regarded as being statistically robust, less 13.9% to reflect the ITS conclusion about comparative costs in Scotland and elsewhere.

5.3.2 It is understandable that the plausibility of the 13.9% adjustment should have been questioned, since it can be demonstrated that wage rates for bus and coach drivers in Scotland are now higher than in the rest of GB outside London. But other evidence on average costs[25] shows a similar picture to the ITS conclusion, namely that operating costs in 2006-7 were lower in Scotland than in GB outside London at that time (14.0% less per vehicle km, and 8.4% less per passenger journey). This apparent conflict of evidence can be reconciled by noting that the increase in bus operating costs between 2006 and the present day was greater in Scotland than in the rest of GB outside London, as shown, for example, by the CPT cost indices.

5.3.3 In fact the ITS conclusion on marginal cost rates, and on the appropriate level of reimbursement rate per generated passenger, were based on an amalgam of sources, including data supplied by CPT (although ITS modified the assumptions made by CPT). ITS used different methods to update their figures, including a GB-based rate (which would probably understate the increases actually experienced in Scotland), and updating with the CPT cost index. The value of £0.279 quoted above (identified in paragraph 5.2.39 of the ITS report) is actually based on operator supplied data, updated by the CPT cost index.

5.3.4 While it is not self-evident that the ITS conclusions should be modified so as to reverse the 13.9% reduction, it is not at all clear that the ITS conclusions would have been the same if later data had been available for Scottish operators on which to base more detailed analysis. It is probable, given the differences in wage rates between Scotland and the rest of GB which can now be demonstrated, that a higher value could be justified than that adopted by ITS. There are almost certainly further areas of debate that could be had about the ITS analysis.

5.3.5 There are technical difficulties in coming to a definitive view, and a pragmatic approach is that the 13.9% reduction in cost rates applied by ITS should be removed. This is equivalent to increasing the ITS rate by 16.14%[26], leading to a base value for additional cost per generated passenger of £0.344 * 1.1614 = £0.400 in 2009-10 prices.

5.4 Base costs

5.4.1 There remain a number of other areas of uncertainty with regard to the basis of for the specific additional cost values recommended by ITS. In particular, the cost indices that ITS have used in various part of the analysis to bring costs to a common 2009-10 price base, seem likely to have underestimated the differences in cost inflation incurred by Scottish bus operators relative to those in Great Britain (outside London).

5.4.2 CPT has attempted to simulate the ITS calculations, using a different cost inflator, and reflecting the fact that some of the alternative cost rate estimates are derived directly from Scottish operator data in 2009. The overall conclusion reached was that the combined net additional cost per generated passenger (including both marginal operating and marginal capacity costs) should be increased by 7% relative to the figure quoted by ITS.

5.4.3 Making these adjustments is far from straightforward, and there remains considerable scope for uncertainty with regard to both the interpretation of how ITS reached the quoted conclusions on additional cost rates, and how it might be corrected. But it seems likely that

[25] As in Tables 10 and 11 of Transport Scotland's Bus and Coach Statistics 2010-11,

[26] i.e. multiplying by 1/(1-0.139) = 1.1614

the ITS analysis may not have fully recognised the differences in changes in costs rates between the bus industry in Scotland and that elsewhere in Great Britain, and that as a consequence some adjustment is merited. Given the difficulty of further diagnosis of the ITS methodology, it is therefore proposed that the net additional cost rate per generated passenger is increased by 7.0% from £0.400 to £0.428 in 2009-10 prices.

5.5 Impact of differences in average journey length

5.5.1 Data provided by CPT, referenced previously in Chapter 3, shows that in 2011, the average single cash fare that would be paid for concessionary journeys was some 19% higher than the average adult single cash fare actually paid by adult non-concessionary passengers. This implies that on average, concessionary passengers make longer journeys than non-concessionary passengers buying cash single tickets. There is evidence from a number of sources that journey lengths by concessionary passengers increased substantially following the introduction of free travel in October 2002. CPT has suggested that concessionary journey lengths have continued to increase beyond that date, and in particular from 2006-7 (the period on which ITS conclusions are predominantly based), and consequently proposed that additional cost rates should be further increased to a cumulative value of £0.459 in 209-10 prices.

5.5.2 The most consistent data on bus journey lengths comes from the Scottish Household Survey (SHS), using the age of respondent (60 or above, and below 60) as a proxy measure to distinguish between journeys by concessionary passholders and others. However, the modest sample sizes for individual years, coupled with the probable influence of erratic winter weather patterns, do not give as clear a picture of overall trends as would be desirable. Bespoke analysis of SHS data by Transport Scotland gives the annual data summarised in Table 5.1, in which data has been summarised by calendar year and by financial year.

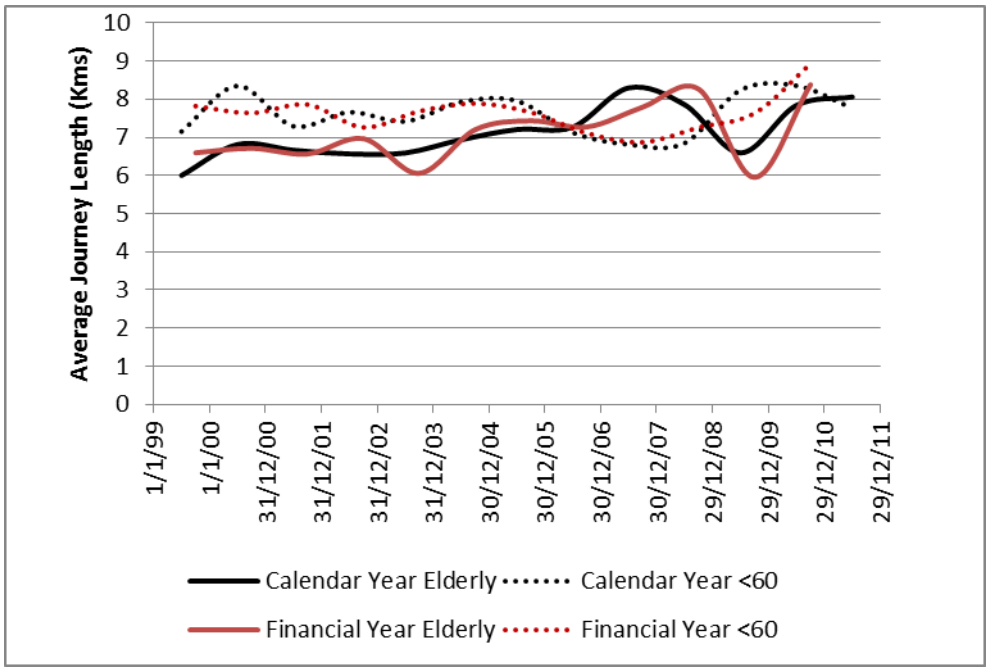
Table 5.1 Average Bus Journey lengths (kms), bus passengers aged 60 or more, and less than 60

Calendar Year	60 or older	Less than 60		Financial year	60 or older	Less than 60
1999	6.00	7.15		1999-00	6.60	7.82
2000	6.81	8.35		2000-01	6.71	7.64
2001	6.66	7.29		2001-02	6.56	7.86
2002	6.57	7.66		2002-03	6.97	7.26
2003	6.59	7.42		2003-04	6.06	7.68
2004	6.94	7.93		2004-05	7.20	7.89
2005	7.21	7.95		2005-06	7.43	7.65
2006	7.27	7.12		2006-07	7.27	7.11
2007	8.30	6.81		2007-08	7.79	6.87
2008	7.86	6.85		2008-09	8.26	7.26
2009	6.59	8.24		2009-10	5.95	7.63
2010	7.84	8.35		2010-11	8.38	8.93
2011	8.06	7.76				

5.5.3 With a typical sample size in later years of less than 800 or so, there is little merit in attempting a more detailed disaggregation by time, but plotting the annual data at the mid-

point of each year (i.e. 1st July for the calendar year and 1st September for the financial year) gives a broad sense of the underlying trends, as shown in Figure 5.1 below.

Figure 5.1 Average bus journey lengths



5.5.4 It is clear that over the period covered, the average bus journey lengths of passengers aged 60 or more have increased to about the same length of journeys as those of bus passengers aged less than 60. However, in recent years the data shows large fluctuations, with in particular a significant fall in the average trip length of older passengers in 2009-10 which presumably coincides with a period of extreme winter weather. However, it is difficult to conclude that there is strong evidence of a consistent upward trend in journey lengths from 2006-7, nor indeed that concessionary journey lengths are currently significantly different to those of non-concessionary journeys[27].

5.5.5 Consequently, we do not believe there is any justification for further uplifting of the ITS additional cost rates on the grounds of increased average concessionary trip lengths. However, it is acknowledged that there is uncertainty about future trends in concessionary journey lengths. **We recommend that Transport Scotland should seek to monitor the extent to which the trend in journey lengths by concessionary passengers differs significantly from that of non-concessionary passengers**. If this is the case in the future, it would present some grounds for review of additional cost rates.

5.5.6 It should be noted that even if not increased on grounds of concessionary journey length, the additional cost rate of £0.428 per generated passenger that is our preferred value is substantially greater than equivalent values that we are aware of on an anecdotal basis from applications of the DfT Reimbursement Calculator in England. In our experience it is rare to obtain values that exceed £0.25 per generated passenger, and often additional capacity

[27] Note that this does not conflict with the observation that concessionary journeys are on average longer than those of adult cash single passengers. This arises from the fact that cash single fares will tend to be priced to attract shorter distance journeys, whereas other ticket types are more financially attractive for longer distance journeys. This is demonstrated by the CPT data on the prices of different ticket types, with return tickets and ten-journey carnets priced at significantly more per journey than single tickets.

costs are regarded as zero, so that the only reimbursement is for marginal operating costs at about £0.06 to £0.07 per generated passenger.

5.5.7 However, for meaningful application the DfT Calculator requires an array of local values that reflect local network characteristics, and has certain characteristics that lead to counter-intuitive results. Consequently, although the recommended additional cost rate of £0.428 per generated passenger is at the high end of the potential range of values, we have no particular reason for believing that this does not properly reflect the data and analysis carried out by ITS, with the exceptions of the modifications identified above. In any case, it is worth noting that even with additional cost rates of this order of magnitude, the overall contribution of additional costs to total reimbursement is significantly less than that of revenue forgone.

5.6 Updating additional cost parameters over time

5.6.1 The most appropriate way of allowing for additional costs in reimbursement calculations is to apply a marginal cost rate per generated passenger to an estimate of the volume of generated passengers, as derived from the Reimbursement Factor. The discussion above leads to the view that the best basis for the additional cost rate per generated passenger is a value of £0.428 in 2009-10 prices, based on the ITS conclusions but increased to allow for the likelihood that differences in cost rates between Scotland and the rest of Great Britain were not sufficiently taken into account.

5.6.2 The question then arises as to how this value should be adjusted for later years, given the impact of general inflation, as well as of price factors (such as fuel and labour costs) that are specific to the bus industry.

5.6.3 Different indices are available, including two indices of average costs per vehicle kilometre and average cost per passenger journey which are published as National Statistics by Transport Scotland. However, these can be volatile, partly because of the dependence on estimates of total vehicle kilometres and passenger journeys, and are subject to some publication lags. The preferred option is to use the bus industry's own cost index, which is prepared and published by the CPT. This takes the form of a report on the percentage change in operating costs over the previous year, based on returns submitted to an independent third party which collates the data from individual operators. Updates are published every six months (reflecting the annual change to end-December and then end-June) with a lag of about three months.

5.6.4 The index values calculated from the published CPT index for the years from 2009-10 are summarised in Table 5.2. These have been constructed by taking the average of the December and June increases to give an estimated increase in the year ending in the March between these dates, thus smoothing short term fluctuations. For 2012-13, the increase in the year ending June 2012 has been assumed to apply to the year ending December 2012.

Table 5.2 Cost index (March 2005=100) based on CPT-Scotland data

Additional Cost index	2009-10	2010-11	2011-12	2012-13
CPT-Scotland	140.154	145.480	154.427	163.925

5.7 Conclusions on Additional Costs

5.7.1 Bus operators are entitled to reimbursement for additional costs incurred as a result of providing bus travel at free fare. The preferred approach is to calculate this through the application of a marginal cost rate per generated passenger.

5.7.2 We have reviewed the ITS 2009 Study for Transport Scotland and concluded that on the whole there is no strong reason to dispute the methods used by ITS to derive estimates of marginal cost rates.

5.7.3 However, an unresolved issue from the 2009 study was an ITS view, based partly on econometric analysis, that relevant Scottish bus operator's labour costs are lower than those in England. It is not possible to unpick the ITS analysis that led to this view, but there is sufficient room for doubt to lead us to the conclusion that it is not unreasonable to recast the ITS values without this reduction. We have also looked at the internal calculations within the ITS work, and concluded that these seem likely to have inadequately accounted for faster growth in costs in the bus industry in Scotland from 2006-7 compared to the rest of Great Britain outside London.

5.7.4 CPT has also proposed that the cost rate should be increased to reflect an assumption that on average concessionary journeys are longer than those of non-concessionary passengers. In our view, there is little strong evidence to support this assumption, and we do not believe that an adjustment on these grounds is justified.

5.7.5 This leads to an estimated marginal cost rate per generated passenger of £0.428. We note that this is much higher than equivalent values currently in use in England. A compromise rate, which is the average of our preferred value and that proposed by CPT, is £0.443 per generated passenger in 2009-10 prices.

5.7.6 This value will need to be updated from time-to-time to reflect general price inflation and influences on cost levels that are specific to the Scottish bus industry. In our view an index based on the cost index published by the CPT reporting on changes in costs for Scottish bus operators provides the most-robust basis for this updating of the cost per generated passenger.

6 Reimbursement Calculations

6.1 Summary of key findings on reimbursement inputs

6.1.1 The preceding Chapters have considered the main elements that in combination determine "no better off/no worse off" reimbursement for bus operators.

6.1.2 Very broadly, our conclusions on the reimbursement parameters that should be used for calculation of 2013-14 reimbursement of operators are as follows:

- Discount factor: appropriate values are between 18.0% and 19.25% (prior to any "degeneration", and as used to estimate the average fare forgone from the shadow fare), on the basis of the non-concessionary ticket sales and revenues reported by CPT for 2011. The gap between the two values reflects different assumptions by ourselves and CPT, but the difference is not great. A potential compromise value calculated from the average of these two figures is 18.60%;
- Elasticity parameters: a wide range of values could be used, depending upon views about data reliability, willingness to make assumptions about comparability of source and application, and estimating assumptions. A potential compromise value would be represented by the average of the two principal candidates, representing our best estimate of the long-run All-Scotland value, and CPT's.
- Choice of price index for Reimbursement Factor calculation: it is necessary to allow for price inflation in calculating the impact of changes in fare levels on the demand for journeys by passholders in the absence of the concession. We propose an index based on the General Retail Price Index, but with additional element that reflects the impact of changes in the price of petrol on passholder car/bus mode choice decisions. We have proposed that a combined index in which the Petrol and oil component of the RPI is given a 22% weight, against 78% for the general RPI.
- Additional cost rate: reimbursement for additional costs should be calculated as the product of estimated generated concessionary journeys and an additional cost rate per generated concessionary passenger; we propose that the cost rate is based on the value estimated by ITS in the 2009 study for Transport Scotland, but with the rate increased from £0.344 per generated passenger to £0.428 per generated passenger, in 2009-10 prices. CPT believe that an additional increase is justified to £0.459 per generated passenger in 2009-10 prices, on the grounds that concessionary trip lengths have continued to increase from 2006-7. We do not believe there is clear evidence that this is so. A potential compromise value representing the average of these two would give a value of £0.443 per generated passenger in 2009-10 prices.

6.2 Projected All-Scotland values for illustrations

6.2.1 In order to illustrate the reimbursement implications of any given set of reimbursement parameters, we have used projections of likely out-turn concessionary journey numbers for Scotland in 2012-13 and average shadow fare values as currently forecast by Transport Scotland. In order to illustrate the reimbursement calculations going forward, we have assumed no change in concessionary journeys from 2012-13, and that the adult cash single

fare will increase by 5% in current prices per year. These assumptions are intended purely for illustrative purposes and have no other status.

6.2.2 With regard to price levels, outturn figures are available for the various RPI and CPI components up to and including September 2012. It has been assumed that the annual change in prices reported at September will continue at the same rate for the remaining six months of the year, to the end of March 2013. For 2013-14 and 2014-15, it has been assumed that all indices will change by 2.5% per year.

6.2.3 The data, and these various assumptions and projections are summarised for 2012-13, 2013-14 and 2014-15, in Table 6.1.

Table 6.1 Assumed concessionary journeys, fares and price levels for reimbursement illustrations

Summary of actual and projected concessionary journeys, fares and price indices	Projected	Illustrative Forecasts	
Year	2012-13	2013-14	2014-15
Concessionary journeys (m)	146.568	146.568	146.568
Annual Change	-1.0%	0.0%	0.0%
Average concessionary (shadow) adult cash single fare (current prices)	£2.041	£2.143	£2.250
Annual Change	6.3%	5.0%	5.0%
Retail Price Index, All Items, 2001-2 = 100	140.4	143.9	147.5
Annual Change	2.8%	2.5%	2.5%
Petrol and oil, 2001-2 = 100	183.7	188.3	193.0
Annual Change	2.5%	2.5%	2.5%
CPT Operating Cost Index, 2009-10 =100	117.0	119.9	122.9
Change	6.2%	2.5%	2.5%
Calculated Current Scheme Reimbursement (uncapped)	£201.92	£222.62	£233.75
Annual Change	5.3%	10.3%	5.0%
Reimbursement cap	£187.00	not determined	
Annual Change	3.9%		

6.2.4 For 2012-13, we have shown the reimbursement that would be paid under the current National Rate, if no Reimbursement cap applied, and also the Reimbursement cap itself. The Reimbursement Cap for 2013-14 and 2014-15 has not yet been determined.

6.3 The Reimbursement Calculation process

6.3.1 The calculation of reimbursement is illustrated in Table 6.2, which works through the reimbursement implications of a single set of reimbursement parameters, in this case the MVA/Minnerva Preferred parameter values.

Table 6.2 Calculation of Reimbursement for Illustrative Reimbursement Scenario (Minnerva/MVA preferred parameters)

Reimbursement Parameters	MVA/Minnerva Preferred Values		
Reimbursement Year	2012-13		**Commentary on calculations**
Concessionary journeys, (m) Reimbursement Year	146.568		Input value based on Reimbursement Year
Average concessionary (shadow) adult cash single fare, Reimbursement Year prices	£2.041		Input value based on Reimbursement Year
Discount Factor relative to Shadow Fare	19.25%		Input value based on chosen Discount Factor option
Average fare that would have been paid in the absence of the scheme (2001-2 prices)	£1.10		Calculated by application of Price Index to the Average Fare Forgone
Lambda	0.703		Selected elasticity parameter Lambda value
Beta (Deindexed, at 2001-2 prices)	-0.503		Selected elasticity parameter Beta value
Illustrative point elasticity at 2002 fare of £0.859	-0.318		
Reimbursement Factor	58.4%		Calculated from Lambda, Beta and Average Fare Forgone in 2001-2 prices
Revenue forgone			
Reimbursement for revenue forgone (m)	**£141.05**		Product of Non-generated journeys and Average Fare Forgone
Additional costs			
Base marginal operating and capacity cost per generated passenger, 2009-10 prices	£0.428		Selected additional cost rate per generated passenger in 2009-10 prices
CPT Cost index relative to 2009-10	117.0		Input value
Cost per generated passenger in the reimbursement year	£0.500		Additional cost rate inflated to Reimbursement Year prices
Generated journeys (m)	60.985		Total concessionary journeys less non-generated journeys
Reimbursement for additional costs (m)	**£30.49**		Product of generated journeys and additional cost rate
Total reimbursement calculated (uncapped) (m)	**£171.5**		Sum of revenue forgone and additional cost
Net Reimbursement Rate (as % of journeys * shadow fare)	**57.3%**		Calculated reimbursement as % of "value" of concessionary journeys at shadow fare
2012-13 Predicted Reimbursement Payment	***£187.0***		When known
Reimbursement parameters as defined in current "scheme"			
"Generation Factor" G	58.4%		Same as Reimbursement Factor
"Discount Factor" D	11.2%		Discount Factor * Reimbursement Factor
"Additional Cost rate" C	10.2%		Additional cost reimbursement as % of "value" of concessionary journeys at shadow fare

6.3.2 The initial parts of the table set out the key inputs. The significant steps in the calculation produce:

- the average fare forgone in current prices, necessary to work out the revenue forgone;
- the Reimbursement Factor, which determines how many of the observed concessionary journeys are regarded as non-generated (i.e. would have been made even if there was no concession), and generated;
- the reimbursement for revenue forgone; and
- the reimbursement for additional costs.

6.3.3 The total reimbursement calculated for projected 2012-13 concessionary journeys and shadow fares on the basis of this scenario is £171.5 million.

6.3.4 If these calculations were to be applied in the form of a standard All-Scotland National Reimbursement Rate, the rate that would be used is 57.3%. This is calculated by relating the total reimbursement (£171.5m) to the total value of concessionary journeys as measured by the average shadow fare. In this case the average shadow fare is £2.041, so

that the total value of concessionary journeys is 146.568m*2.041 = £299.15m. So the overall Reimbursement Rate is 171.5/299.15 = 57.3%.

6.3.5 The calculated value of Reimbursement can be compared to the actual amount of Reimbursement paid under the current scheme, or the Reimbursement Cap if this would be smaller.

6.3.6 The reimbursement parameters defined in the Current Scheme are shown for comparison. The current Reimbursement Factor is 61.5%, which compares with the value of 58.4% calculated from the combination of the current Shadow Fare, and the preferred Discount Factor and elasticity parameters. The "current scheme" Discount Factor is 4.5% (post-degeneration), which contrasts with the 11.2% implied by the combination of selected Discount Factor and Reimbursement factor. The additional cost element of reimbursement illustration is calculated as a proportion of the value of the scheme; at 11.2% this is somewhat larger than the (broad) 10% that is nominally incorporated in the current National rate.

6.3.7 However, these comparisons can easily be misleading, because of the way in which the components of the current scheme are defined. A more useful comparison is between the current National rate (67.5%), and the calculated National rate from the Reimbursement Scenario (the 57.3%). But the current national Rate is not a correct guide to actual levels of reimbursement, because of the application of reimbursement caps. As was shown in Table 6.1, the projected reimbursement spend in 2012-13 would have been over £200 million if a cap on Reimbursement of £187 million had not applied. The effective National Reimbursement Rate as applied in 2012-13, because of the Reimbursement cap, is actually 62.8%.

6.4 Illustrations of alternative Reimbursement Scenarios (2012-13)

6.4.1 There are different possible combinations of reimbursement parameters, which collectively imply a wide range of levels of reimbursement. Table 6.3 focusses on the main alternatives that have emerged from the study process which are as follows:

- the MVA/Minnerva preferred values, based on the most recent data and having considered all of the issues and arguments raised by CPT;
- those proposed by CPT[28]; and
- values proposed by MVA/Minnerva which represent a compromise position.

6.4.2 These three sets of reimbursement parameters are indicative of the uncertainties surrounding reimbursement levels and represent a plausible range of values from within which Transport Scotland could choose with confidence.

[28] We have taken the reimbursement parameters set out in the spreadsheet "20130104 Reimbursement Scenarios – SDG version.xlsx" as representing the preferred position of CPT's advisors, using long run elasticity estimates.

Table 6.3 2012-13 Reimbursement estimates, with alternative reimbursement parameters

Reimbursement Parameters	MVA/Minnerva Preferred Values	CPT	Compromise values
Reimbursement Year	2012-13	2012-13	2012-13
Concessionary journeys, (m) Reimbursement Year	146.568	146.568	146.568
Average concessionary (shadow) adult cash single fare, Reimbursement Year prices	£2.041	£2.041	£2.041
Discount Factor relative to Shadow Fare	19.25%	17.96%	18.60%
Average fare that would have been paid in the absence of the scheme (2001-2 prices)	£1.10	£1.12	£1.11
Lambda	0.703	0.673	0.688
Beta (Deindexed, at 2001-2 prices)	-0.503	-0.439	-0.471
Illustrative point elasticity at 2002 fare of £0.859	-0.318	-0.267	-0.292
Reimbursement Factor	58.4%	62.3%	60.3%
Revenue forgone			
Reimbursement for revenue forgone (m)	**£141.05**	**£152.87**	**£146.82**
Additional costs			
Base marginal operating and capacity cost per generated passenger, 2009-10 prices	£0.428	£0.459	£0.443
Cost per generated passenger in the reimbursement year	£0.500	£0.537	£0.518
Generated journeys (m)	60.985	55.274	58.194
Reimbursement for additional costs (m)	**£30.49**	**£29.67**	**£30.17**
Total reimbursement calculated (uncapped) (m)	**£171.5**	**£182.5**	**£177.0**
Net Reimbursement Rate (as % of journeys * shadow fare)	**57.3%**	**61.0%**	**59.2%**
2012-13 Predicted Reimbursement Payment	***£187.0***	***£187.0***	***£187.0***
Reimbursement parameters as defined in current "scheme"			
"Generation Factor" G	58.4%	62.3%	60.3%
"Discount Factor" D	11.2%	11.2%	11.2%
"Additional Cost rate" C	10.2%	9.9%	10.1%

6.4.3 It can be seen that collectively, these various choices of reimbursement parameter imply net Reimbursement Rates (relative to the Shadow Fare) of between 57.3% (Minnerva/MVA preferred parameters), and 61.0% (CPT values based on medium/log run elasticities). The compromise values of parameters lead to a Net Rate between these two of 59.2%. CPT's analysis of shorter-run elasticities, for example of change in demand to 2005-6, would give larger Net Reimbursement Rates (for example 62.3% on the above data), but these are less relevant because of their short-run nature, and also the fact that they will exclude behavioural response from the introduction of the National concession.

6.4.4 In our view, the lower values within this range are the most robust and best reflect the available evidence. However, there are various underlying uncertainties that cannot be

readily quantified, which are likely to imply that the confidence intervals associated with the Net Reimbursement Rate are larger than the range of values quoted above would suggest.

6.4.5 We also recognise that in making decisions on reimbursement arrangements, a number of factors need to be taken into account that cannot be reduced to evidence-based analysis. In particular, consideration needs to be given to the practical impact of large scale changes in the amount of concessionary travel reimbursement, as well as budgetary restraints.

6.4.6 It is also worth emphasising that nearly all combinations of reimbursement parameters that we have established imply that 2012-13 levels of reimbursement payment should be less than those actually made (as constrained by the current Reimbursement cap), and significantly less than the payments that would be made under the current 67% Reimbursement Rate, if no cap was applied. In our view there is a very strong argument that the reimbursement arrangements of the current National scheme are over-generous and should be reduced.

6.5 Potential Reimbursement Levels in 2013-14 and 2014-15

6.5.1 Forecasts of both reimbursement quantities and updated Net Reimbursement Rates with the various alternative reimbursement parameters are summarised in Table 6.4 below. These draw on the forecasting assumptions set out in Table 6.1 of the volume of concessionary journeys, the change in fare levels, and the likely change in price levels. It should be emphasised that these are for illustrative purposes and have no particular status.

6.5.2 For simplicity and without giving them any particular status, we have assumed for the purpose of illustration that in 2013-14:

- concessionary journeys stay at the expected level of the 2012-13 outturn that is 146.358m older and disabled concessionary journeys. Journeys declined by 2.5% between 2011-12 and the expected 2012-13 outturn, so this assumption assumes that this trend decline is halted;
- it is assumed that all price indices increase by 2.5% relative to 2013-14, which is very similar to the increase from 2011-12 to 2012-13; and
- the shadow fare increase by 5%, which is somewhat less than the 7.5% (nominal) increase observed between 2011-12 and 2012-13.

6.5.3 The reimbursement consequences of these assumptions are shown in Table 6.4, using the same combinations of reimbursement options as was illustrated in Table 6.3.

Table 6.4 2013-14 Reimbursement option illustrations

Reimbursement Parameters	MVA/Minnerva Preferred Values	CPT	Compromise values
Reimbursement Year	2013-14	2013-14	2013-14
Concessionary journeys, (m) Reimbursement Year	146.568	146.568	146.568
Average concessionary (shadow) adult cash single fare, Reimbursement Year prices	£2.143	£2.143	£2.143
Discount Factor relative to Shadow Fare	19.25%	17.96%	18.60%
Average fare that would have been paid in the absence of the scheme (2001-2 prices)	£1.13	£1.14	£1.14
Lambda	0.703	0.673	0.688
Beta (Deindexed, at 2001-2 prices)	-0.503	-0.439	-0.471
Illustrative point elasticity at 2002 fare of £0.859	-0.318	-0.267	-0.292
Reimbursement Factor	57.9%	61.8%	59.8%
Revenue forgone			
Reimbursement for revenue forgone (m)	**£146.75**	**£159.28**	**£152.86**
Additional costs			
Base marginal operating and capacity cost per generated passenger, 2009-10 prices	£0.428	£0.459	£0.443
Cost per generated passenger in the reimbursement year	£0.513	£0.550	£0.531
Generated journeys (m)	61.769	55.978	58.938
Reimbursement for additional costs (m)	**£31.66**	**£30.80**	**£31.32**
Total reimbursement calculated (uncapped) (m)	**£178.4**	**£190.1**	**£184.2**
Net Reimbursement Rate (as % of journeys * shadow fare)	**56.8%**	**60.5%**	**58.6%**
2012-13 Predicted Reimbursement Payment	***£187.0***	***£187.0***	***£187.0***
Reimbursement parameters as defined in current "scheme"			
"Generation Factor" G	57.9%	61.8%	59.8%
"Discount Factor" D	11.1%	11.1%	11.1%
"Additional Cost rate" C	10.1%	9.8%	10.0%

6.5.4 The change from 2012-13 to 2013-14 does not affect the relativities between the reimbursement options, but does impact on the different components of the calculation. Using the Minnerva/MVA preferred reimbursement parameters for illustration, we see that relative to 2012-13, the 2013-14 calculation:

- gives a higher overall quantity of reimbursement (increasing from £171.5m, to £178.4m); this is largely a result of the higher fare and average cost rate;
- the net Reimbursement Rate reduces slightly from 57.3% to 56.8%, reflecting the assumed increase in fares above the rate of inflation; and
- the latter impact is also evident in the reduced Reimbursement Factor ("Generation Factor" G), which reduces from 58.4% to 57.9%.

6.5.5 If the Reimbursement Rate did not change between the two years (as is the case with the current National Rate), the impact of a 5% increase in fares in current price terms is to

increase overall reimbursement by 5%, even if this was substantially more than the rate of inflation. In the counterfactual, the journeys not generated by the concession would fall if fares increased in real terms. By using an elasticity-based model, this can be reflected in the Reimbursement Factor, which would reduce. Reimbursement still increases with above inflation fares, both in current price and real price terms, but to a lesser extent than it would with a fixed Reimbursement Rate.

6.5.6 With the forecast assumptions for 2013-14 as set out above, the Net Reimbursement Rate with the Compromise parameter values is 58.6%, with total reimbursement of £184.2 million.

6.5.7 Similar calculations for illustrative 2014-15 forecasts are shown below in Table 6.5. These use the same assumptions of no growth in journeys, 5% growth in adult cash single fares per annum, and 2.5% increase in prices per annum, as for 2013-14. The forecast growth in adult cash single fares relative to the forecast change in price levels leads to a Net Reimbursement Rate of 56.2% with our Preferred reimbursement parameters, and a Rate of 58.1% with the compromise parameters. If concessionary journeys remained at the predicted 2012-13 level, the resulting level of concessionary reimbursement payment would be £185.5m with our preferred reimbursement parameters, and £191.6m with the compromise amounts.

Table 6.5 2014-15 Reimbursement Option Illustrations

Reimbursement Parameters	MVA/Minnerva Preferred Values	CPT	Compromise values
Reimbursement Year	2014-15	2014-15	2014-15
Concessionary journeys, (m) Reimbursement Year	146.568	146.568	146.568
Average concessionary (shadow) adult cash single fare, Reimbursement Year prices	£2.250	£2.250	£2.250
Discount Factor relative to Shadow Fare	19.25%	17.96%	18.60%
Average fare that would have been paid in the absence of the scheme (2001-2 prices)	£1.1537	£1.1722	£1.16
Lambda	0.703	0.673	0.688
Beta (Deindexed, at 2001-2 prices)	-0.503	-0.439	-0.471
Illustrative point elasticity at 2002 fare of £0.859	-0.318	-0.267	-0.292
Reimbursement Factor	57.3%	61.3%	59.3%
Revenue forgone			
Reimbursement for revenue forgone (m)	**£152.65**	**£165.93**	**£159.13**
Additional costs			
Base marginal operating and capacity cost per generated passenger, 2009-10 prices	£0.428	£0.459	£0.443
Cost per generated passenger in the reimbursement year	£0.525	£0.564	£0.545
Generated journeys (m)	62.558	56.688	59.688
Reimbursement for additional costs (m)	**£32.86**	**£31.97**	**£32.51**
Total reimbursement calculated (uncapped) (m)	**£185.5**	**£197.9**	**£191.6**
Net Reimbursement Rate (as % of journeys * shadow fare)	**56.2%**	**60.0%**	**58.1%**

7 Recalculation of the Reimbursement Rate

7.1 The National Reimbursement Rate

7.1.1 The principal stimulus for the current research was the need to have a systematic method for updating the National Reimbursement Rate so that it continued to satisfy the Scottish Government's "no better off, no worse off" objective.

7.1.2 Fare levels, prices and costs all change over time, and it has been particularly evident that the average shadow fare, based on the adult cash single fare that concessionary passengers would be charged for their journeys, has been increasing at a much faster rate than prices generally, and indeed the bus fares experienced by non-concessionary passengers. Such increases in fares are bound to increase the gap between the concessionary journeys actually made, and those that would be made if those fares had to be paid by passholders, i.e. will increase generation.

7.1.3 The calculation process illustrated in the preceding chapter demonstrates how the logical consequences of changes in fares can be followed through in terms of changes to the allowance for generation, and hence the calculation of reimbursement for both revenue forgone and additional costs.

7.1.4 We have identified a range of elasticity parameters that can be used to update the Reimbursement Factor. We have examined the basis for calculating an overall average discount factor, and also for updating the additional cost element of reimbursement. The illustrations of the reimbursement calculations provide a basis for setting a revised Reimbursement Rate for 2013-14, taking into account the strength of the evidence base, theoretical issues and also the practical consequences of change.

7.1.5 However, it should be noted that although this updating process will boost the likelihood that the National Reimbursement Rate delivers "no better off, no worse off" reimbursement at a national, "average operator" level, it will not address a fundamental weakness that a national rate will almost inevitably not leave bus operators no better off, and no worse off at the individual level:

- bus operator fares vary widely, and consequently the percentage of concessionary journeys generated by the concession will also vary;
- the commercial policies that operators pursue will lead to significantly different discounts being provided to passengers by some operators compared to others; and
- operational characteristics will vary, and so will the likely justification for payment of additional costs.

7.1.6 The consequence is that a national rate that does not take into account of these differences will over-reimburse some bus operators and under-reimburse others. This in itself is potentially a source of conflict with EEC regulations intended to regulate state aid.

7.1.7 A more practical problem is that since reimbursement is largely driven by the cash single fare, a national rate provides a strong commercial incentive for individual bus operators to increase their cash single fares at a greater rate than they would do otherwise. The fact that

the cash single fare has risen as rapidly as it has (having increased by 27% in real terms between 2006-7 and 2012-13, as measured by the CPI, and 25% as measured by the RPI) is almost certainly one consequence of this.

7.1.8 For the individual operator, a national rate that is not influenced by the operator's own fares means that as an operator increases its cash single fare, concessionary revenue increases in direct proportion. In contrast, with non-concessionary passengers market forces operate to reduce revenue yield since demand is moderated by passenger resistance. This incentive to increase the cash single fare will have been accentuated by the imposition of caps on annual reimbursement totals, leading some operators to have intentionally brought forward fare increases to maximise their share of a limited annual pot[29].

7.1.9 In our view, a move away from a single national reimbursement rate would therefore reduce the rate of increase in fare levels, (and hence reduce the rate of growth of reimbursement payments) that has been experienced in the last few years, and reduce the need for reimbursement caps that impose an arbitrary ceiling on expenditure.

7.1.10 Alternatives to the National Rate are inevitably more complex than the present system[30]. The great attraction of the current system is its simplicity, which in operational terms means that individual operators can have a clear idea about future revenue streams, while (particularly with smartcard-based automation) minimising Government's administrative overhead. If a system that was more sensitive to individual bus operator characteristics was to be put into place, care would therefore be needed to ensure that an appropriate balance was struck between "theoretical" correctness and practical issues.

7.1.11 Operator specific calculation of the Reimbursement Factor need not be particularly complex or onerous. For example, it would be easy to calculate operator-specific reimbursement factors from the data that is already collected. This would reduce incentives to excessive fare increases, without incurring significant additional demands for data or administrative resources. But addressing other differences between operators (e.g. with regard to additional costs) could impose substantial additional complexity that might be disproportionate to benefits.

7.1.12 Even though the focus of much of the current research has been on updating the National Reimbursement Rate, the methods developed for calculating reimbursement could largely be applied at a more disaggregate level without significant further research.

7.1.13 However, it is important to note that a radical change to the reimbursement system could have a number of unintended consequences that were destabilising to the bus network and create dis-benefits. The economics of bus operations vary greatly, and a one-size-fits-all reimbursement solution might lead to some significantly sub-optimal outcomes. Because care is required, a change to operator specific rates is not an option for the short term, but this should not inhibit consideration of changes to the current National Scheme

[29] It is recognised that Transport Scotland has implemented various checks on operator fare increases to try to moderate this type of behaviour, but this primarily addresses the symptom rather than the problem.

[30] However, alternative methods need not be significantly more complex or difficult to operate. In England, individual Travel Concession Authorities are responsible for calculating reimbursement payments, each potentially for a large number of individual operators, with different rates which may vary from month to month. These arrangements are now generally tried and tested.

arrangements in the longer term. **We recommend that Transport Scotland undertakes some preliminary investigation of potential options and their consequences**.

7.2 Practical steps with regard to future reimbursement rates

7.2.1 On the basis that 2013-14 reimbursement arrangements in Scotland are on the same principle as currently, with one reimbursement rate applied to all operators, Transport Scotland needs to decide on the specific reimbursement rate itself so that reimbursement payments for individual operators can be calculated from 1 April 2013.

7.2.2 Although we have stated our preference for the specific reimbursement parameters quoted above in Chapter 6, we recognise that following consultation with CPT and other interested parties, Transport Scotland may choose a different set of parameters. **We strongly recommend that the Transport Scotland decision is articulated in terms of explicit choices of reimbursement parameters, which should be regarded as fixed for 2013-14, and explicit assumptions about price levels and fare levels in 2013-14**.

7.2.3 The reimbursement parameters that need to be specified are as follows:

- the Discount Factor, as defined in Chapter 3. For the avoidance of doubt, this should be prior to the application of any assumptions about generation, to clearly separate the concepts of average fare estimation from the estimation of generation;
- the elasticity parameters, i.e. values for Lambda and Beta as defined in Chapter 4, and with the Beta value dimensioned to a given price level measured by a given price index;
- definition of the price index to be used to convert the average fare forgone at the "current" price to the price level at which Beta is dimensioned; and
- the base additional cost rate, specified at a given point in time and price level.

7.2.4 The National Reimbursement Rate can then be calculated as an output from a calculation involving these reimbursement parameters, and the explicit assumptions about 2013-14, namely:

- the average shadow fare in the year, in nominal (current price) terms;
- forecasts of the level of the chosen price index; and
- forecasts of the price index to be used to inflate the additional cost rate.

7.2.5 **It is recommended that assumptions are chosen following consultation with CPT and other interested parties.** The starting point needs to be clearly established base-line numbers at specified dates in the base year e.g. the out-turn average shadow fare at an agreed date, and likewise for the price indices.

7.2.6 Were serious consideration to be given to moving away from the shadow fare as the basis for monitoring operator fare levels, appropriate adjustments might be needed to the discount factor, but in principle this should not affect the overall quantum of reimbursement that is calculated.

7.2.7 Given these inputs, calculation of the Reimbursement Rate itself can be carried out in one step with one formula. However, it is easier to understand the logic involved if the

arithmetic is separated into distinct steps. Appendix C provides a worked example of a practical reimbursement calculation that may be helpful in presenting proposals for change.

7.2.8 Calculation of an appropriate Reimbursement Rate for 2014-15 would follow an identical process to that described above. Of the various reimbursement parameters used in 2013-14, **we recommend that the discount factor is subject to regular review**, requiring some process for gathering in equivalent data on commercial bus ticket sales and revenues as provided to the current study by CPT. **We recommend that there is a formalisation of the requirement on operators to provide this data**. The calculations set out in Chapter 3 provide a template that can be used to inform such a review. Consideration should be given to using the "Method (b)" approach to help review assumptions about the journeys made using period tickets that are implicit in discount factor calculations.

7.2.9 With regard to the elasticity parameters, we do not believe that the elasticity of passenger responses will change significantly over time and so a detailed review of these need only be carried out periodically, for example if and when any significant additional evidence on concessionary elasticities becomes available. **We recommend that Transport Scotland monitors emerging research on concessionary travel, and any relevant developments in England and the other devolved administrations.**

Appendix A Overview of bus reimbursement calculation principles

In principle, the calculation of "no better off, no worse off" reimbursement involves a number of distinct elements, although in practice these are often combined or simplified. The Scottish reimbursement formula reduces the components into a single factor, nominally calculated to reflect average all-Scotland characteristics, applied to an operator's average adult single fare, but implicitly it incorporates assumptions about each of the different elements. Figure 1 summarises how each of the different elements interact in order to calculate reimbursement of a public transport operator for providing free concessionary travel.

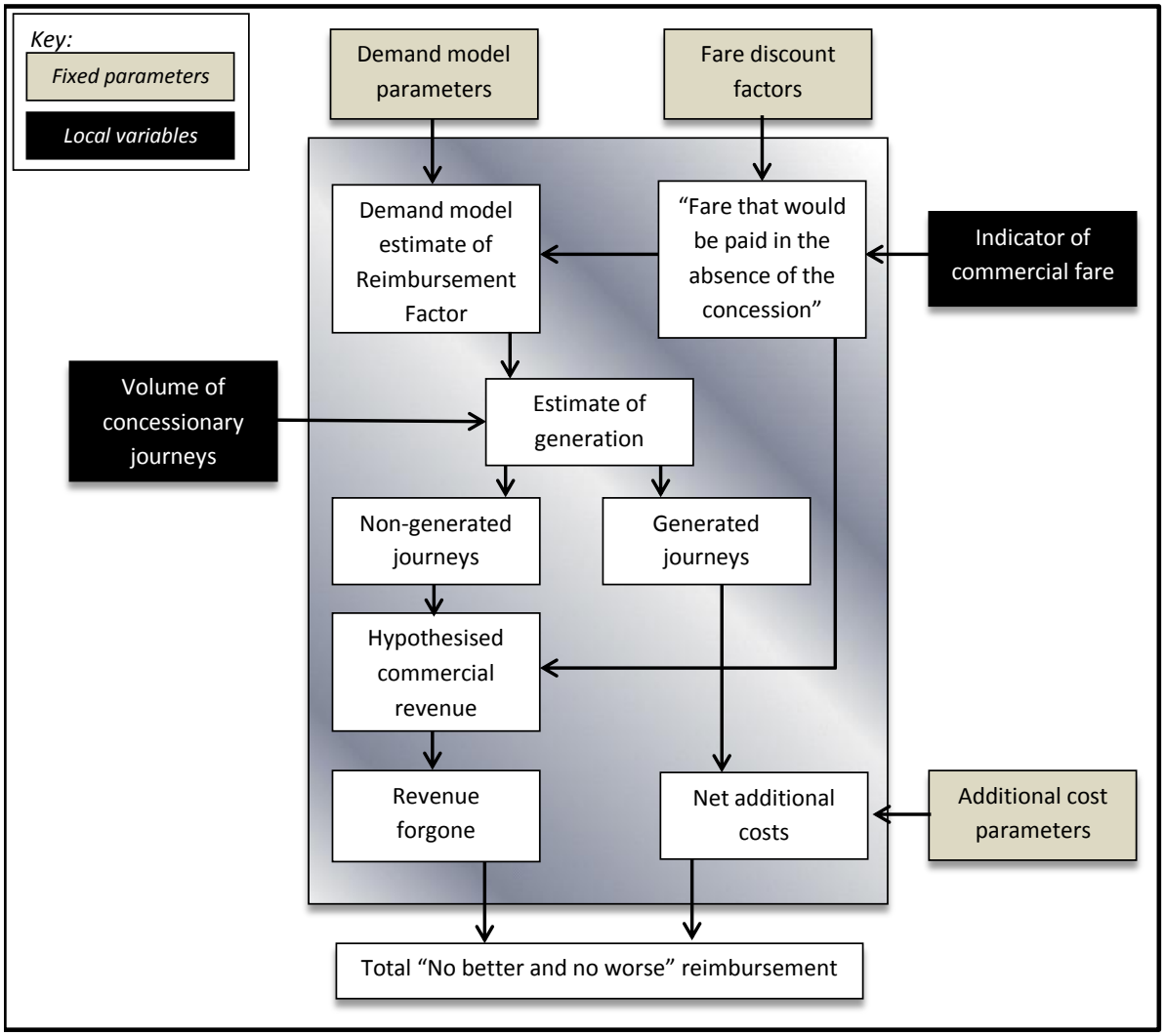


Figure 1 Reimbursement Calculation Flow Chart

The calculation process involves a number of steps.

First, the average fare that would be paid by concessionary passholders in the absence of the concession (the "commercial" fare or Average Fare Forgone) is calculated. In the DfT

Calculator, the calculation is driven by an estimate of the average cash fare paid, which is then reduced via a discount factor intended to reflect the availability of various discount tickets (such as day tickets), and the probability of these tickets being used by passholders.

Second, a demand model (which simulates how passenger volumes vary with changes in fare) is used to determine the proportion of concessionary passenger journeys "generated" by the concession. This is necessary because it is not possible to directly observe the journeys that would have been made in the counterfactual. Instead, observed concessionary journeys are used as a proxy, but with allowance made for generation, i.e. the proportion of concessionary journeys that would not have been made at the commercial fare.

In the DfT Calculator, the measure of generation is the Reimbursement Factor, which is the ratio of passenger journeys at the commercial fare to passenger journeys at the concessionary fare. The proportion of travel "generated" by the concession is often known as "the Generation Factor" but at least two alternative definitions are in common use, and the Reimbursement Factor (the ratio of non-generated to concessionary journeys) is the preferred measure of generation as it provide less scope for confusion.

The demand model parameters reflect assumptions about the sensitivity of demand to fare levels, often summarised as an elasticity: see note below. The Reimbursement Factor is a function of these parameters, as well as the average far forgone that concessionary passengers would have paid in the counter-factual.

Third, once the Reimbursement Factor has been calculated, it can be applied to the observed quantity of concessionary journeys to separate non-generated (i.e. counter-factual) journeys from generated journeys.

Fourth, since the objective is that the operator should be financially no worse off, the reimbursement due for revenue forgone is the revenue that would be earned by the operator ie the hypothesised commercial revenue. This is the product of the non-generated ("commercial") trips and the commercial fare.

Fifth, the fact that the operator will carry additional passengers because of the concession may mean that it incurs additional operating costs. The DfT Calculator estimates an additional cost rate per generated passenger using various factors that reflect network characteristics, which when multiplied by the number of generated passengers gives reimbursement for additional costs.

Total "no better off, no worse off" reimbursement is then the sum of revenue forgone and additional costs.

In the Scotland-wide Free Bus Travel Scheme for older and disabled people, a single factor which is termed the Net Reimbursement Rate is applied to the adult cash single fare that would be charged for each concessionary journey made. The rate implicitly includes allowance for all three of the distinct concepts of:

- the reimbursement factor (allowance for generation);
- the discount factor (allowance for the likelihood that concessionary passengers would use discounted tickets rather than the adult cash single fare, to some extent); and

- additional costs (allowance for the likelihood that additional operating costs would be incurred in carrying generated concessionary passengers).

The great advantage of a single, fixed reimbursement rate is the simplicity of the concept. It can be applied at any level of aggregation. The reimbursement owed to an operator can be calculated for an individual concessionary passenger, provided that the adult cash single fare that would have been paid for that journey is known. Or alternatively, it can be calculated for an operator, for the total number of concessionary journeys carried, or for all operators, provided that the average value is known of the adult cash single (Shadow Fare) fare that would have been paid for the journeys being reimbursed.

Application of a single Reimbursement Rate at any level gives an arithmetically identical result. However, concepts such as generation, discount factors and additional costs are hard to visualise in terms of a fraction of the adult cash single fare of an individual concessionary passenger journey. They make much more sense in terms of a proportion of a given total of concessionary journeys (as in the proportion of observed concessionary journeys that would continue to travel in the absence of the concession), although it is necessary to think in terms of the average value of concessionary journeys (eg the average adult cash single fare) rather than the fare that would be paid for an individual journey. Moreover, since reimbursement through the Scottish National Scheme has the objective that operators as a whole are left no better off and no worse off, determination of the reimbursement rate should be on the basis that it matches the average characteristics of operators as a whole.

It should be noted that irrespective of the level at which components of reimbursement are calculated, it is always possible to apply the resulting calculations using a single rate, but care is needed to ensure that appropriate mechanisms are in place to systematically update the Rate so that it continues to deliver "No Better Off, No Worse Off" reimbursement at the chosen level of aggregation.

Appendix B - Glossary of terms

Accent	Accent Marketing and Research, a market research company that undertook research for the Scottish Government on the likely impact on concessionary journeys numbers of the equalisation of the age of eligibility for the concession to men aged 60 to 64 ("*age equalisation*").
Additional Costs	Additional costs that bus operators necessarily incur as a consequence of the concession, to which they are entitled to be reimbursed.
AFF	See *Average Fare Forgone.*
Age equalisation	In April 2003 the age at which men became entitled to a concessionary pass on grounds of age was lowered from 65 to 60, to bring it line with the age of eligibility of women.
ATCO	Association of Transport Co-ordinating Officers. Interest group of local authority public transport officers.
Average Fare Forgone	The average fare per journey that concessionary passholders would pay in the absence of the concession (abbreviated to "*AFF*").
Beta	One of two parameters that determine the shape of the *demand curve* which is used to simulate the relationship between the fare paid and the demand for bus journeys. The other is known as "*Lambda*".
Confounding factors	The various non-fare influences on the demand for bus travel which may affect differences in concessionary bus journey volumes before and after the introduction of free travel. To calculate a fare elasticity, it is necessary to fully account for such factors to ensure that the residual change in demand is caused only by the change in concessionary fare.
Counter-factual	The hypothetical situation in which there is no concessionary fare (that is passholders have to pay the full, equivalent, commercial fare) but all other things are the same. "No better off, no worse off" reimbursement should leave operators in the same financial position as they would have been in the counter-factual.
CPI	The Consumer Price Index, which with the *RPI* is one of the commonly used measures of consumer price inflation.
CPT	Confederation of Passenger Transport. In this report CPT will generally refer to CPT – Scotland, which represents Scottish bus operators.
Damped exponential model	A particular form of demand model used for calculating the Reimbursement Factor, in which the point elasticity increases with fare but less than proportionately. It requires two parameters which between them dictate the point elasticity at any given fare; these are

	known as Lambda and Beta.
Degeneration	Application of a Reimbursement Factor or Generation Factor to take away generated concessionary journeys from an observed quantity of concessionary journeys.
Demand model or demand curve	A mathematical expression used to simulate the relationship between the demand for bus journeys and the fare that passengers are charged for each bus journey. They are used to calculate the Reimbursement Factor, because they can be used to estimate the relationship between observed concessionary journeys at free fare with the fewer journeys that would be made in a counterfactual in which a non-zero fare is charged.
Determination archive	The archive of data and documents collected at the time of the Determination of appeals by four bus operators against the reimbursement arrangements of Strathclyde PTE in 2003.
Discount Factor	The percentage by which the *Reference Fare* is reduced to give the estimated *Average Fare Forgone*.
Discount Tickets	See *Period Tickets*.
Elasticity	A measure of the extent to which the demand for bus journeys is sensitive to the fare charged. It is commonly described in terms such as the percentage change in demand as a proportion of the percentage change in fare. The point elasticity is one such measure and is used most frequently in this Report.
Equilibrium	The concept of the transport system or part of it being in balance, after changes (such as fare increases or changes to transport supply) have been in place for some time and consequent adjustments of demand and supply have evened out.
Exponential constant	The mathematical constant "e", which has particular mathematical properties and is part of the formula used in the damped exponential model.
Generated Journeys	The number or percentage of observed concessionary journeys which are generated, or which would not have been made if there was no concession.
Generation	The concept that additional bus journeys are made at the concessionary fare (for older and disabled passholders, zero fare) by concessionary passholders relative to the journeys that would have been made if the *average fare forgone* had been paid.
Generation factor	A measure of the extent of generation. There are different ways in which it can be defined, and because of the potential scope for confusion it is not used in this Report. A less ambiguous measure of

	generation is represented by the *Reimbursement Factor*.
ITS	Institute for Transport Studies, University of Leeds, which carried out the study for Scottish Government Social Research reporting in 2010 "Improving the evidence for setting the reimbursement rate for operator sunder the Scotland-wide Older and Disabled Persons Concessionary Bus Scheme". This was the predecessor of the current Study and in particular examined *Discount Factors* and *Additional Costs*.
Lambda	The second of the two parameters that determine the shape of the *demand curve* which is used to simulate the relationship between the fare paid and the demand for bus journeys. The other is known as "*Beta*".
Long run	The period of time after a particular change (such as a change in the fare) after which it is considered that consequent change sin travel behaviour will have stabilised so that the relationship between supply and demand is in *equilibrium*.
Period Tickets	Bus tickets such as day tickets or weekly tickets which entitle the purchaser to make an unlimited number of journeys within the specified period of validity of the ticket e.g. in day or week of purchase. The key characteristic of these types of tickets is that the number of passenger journeys made using each ticket type is typically not recorded with any accuracy, and therefore the average number of journeys made per ticket purchased, and hence the average price per journeys is not known. Such tickets may include 4-weekly tickets and longer-period season tickets. Sometimes known as *discount tickets*.
Point elasticity	The elasticity at a particular point on the demand curve, as would be calculated from the change in demand arising from a very small change in fare.
pteg	The Passenger Transport Executive Group, which represents the Passenger Transport Executives, including Strathclyde Passenger Transport Executive at the time it was responsible for concessionary travel in Strathclyde. ***pteg*** sponsored research by MVA Ltd to examine trends in concessionary travel which has been used in the elasticity analysis reported here.
Reference Fare	The fare used to measure the level of fares charged by an individual operator, relative to which the *Average Fare Forgone* is calculated by application of the *Discount Factor.* The current Scottish National Scheme uses the *Shadow Fare*, measured from the adult cash single fare scale, as the Reference Fare.
Reimbursement Factor	The ratio of concessionary journeys that would continue to be made in the counter-factual, to the observed concessionary journeys actually made with the concession.

Reimbursement Period or Reimbursement Year	The particular period (e.g. a given financial year) for which reimbursement is being calculated.
RPI	The Retail Price Index, which with the *CPI* is one of the commonly used measures of consumer price inflation.
Shadow Fare	The fare recorded for individual concessionary passenger journeys by looking-up the adult cash single fare that would have been charged for the journey in the absence of the concession (from the passenger boarding stop, and stated alighting stop. The Shadow Fare is currently used as the *Reference Fare* in the National Scheme.
Short run	The period of time immediately after a change in the transport system, such as a change in fare, in which short term changes in travel patterns may happen but these may not reflect changes that take a longer period to materialise (which should be fully apparent in the *long run*).
SPT	Strathclyde Passenger Transport, the organisation which was responsible for public transport co-ordination, and concessionary travel, in the Strathclyde Region until April 2006.

Appendix C – Worked Example of Reimbursement Calculations

The objective of this Appendix is to demonstrate how the principles of reimbursement described above are translated into practical calculations of reimbursement payments. Initially, the calculations are illustrated using hypothetical reimbursement parameters, to help make the arithmetic more easily understood. They are then repeated with an illustrative set of reimbursement parameters taken from the analysis reported in the main text.

For simplicity, the illustrations use round numbers, and assume that 100 million concessionary bus passengers are carried at zero fare in a given period. Suppose that on average, the adult cash single fare that would have been paid on each of these journeys would have been £2.00, and that this is the value recorded as the Shadow Fare for each journey.

Hypothetical Reimbursement Parameters

As an initial illustration, suppose that the discount factor is 20%. This implies that the Average Fare Forgone is (100% - 20%), or 80% of the Shadow Fare. If the latter is £2.00, then the Average Fare Forgone will therefore be 80% of £2.00 or £1.60 per passenger journey.

The Reimbursement Factor is calculated from the combination of the Average Fare Forgone and the elasticity parameters (the Lambda and Beta values). Leaving the precise values of these and the algebra associated with the Reimbursement Factor to one side, suppose that, in combination, these give rise to a Reimbursement Factor of 60%. This implies that of the 100 million observed concessionary passenger journeys made at zero fare, 60% would continue to be made if passholders had to pay the Average Fare Forgone of £1.60 per journey. So 60% of 100 million, or 60 million concessionary journeys are regarded as non-generated, in other words they would continue to be made in the absence of the concession.

Hence the revenue forgone – the revenue that operators would have received in the absence of the concession – is £1.60 * 60 million which equals £96 million.

If 60% of the observed concessionary journeys are non-generated, the balance of 40% or 40 million journeys are regarded as generated by the concession. They are journeys that would not have been made unless free travel was allowed, and operators are entitled to reimbursement for the additional costs of carrying them. Assume that the additional cost rate per generated passenger is £0.40. Then the reimbursement for additional costs will therefore be £0.40 * 40 million, which equals £16 million.

Total reimbursement is therefore £96 million + £16 million, which equals £112 million.

An equivalent way of calculating the amount of reimbursement due is in terms of a Net Reimbursement Rate. The above calculations could be carried out for an individual observed concessionary journey relative to the average Shadow Fare, but doing so is counter-intuitive because it requires thinking in terms of fractions of journeys. It is easier to calculate a Net Reimbursement Rate as the ratio of total reimbursement, to the value of travel measured by the Shadow Fare. The total value of travel is £2.00 * 100 million journeys, which equals £200 million. Since Reimbursement is calculated to be £112 million, the Net Reimbursement Rate is £112 m /£200 m which equals 0.56 or 56.0%. So reimbursement can be calculated in terms of 56% of the shadow fare per observed concessionary journey.

Calculation with Compromise Reimbursement Parameters

Similar calculations can be carried out with any of the sets of reimbursement parameters developed within this report. For illustration here, we use the Minnerva/MVA Compromise values shown in Table 6.3 (which summarises identical calculations to those described below). The precise reimbursement parameters, some of which are year-dependent in which case we have used predicted 2012-13 values, are:

- Discount Factor: 18.60%
- Elasticity Lambda Parameter: 0.688
- Elasticity Beta Parameter: -0.471
- Price Index for Reimbursement Factor Calculations: RPI with 22% Petrol weighting which in 2012-13 is predicted to stand at 149.9 relative to 2001-2 = 100;
- Additional Cost Rate = £0.443 per generated passenger in 2009-10 prices, and £0.518 per generated passenger in 2012-13 prices.

The calculations continue to use the assumed 100 million concessionary journeys, and an average shadow fare of £2.00.

If the Discount Factor is 18.60%, then the Average Fare Forgone is (100% - 18.60%) or 81.40% of the shadow fare of £2.00, or £1.628. This is the fare revenue that the bus operator would have received for each journey made by passholders if the concession didn't exist i.e. that is not generated.

In order to apply the elasticity parameters, it is necessary to convert the Average Fare Foregone from current prices (assumed to be 2012-13) to 2001-2 prices – the price level of the fares from which the elasticity parameters were determined. If the weighted price index in 2012-13 is 149.9, it implies that the relevant prices were 49.9% higher than in 2001-2, and that the 2001-2 price equivalent of the 2012-13 Average Fare Forgone of £1.628 is (£1.628/1.499) which equals £1.086.

The Reimbursement Factor is calculated from the formula RF = Exp(Beta * Fare ^Lambda), or Exp(-0.471 * £1.086$^{0.688)}$. Calculating this in parts, £1.086 raised to the power of 0.688 = 1.0584. This value multiplied by Beta is 1.0584 * -0.471 which equals -0.4985. Finally, the exponential constant e is raised to this power, which equals $e^{-0.4985}$ or 0.6074. The Reimbursement Factor is therefore 60.7%, in other words it is estimated that if the average fare forgone was £1.086 in 2001-2 prices, then of the 100 million concessionary journeys observed, 60.7 million would continue to be made in the counterfactual, and 39.3 million concessionary journeys are regarded as generated by free travel.

Since in the counterfactual, the bus operator would have received an average fare forgone of £1.628, the total revenue forgone from the 60.7 million non-generated journeys will be 60.7 * £1.628 = £98.8 million.

The bus operator is not entitled to receive any revenue forgone from the 39.3 million generated journeys, but is entitled to reimbursement for the additional costs incurred in carrying them. With the additional cost rate of £0.518 per generated passenger, the additional cost reimbursement will be 39.3 million * £0.518 which equals £20.36 million.

Total reimbursement is therefore £98.8 million + £20.36 million, which equals £119.2 million.

Another way of expressing the result of the calculation is as a Net Reimbursement Rate per £ of shadow fare. This is how the current Scottish system is applied. The Net Reimbursement Rate can be calculated from £119.2 million, divided by what could be called "the value of travel" - the product of the observed concessionary journeys, and the shadow fare, in other words £119.2 / (£2.00 * 100) = 119.2/200 = 59.6%.

The Net Reimbursement Rate could therefore be thought of in terms of the proportion of the Shadow Fare that an operator is paid for – so a concessionary passenger carried at a shadow fare of £1 receives reimbursement of £0.596, or at a shadow fare of £2.00, reimbursement of £1.192.

The above calculations could all be carried out on a per-observed concessionary passenger basis, but is more intuitive to calculate it in terms of reimbursement for a given volume of concessionary journeys, so that concepts such as reimbursement factors do not imply fractional (non-integer) journeys.

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