Elasticities and diversion ratios

1. The profit incentive analysis in Appendix I required a number of inputs, including estimates of own fare elasticities and diversion ratios. Specifically, we required:

   (a) own coach fare elasticities for Scottish Citylink and Stagecoach;

   (b) own coach service level elasticities for Scottish Citylink and Stagecoach; and

   (c) coach diversion ratios between Scottish Citylink and Stagecoach.

2. This appendix discusses our approach to obtaining the ranges of estimates for the elasticities and diversion ratios used in the incentive modelling, and our consideration of various concerns raised by the parties.

Own price elasticity of demand

3. The own price elasticity for coach travel measures the percentage change in the number of coach passengers resulting from a proportionate increase in coach fares. So, for example, if fares increase by 2 per cent and passenger numbers fall by 4 per cent, the own price elasticity is calculated as –2 (–4 divided by 2). Normally when the price of a service increases, and all else remains unchanged, the number of passengers who travel on that service decreases, so we would expect the own price elasticity to be negative.

4. A price elasticity of –1, or a ‘unit elasticity’, leaves revenues unchanged, as the impacts on revenue of the increased fares and lost passengers from a price increase are exactly offsetting. Demand is considered ‘inelastic’ when the absolute value of the own price elasticity is less than one—in this case overall revenue increases following a price increase. With ‘elastic’ demand, ie an own fare elasticity with absolute value greater than one, increased prices lead to reduced revenues.

5. Own price elasticities of demand can be subdivided between *firm-specific* price elasticities of demand (the proportion of customers who would stop buying *from that operator* in response to an increase in price by *that* operator) and *market* price elasticities of demand (the proportion who would *stop using the mode of transport* if all operators of the same mode increased prices by the same proportion). On flows where more than one operator operates in any given mode, we would expect the firm-specific elasticity of demand to be more price-elastic (sensitive) than the mode elasticity, as passengers would have the ability to switch between operators within the same mode.

6. We would also expect own price elasticities of demand to vary by *type* of passenger, as some passengers have less flexible travel requirements than others (eg business travellers usually are less price sensitive than, say, leisure travellers), and some passengers have more alternative options available than others (eg car owners).

7. Passengers may respond to changes in prices slowly, as initially their options are limited by their place of work, location of their home, etc. So short-run passenger responses to price increases (and service reductions) are generally smaller in absolute value (less elastic) than long-run elasticities, where passengers have additional choices like relocating their homes or changing their jobs.

Service elasticities

8. Service elasticity refers to the response of passenger numbers on a service to a change in some continuous measure of the level of service, for example changes in journey time or frequency. One particular type of service elasticity is known as *headway elasticity*.[1] Headway elasticity is the responsiveness of passenger numbers on a flow to a change in headway.

Diversion ratios

9. If the price of a particular service increases (or the service level decreases), the own price elasticity of demand will allow us to calculate the proportion of passengers who will cease to use that particular service. Diversion ratios allow us to calculate the proportion of passengers lost as a result of a price increase on one service that will switch to the competing service.

10. If we know the own-price elasticity of one operator's coach demand, and the diversion ratio from that operator to another coach operator, we can calculate the effect of an increase in the first operator's fares on demand for the second operator's coach services. For example, on the basis of an own price elasticity of –0.5 for Firm A's coach service, a 10 per cent fare increase by Firm A would reduce Firm A's coach demand by 5 per cent. With a diversion ratio of 20 per cent from Firm A to Firm B, one-fifth (20 per cent) of the 5 per cent reduction of Firm A's demand would switch from Firm A to Firm B in response to a 10 per cent increase in Firm A's fares.

Derivation of elasticity and diversion ratio estimates

11. We examined three sources of information for deriving estimates for the elasticities and diversion ratios required for the incentive modelling:

    (a) existing published literature;

    (b) data from a passenger survey conducted on behalf of the CC for this inquiry by market research agency Synovate; and

    (c) historical data at flow level provided by the parties.

12. We present our findings from our review and analysis of each of these sources next.

Literature review

Own price elasticity of demand

13. There are a number of UK studies estimating rail and bus own price elasticities of demand, but there are very few UK studies of coach fare elasticities. As part of the National Express Group/Greater Anglia inquiry in 2004, the CC commissioned Professor Wardman of the Institute of Transport Studies (ITS) in Leeds University to review the existing literature on the elasticities of demand for coach and rail

[1]Headway is the average interval between coaches, measured in minutes (eg if six coaches depart each hour on a particular flow, the headway is 10 minutes).

services.[2] The CC also commissioned Professor Wardman in 2005 to produce a similar review for the National Express/ThamesLink inquiry.[3]

14. On the basis of his review of these studies, Professor Wardman estimated the mode own price elasticity of demand for coach travel to be about –1.1; ie a 5 per cent increase in coach fares would result in a 5.5 per cent decrease in passenger numbers. He stated in his report that he found this figure to be plausible given the cost sensitivity of coach travellers, and, while less elastic than the leisure fare elasticity in the rail market (he cited evidence of elasticities greater than –1 for off-peak rail), this could be accounted for by coach fares being generally lower than rail fares and coach travellers having fewer alternative modes of travel.[4] Professor Wardman considered that the generation of new trips as a result of fare decreases would be relatively large in the price-sensitive coach market, and considers the own fare elasticity estimates in studies 3, 4 and 5 in Table 1 to represent lower bounds as they did not account for new trip generation.

TABLE 1 **Wardman review of coach elasticity estimates**

Study	*Context*	*Own fare*	*Time*	*Headway*
Douglas* (1987)	UK inter-urban coach flows	–1.10		
HFA† (1990)	UK stated preference on inter-urban travel	–1.20	–1.30	
Oscar Faber TPA‡ (1993)	Cross Forth journeys; 9% business, 67% commuting	–0.45	–2.10	–0.73
Toner and Wardman§ (1993)	Leisure travel in south-east UK	–0.37	–1.00	–0.50
TPA¶ (1992)	Transpennine trips for leisure purposes	–0.21	–0.13	

Source: *Review of Rail and Coach Elasticities* by Professor Mark Wardman, www.competition-commission.org.uk/inquiries/ref2005/neg/pdf/review_wardman_oct05.pdf, Table 9.

*Douglas, N J (1987) *A Welfare Analysis of Transport Deregulation*, Gower Press.
†HFA (1990) *Market Research Study into Coach Demand*, prepared for London Regional Transport.
‡Oscar Faber TPA (1993) *Setting Forth Revealed Preference and Stated Preference Models*, prepared for Scottish Office.
§Toner J P and Wardman M (1993) *Network SouthEast Off-Peak Inter-Urban Mode Choice Model II,* Technical Note 334, Institute for Transport Studies, University of Leeds.
¶TPA (1992) *TransPennine Rail Strategy Study: Study Report*.

15. Atkins, a UK-based design, transport and engineering consultancy, produced a study[5] in 2003, commissioned by the Government Office for the South East (GOSE) and the South East England Regional Assembly (SEERA), examining the network of express buses and scheduled coaches in the South-East of England. In their report, they suggested that a broad estimate of –1.0 for the short-run value of the mode own price elasticity of demand for coaches might be applicable. While this is much higher (in absolute value) than the short-run elasticity of around –0.4 for local buses services in general, they suggested it was consistent with the different mix of trip purposes found in coaches, which contain a much larger leisure element. However, they suggested that this generalization might not apply to coach *commuter* services.

Own price elasticity of demand by passenger type

16. As part of the National Express/Midland Mainline inquiry in 1996, the CC commissioned the ITS to carry out a study as to appropriate elasticities on the relevant

[2]www.competition-commission.org.uk/inquiries/completed/2004/natexpress/evidence_rail_and_coach_elasticities.pdf.
[3]www.competition-commission.org.uk/inquiries/ref2005/neg/pdf/review_wardman_oct05.pdf.
[4]The figure of –1.1 is similar to the figure slightly above unity for the bus fare elasticity in the long run that was included in the large scale review of fares conducted as part of the 'Black Book' demand for public transport (Transport Research Laboratory et al, 2004).
[5]www.southeast-ra.gov.uk/meetings/other/2003/bus_summit/express_bus_and_coach_final_report-april_2003.pdf.

routes.[6] The ITS recommended the use of the following coach elasticity estimates for leisure, student and retired passengers, based on research existing at the time:

TABLE 2 **ITS estimates of coach elasticities by type of passenger**

	Passenger type		
Elasticity	*Leisure*	*Student*	*Retired*
Own-fare	–1.1	–1.5	–1.5
Time	–1.1	N/A	N/A
Headway	–0.4	N/A	N/A

Source: NEG/Midland Mainline report, Tables 4.17 and 4.18.

Note: N/A = not applicable.

Service elasticities

17. As mentioned above, the headway elasticity is the proportionate response of passenger demand on a flow to an increase in the interval between coach departures. Professor Wardman estimated coach headway elasticities to be in the order of –0.4; that is, a 10 per cent increase in the interval between departures would lead to a 4 per cent decrease in passengers. The other studies reported in his review, listed in Table 1, included headway elasticities of –0.5 and –0.7. We therefore considered the range of headway elasticities from the literature to be between –0.4 and –0.7.

Diversion ratios

18. For the diversion ratios in which we are interested, ie those between Stagecoach and Scottish Citylink coach services pre-joint-venture, no published estimates were available.

Company evidence

19. Stagecoach told us that [✂].

20. Scottish Citylink also told us that [✂].

21. We noted that none of the estimates from the literature were route- or flow-specific, nor were they specific to Scotland, and in many cases were derived using widely differing methodologies. A number of the features of a given flow (frequency, number of alternative operators and modes, proportion of business/leisure travellers) can have a strong impact on the magnitude of the elasticities.

Evidence from the CC passenger survey

Own fare elasticities for coaches

22. The CC commissioned a passenger survey[7] which questioned passengers on 13 overlapping flows (where the main parties both offered services prior to the joint venture) about the point at which they would switch away from using the coach

[6]These were central London to Sheffield, Chesterfield, Derby, Nottingham and Leicester.
[7]www.competition-commission.org.uk/inquiries/ref2006/citylink/pdf/survey_coach_passengers_scotland.pdf.

service they travelled on in response to an increase in fares on that service. The interview question was:

> Would you have travelled on [the primary diversion option][8] instead of the coach service you travelled on if the price of your coach ticket had been [asked sequentially]: 50%, 1%, 30%, 3%, 10%, 5% higher?

23. The Computer Assisted Telephone Interview (CATI) system used presented the appropriate primary diversion option from the relevant previous question and calculated actual price points for the interviewer to read out, based on the actual fare paid by the respondent.

24. Respondents were asked separately what proportion of their journeys they would divert under the scenario given in the question above:

> If the price of your coach ticket increased to [the lowest price at which respondent indicated they would switch] for a sustained period and you did decide to change some or all of your journeys to [the primary diversion option stated], would you change: all of your journeys, about three-quarters of your journeys, about half of your journeys, about a quarter of your journeys, or less than a quarter of your journeys?

25. From their responses to these questions, we were able to construct own fare elasticity estimates with respect to passenger journeys for coach travel on the joint venture's services following a 10 per cent increase in fares. The parties queried whether we would find demand to be more elastic if we weighted the journeys lost by the actual revenue paid. We constructed similar elasticities where the passengers were also weighted by the actual fare they paid. Both sets of results are presented in Table 3.[9]

TABLE 3 **CC survey estimates of own price elasticities for coach travel by journey purpose**

	Commuters	*Students*	*Leisure and personal*
Own fare elasticity based on a 10% fare increase (unweighted)	–0.6	–0.8	–0.4
95% confidence intervals	*(–0.3, –1.4)*	*(–0.4, –1.6)*	*(–0.2, –0.6)*
Own fare elasticity based on a 10% fare increase (weighted by actual fare paid)	–0.4	–0.5	–0.6
95% confidence intervals	*(–0.1,–2.1)*	*(–0.1,–1.7)*	*(–0.2,–1.1)*

Source: CC analysis and passenger survey.

Notes:
1. Based on an overall sample of 48 commuters, 57 students and 238 leisure and personal travellers.
2. Confidence intervals at 95 per cent (lower bound, upper bound).

26. We focused on the results for passengers travelling for leisure and personal purposes, as these represented almost 70 per cent of our respondents (and over 80 per cent of the passengers screened on the coaches) and therefore were the

[8]The question asked to determine the primary diversion option was:

> I would now like you to imagine that Scottish Citylink and Motorvator/Megabus stop running [on this flow]. Imagine that they stop running completely and permanently. All other transport options remain available exactly as at present. Which one of the following would you be most likely to do?

The interviewer then read out the following options: all of those transport modes that the respondent had previously used, modes that he or she was aware of, an option not to travel and an option to travel to a different destination.

[9]Elasticity estimates for a 5 per cent fare increase were calculated, but were based on a very small number of respondents indicating they would switch, and we did not consider these as robust as the estimates for a 10 per cent price increase. The elasticity at 10 per cent is less negative because the larger response by passengers in the numerator is more than offset by the greater increase in price in the denominator.

most statistically robust of the three estimates. For this category, the weighting by actual fares paid did increase the elasticity of demand, but it also widened the confidence interval about the estimates. For commuters and students, the revenue weighting reduced the elasticity estimates, implying that switching leisure and personal passengers were paying higher than average fares, while switching commuters and students were paying lower than average fares.

27. The parties considered that the elasticity estimates from the survey should have been based on a combination of all respondents, not only passengers travelling for leisure and personal purposes. We disagreed, as the survey sampling did not control the proportions of commuters, students, and leisure and personal business travellers such that we could be confident that our survey sample was representative of the travelling population in respect of journey purpose. Combining the three groups would give a less reliable estimate than that from analysing the largest representative group, and would also give a misleading impression of greater precision.[10]

28. We note, however, that the analysis of yield management (see paragraphs 50 to 66) suggests that if any revenue is lost following a fare increase, this is likely to come from those passengers paying the highest fares, which in this instance appears to be best modelled using the leisure and personal business group of respondents.

Derivation of diversion ratios

29. Our passenger survey also afforded us the possibility to impute inter-operator diversion ratio estimates from the data.[11] Passengers were asked about other public or private transport options they had used in the past two years for the same journey. On the basis that past experience with another mode or operator made diversion to that mode or operator more likely, we used passenger responses in relation to their experiences with the pre-joint-venture operators to construct both conservative and generous estimates of inter-operator diversion ratios.

30. The conservative estimate included as diverting passengers *only* those who indicated the other joint venture party as their *sole* past experience[12]—a very stringent standard which we considered to represent the absolute minimum possible diversion ratio value.

31. The generous estimate selected each passenger who had *any* experience of the other joint venture party as one who would divert to the other joint venture party. While this approach is likely to pick up many more passengers than the conservative measure, it may be considered more realistic to the extent that passengers are more likely to switch between coach operators before they consider other modes of transport. This generous estimate still may represent an underestimate, as it does not pick up any new customers who began travelling in the past year who therefore

[10]This is because the confidence interval narrows as a result of a larger overall sample, but bias is introduced via the combination of the three unrepresentative groups into one.

[11]Passengers were asked the following question:

> Firstly, thinking about the journey you were making from [starting point] to [ending point] during which my colleague interviewed you, what public or private transport options have you used for THIS JOURNEY in the past two years, other than the service you used that day?

Responses were coded to include coach services run by Scottish Citylink, megabus, Motorvator, and a number of other possibilities.

[12]That is, for the conservative estimate, all respondents on a Scottish Citylink coach who had previously travelled *only* on megabus/Motorvator and no other operator or mode would be considered as likely to divert to megabus/Motorvator. Similarly all respondents travelling on megabus/Motorvator who had previously travelled *only* on Scottish Citylink and no other operator or mode would divert to Scottish Citylink. These were aggregated for the two operators. We did not try to estimate different diversion ratios for each operator, as we considered that such results might not be reliable—we were carrying out the analysis for individual operators based on passengers travelling on the joint venture's combined services, and the majority of passengers had indicated that they were aware that the two companies were now operating jointly.

would not have had the opportunity to experience the pre-joint-venture operators' services.

32. The conservative estimate of the symmetric diversion ratio between the parties to the joint venture produced by this methodology was 0.1, and the generous estimate was 0.6. We considered the upper half of the range, from 0.3 to 0.6, to represent the likely range of estimates for the true diversion ratio for the reasons outlined above.

33. We were able to apply a test to this methodology to examine how robust its predictions were. In the same survey questions, passengers had also indicated whether they had past experience with rail services. In addition, we had actual stated preferences for passengers indicating whether they would divert to rail from the survey. We were therefore able to apply the same methodology to generate a diversion ratio estimate for rail, and compare this with the stated preference-based diversion ratio for rail. The methodology produced a conservative estimate of 0.02 for diversion to rail, and a generous estimate of 0.65. The stated preference diversion ratio to rail estimate was 0.60, suggesting that the upper bounds of the ranges produced by our methodology might represent more appropriate estimates of the true diversion ratio.

Econometric estimation

34. The parties provided us with historical flow level data which we used to try to estimate own and cross-price elasticities and service elasticities for their services based on average revenues, passenger numbers, and vehicle journeys.[13] We did not have comparable data on alternative coach operators and possible competing modes on these flows. We carried out a series of flow-by-flow and panel estimations[14] which generated results that were implausible, with many incorrectly signed and insignificant coefficient estimates on the relevant elasticities. The results also appeared inconsistent with the evidence we had received from the main parties, third parties and from our passenger survey.

35. We considered that a number of limitations with our data may have resulted in these implausible estimates, including the lack of comparable historical marginal fares at flow level, and/or the omission of fare and demand information on alternative modes and operators. As a result, we concluded that given these limitations, estimation of elasticities from this data was ineffectual.

Synthesis of evidence into ranges of parameters for incentive modelling

36. We then returned to the accumulated evidence from the literature and our passenger survey to construct ranges of operator own fare and service level elasticities and diversion ratios appropriate for our incentive analysis.

37. We considered the range of estimates in the confidence interval surrounding the leisure and personal passenger survey elasticity estimate weighted by revenues, ie –0.2 to –1.1, as our starting point for the coach fare elasticities for our incentive modelling, as these included the upper range of estimates derived from the literature.

38. We also noted that a number of fare increases and service reductions had occurred shortly after the joint venture transaction. We considered whether, as a result, our survey sample may have excluded some of the more price-sensitive passengers who

[13]'Vehicle journeys' represents the frequency of coach operations on a four-weekly basis. It does not account for duplications.
[14]We estimated each operator's coach passengers against a constant term, the operator's own average coach fares, the other operator's average coach fares, own vehicle journeys and the other operator's vehicle journeys, all in log-log format.

could have switched away from the joint venture's services altogether or who could have been replaced by less price-sensitive passengers. For this reason, we truncated the lower bound of the range of own coach fare elasticities we considered at –0.4, rather than the lowest estimate within the confidence interval, –0.2.

39. We noted that the estimates from our survey showed coach demand to be less elastic than the estimates from the literature. We also noted that our survey estimates were based on the specific services and geographical area under consideration in this inquiry, and on a time period closer to the actual period under investigation for this inquiry.

40. The parties disagreed with our range of estimates, and told us that the literature estimate of –1.1 should form the *base scenario* for our profitability analysis, not an *upper bound*. They stated that the survey estimates were likely to be underestimates, due to selection bias and reliability issues. They stated further that they considered our estimates to be short run, and we needed to consider how they would increase in the long run. We address these and other concerns by the parties later in this appendix in paragraphs 48 to 81.

41. The range of coach headway elasticities for use in our profit incentive modelling were derived entirely from the literature, and ranged from –0.4 to –0.7. The parties did not dispute these figures, although they did dispute the results of the profit incentive modelling relating to service levels (see paragraphs 19 and 20 of Appendix I).

42. Using our range of estimates of coach own fare elasticities and service level elasticities, and our range of diversion ratios between the two operators, we were able to construct a range of operator-specific own fare and service level elasticities. To do so, we were required to make a number of assumptions:

(a) that the operators were symmetric; and

(b) that the diversion ratios between the operators were symmetric.

43. Under these assumptions, the operator diversion ratio is given by:

$$\varepsilon_{operator} = \varepsilon_{coaches} \big/ (1 - \delta)$$

where:
$\varepsilon_{operator}$ = coach operator own fare/service level elasticity;
$\varepsilon_{coaches}$ = mode own fare/service level elasticity for coaches; and
δ = symmetric inter-operator diversion ratio.

44. While we considered that the assumption of symmetry might be fairly strong in some instances, we noted that in this case it did not seem unreasonable given the closeness of the parties' service offerings to each other, and their significant distance from the next closest substitute service (see paragraphs 79 to 81 for further discussion). We note that the symmetry assumption had been used in past inquiries (eg NEG/Thameslink). In any case, we used it in this context to generate *ranges* of plausible elasticities, rather than attempting to impute precise point estimates.

45. The symmetric operator own fare elasticities imputed from these numbers ranged from –0.6 to 2.8, and are listed in Table 4; the symmetric operator service level elasticities ranged from –0.6 to –1.8, and are listed in Table 5.

TABLE 4 **Imputed symmetric operator own fare elasticities**

	Diversion ratio	
Market elasticity	*0.3*	*0.6*
–1.1	–1.6	–2.8
–0.8	–1.1	–2.0
–0.6	–0.9	–1.5
–0.4	–0.6	–1.0

Source: CC analysis.

TABLE 5 **Imputed symmetric operator service elasticities**

	Diversion ratio	
Market elasticity	*0.3*	*0.6*
–0.7	–1.0	–1.8
–0.6	–0.9	–1.5
–0.5	–0.7	–1.3
–0.4	–0.6	–1.0

Source: CC analysis.

46. In line with their belief that the mode own fare elasticity for coaches is at least as negative as [✄], the parties disagreed with our ranges of imputed firm own fare and service level elasticities. They considered that only a firm own fare elasticity of [✄] (the right-most column in our profit incentive tables) or more negative with diversion ratios of up to [✄] per cent could possibly be considered valid.

47. The upper and lower ends of the imputed ranges of operator elasticities and diversion ratios, and a range of intermediate values, were then used as inputs to the profitability model to estimate the incentives of the joint venture to raise fares or reduce service levels.

Parties' concerns

48. The parties raised a number of issues and concerns in relation to our estimation of elasticities and diversion ratios which they believed invalidated any results from the profit incentive analysis. These included that:

(a) The use of own price elasticities in determining the revenue effects of a fare increase or service decrease was invalid in a yield-managed environment, as the link between inelastic demand and increased revenues was rendered invalid by yield management.

(b) The incentive modelling was based on short-term profit maximization, [✄].

(c) The elasticities did not take into account that short-run elasticities understate passengers' actual responsiveness to price rises and/or service reductions.

(d) There was a systematic bias from the CC's survey method, and in its approach to adjusting the fare elasticities by the stated proportion of journeys that would be switched. Furthermore, the survey was not reliable and not robust.

(e) The assumption of symmetry was not satisfied in practice.

49. We considered all of these concerns, and our analysis of each is discussed below.

Parties' concern 1: Inelastic demand may not lead to a revenue increase from a fare increase under yield management

50. The yield management system for megabus [✄].[15,16,17]

51. [✄]

52. The parties told us that the impact of a fare increase on revenues under yield management would depend on the actual fare paid by the specific passengers who departed as a result of a fare increase. This response will be higher if the passenger departs from a higher fare step, and lower if the passenger was purchasing one of the highly discounted fares. As such, conventional application of elasticities, which only attributed a single fare to all passengers, was not, in the parties' view, appropriate in this context.

53. We considered how a fare increase might operate in a yield-managed environment. In a yield-managed model, an increase in fares can take a number of forms, including: *(a)* an upward shift in one or more prices; *(b)* a reduction in the size of (or removal of) one or more quotas; and *(c)* combinations of these two.[18] What they all have in common is that some of the passengers from the affected step or steps may cease to use the service, while others may remain and pay higher fares. The broad conclusions we reached were the same for all three types of fare increase.

54. With any of the methods of fare increase outlined above, those passengers who were affected by the change will respond in one of the following ways (see example in Figure 1):

(a) some affected passengers will continue to travel on the operator's services and pay a higher fare;

(b) some affected passengers may cease to travel on that operator's services;

(c) as a result of *(b)*, some additional 'cheap' seats will become available for purchase. These will either be taken up by passengers 'cascading down' from higher steps where they previously would have paid a higher fare,[19] *or* by new passengers who previously would have been rationed out from the fare quota because it was already full and they were not prepared to purchase the higher fares available.

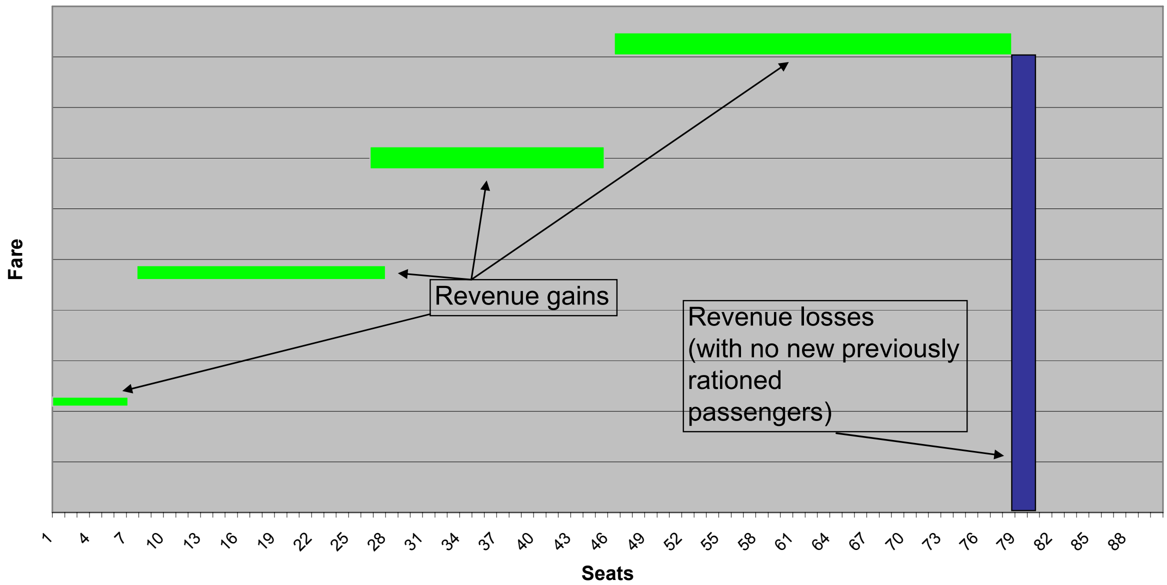
55. It is the effect of *(c)* which is unique to the yield management practised by the parties. If existing passengers cascade down to take up the newly available cheap fares and there are no new passengers purchasing tickets at lower fares, the loss in revenue from any departing passengers ultimately will always come from the *highest* step.[20] As such, the revenue effect of a price increase will be proportionately larger than the passenger journey effect if *existing passengers cascade down to lower steps and no new passengers purchase tickets*. However, to the extent that previously rationed out passengers take up some of the cheap tickets which become available, any loss of

[15][✄]
[16][✄]
[17]Most effective yield management systems have a mechanism to segment customers and prevent *arbitrage* between customer groups—ie they prevent reselling of tickets, and restrict access to cheap tickets by price-insensitive customers often by means of restrictive conditions (eg requiring a Saturday night stay, excluding peak hour departures, dividing seats between first class and economy, etc).
[18][✄]
[19]The lack of a mechanism to prevent less elastic customers from purchasing cheap tickets makes this reallocation of tickets plausible.
[20]That is, the highest step from which previously fares were sold.

revenues from departing passengers will be dampened, and could potentially be completely eliminated.

FIGURE 1

Fare increases under yield management



[✂]

Source: CC analysis.
Notes:
1. [✂] This fare structure does not reflect any actual fare structure used by the parties and is presented purely for illustrative purposes.
2. [✂]

56. Consequently the conclusions from the analysis of yield-managed fares are that:

(a) If any passengers are lost as a result of the fare increase, they always will be lost from the top step; if the fare at the top step is substantially different from the average fare, this will result in conventional elasticities underestimating the revenue impact of a price increase; however, only in extreme circumstances where the highest step is considerably higher than remaining steps will a fare increase result in a negative revenue response.

(b) If any passengers were previously rationed out at lower steps, the influx of these passengers will dampen some of the revenue loss on the top step. With enough rationed passengers, it is possible to achieve a fare increase through any of the mechanisms listed in paragraph 53 without necessarily incurring any reduction in revenues. This will result in the passenger journey response to a fare increase from the survey being *over*stated, as it does not allow for new passengers at lower fare levels. Allowing for the influx of new passengers means that any revenue losses from departing passengers will be dampened or eliminated by new ticket sales at higher fares, leading to larger revenue gains from a fare increase than would otherwise be the case.

57. We then considered how the loss of any fares from the highest step might impact the calculation of our elasticity estimates from our passenger survey. We recalculated the estimates weighting the switching passengers by the highest fares paid on the coaches they were travelling on and compared these with the previous estimates weighted by the fare they had actually paid. We found that the elasticity estimates

and confidence intervals from these two methods were virtually indistinguishable. The own price market elasticity estimates for leisure and personal business travellers in terms of ticket revenue switched in response to a 10 per cent fare increase were both –0.6 (both with confidence intervals of –0.2 to –1.0).[21]

58. [✂] shows further that the majority (over [✂] per cent) of passengers surveyed paid the highest fare paid on the particular coaches on which they travelled. This reflects the fact that quotas for the cheaper steps are very small, and by far the most fares are sold on the higher steps. This explains why weighting by the highest fare paid and the actual fare paid tends not to make any material difference in the estimates.

59. As a result of this analysis, we rejected the parties' criticism that the use of elasticities to approximate revenue effects under yield management was in-appropriate. [✂]

60. However, the analysis did lead us to become concerned that with any previously rationed passengers on hand to purchase tickets made available by departing passengers, our survey estimates were likely to overstate the sensitivity of passenger journeys to changes in fares.

61. The existence of previously rationed passengers is made more likely *(a)* the smaller the size of the seat allocation for discounted quotas; and *(b)* the higher the size of the steps between quotas. In this case, the discounted fare seat quotas are quite small, and some of these fares serve for headline fare comparisons for marketing purposes, so the likelihood of further unmet demand at those fare levels is likely to be high. In addition, in those instances where the height of the steps is large, there are likely to be more passengers whose willingness to pay falls between the tiers of two steps, who may re-emerge as purchasers in the circumstances described above.

62. We noted further that the survey only questioned a sample drawn from the actual population seated on the coach; by definition, the tickets held by passengers who say they would depart as a result of a price increase have not been resold. As a result, the impact of a fare increase on passenger journeys as estimated from our survey is likely to be overestimated.

63. We therefore eliminated the highest of our operator own fare elasticity estimates, –2.8, from our range of estimates for our profitability analysis.

64. The parties disagreed further with our analysis, and maintained that the link between elasticities and revenue effects necessarily broke down under yield management. According to the parties, given that the marginal passenger in a yield-managed service pays more than the average fare, the use of conventional elasticities underestimates the cost of a fare increase to the joint venture, and thus overestimates any incentives by the joint venture to raise fares. The parties stated that the CC's result depended crucially on two arguments, both of which were invalid:

(a) there is a stock of previously rationed passengers at lower steps of the joint venture's yield-managed fare structure—the parties argued that this assumption was inconsistent with the CC's assumption of short-term profit maximization, as a price rise would already have been profitable prior to the joint venture; and

[21]This estimate is less precise that the estimate of [✂] in terms of journeys switched used for the profitability modelling, but not, in a statistical sense, significantly different from it.

(b) in the presence of yield-managed fares and inelastic demand, a price increase could result in lower revenues only under extreme circumstances—the parties contended that this held as a general result.

65. We considered both of these criticisms. In the case of the existence of a stock of previously rationed customers at lower steps of the joint venture's yield-managed fare structure being inconsistent with short-term profit maximization, we rejected this assertion on a number of grounds. First, we noted that the joint venture would have to use a far more complicated fare structure, or even resort to auctioning coach tickets one by one, in order to achieve anything close to the type of first degree price discrimination that would make each passenger pay his reservation price and result in no passengers being rationed out. The transaction cost implications of such a sales method for tickets that typically cost between £1 and £8 would be very likely to outweigh the revenue gains, and so it is not surprising to us that the parties use a method of approximation in their fare structures.[22] Further, we considered that there was likely to be considerable uncertainty at any point in time with respect to how many buyers were willing to pay the price at any fare quota. Without a mechanism to prevent passengers willing to pay the higher prices from buying cheap tickets, the joint venture would risk losing revenues if it overallocated cheap tickets relative to realized demand. Even if the joint venture had perfect knowledge of demand at each fare quota, it still could not prevent passengers willing to pay more from buying cheap tickets if they happened to purchase their tickets early. The joint venture therefore had a strong incentive to restrict the allocation of the cheap tickets *below* the expected level of demand. We noted further that many of the cheapest tickets represent 'headline' fares, used mainly for marketing purposes, and usually a very small number of seats were allocated under these fares. It was therefore highly unlikely for demand for these seats to have been satiated by the very small number offered. We therefore rejected the parties' contention that short-term profit maximization precluded the existence of passengers rationed at discounted fare quotas, and considered the existence of such passengers to be highly likely.

66. The parties' second key point was that under yield management, as long as the last passenger pays more than the average fare, there always exists an elasticity lower than –1 for which any price rise leads to lower revenues. We noted that this result relied on their first contention, namely that no previously rationed customers can exist under the assumption of short-term profit maximization. Then, given that any passengers that are lost are always lost from the highest fare quotas, it is possible to have a price increase which results in lower revenues even with inelastic demand. However, with previously rationed out customers picking up some of the slack in demand caused by the price increase, then it is unlikely that the overall revenue effect will be negative except where the highest fare quota is considerably higher than the remaining fare quotas—a configuration which is not currently observed in the joint venture's yield managed pricing structure.

Parties' concern 2: The incentive modelling was based on short-term profit maximization, [✂]

67. This criticism is addressed in paragraphs 19 and 20 in Appendix I, and paragraph 6.56 of the main report.

[22] Indeed most types of price discrimination practised in other markets (volume discounts, seasonal discounts, student and elderly discounts, etc) represent approximations to first degree price discrimination, and do not in any way imply that firms are deviating from short-term profit maximization.

Parties' concern 3: The elasticities do not take into account that short-run elasticities understate passengers' actual responsiveness to price rises and/or service reductions

68. The inter-modal diversion ratios from our survey are based on the respondents being asked what they would do in the event that 'Scottish Citylink and Motorvator/Megabus stop running [on this flow]. Imagine that they stop running completely and permanently'. As such, we considered that the choice of the diversion option was made based on a permanent loss of the option, not, for example, as a result of the coach being out of service for a day. The survey then established the price increase at which this option would be exercised.

69. In order to determine the proportion of revenues that would be switched, respondents were asked to consider what proportion of their journeys they would change if the price increased to their reservation level 'for a sustained period'. Once again, responses are not based on a short period as would be the case, for example, with coaches being out of service for a day.

70. As such, we view these elasticity estimates as measuring at least a medium-term response. We considered how likely it was for the longer-term passenger response to a fare increase to differ substantially from the medium-term response. We noted that, even for some of the higher fares, a 5 per cent increase in fares did not represent a large sum in absolute terms for an individual passenger. For example, even in the case of the £6 megabus fare for Aberdeen–Edinburgh, a 5 per cent fare increase represented a 30p increase per ticket per journey. The absolute increases would be far less on the lower fares. As such, we did not expect this likely change in fares, even computed on an annual cost basis, to be sufficient in magnitude to induce the type of more drastic long-run response one might see for more expensive travel services—responses like passenger relocation or job change—which would materially impact the magnitude of the elasticity estimates in the longer run.

Parties' concern 4: There was a systematic bias from the CC's survey method, and in its approach to adjusting the fare elasticities by the stated proportion of journeys that would be switched. Furthermore, the survey was not reliable and not robust.

71. One of the main sources of quantitative evidence used in estimating own price market elasticities for coach travel was the passenger survey conducted by market research agency Synovate on behalf of the CC as part of this inquiry.

72. Synovate, an MRQSA-accredited[23] agency, designed and executed the research to ensure that representative samples of coach services were surveyed. The parties were given an opportunity to comment on the design of the fieldwork methodology and the survey questionnaires before they were implemented, and they did not indicate any concerns about reliability or bias. There is no indication in the agency reports that bias for or against the transaction, or bias toward or away from more price-sensitive customers, was introduced by the survey method. Interview monitoring revealed also that respondents were able to understand the questions asked and answer them promptly.

[23]Market Research Quality Standards Association (MRQSA) is an industry body which was set up to develop standards for market research, data collection and data processing.

73. Whilst we recognize that the numbers of follow-up price attitude telephone interviews conducted[24] imply that estimates will include a degree of sampling error, standard 95 per cent confidence intervals have been used to report the elasticity estimates derived from these interviews. Confidence intervals for elasticities based on both the number of journeys that would be expected to be switched away from the coach, and the revenue associated with those journeys, were estimated.

74. The parties also criticized the two-step process of asking passengers whether they would cease to use the joint venture's services, as a result of a fare increase, and then asking what proportion of their journeys they would switch. The parties considered this to be illegitimate, and referred to this as 'scaling down' the elasticity estimates. The parties told us that we should not adjust the responses to the fare increases by the number of journeys that would be switched, as the first question referred to the current journey being undertaken while the second referred to a 'sustained period' of time. They posited that respondents would not be able to understand the notion that they might be able to switch only a proportion of their journeys over a sustained period. However, live interview monitoring reports and a review of some of the tape recordings from the CATI interviews and discussions with the market research agency did not suggest that passengers had any difficulty understanding the questions being asked.

75. The parties also suggested that the fact that the interviewer stated to the respondent that the survey was being conducted on behalf of the CC biased the results by determining which individuals agreed to participate in the telephone survey and by affecting how respondents answered the questions. In particular, the parties suggested that those respondents with concerns about the joint venture were more likely to agree to participate than those with none.

76. We considered whether, in the context of our inquiry, a coach traveller who held a negative view of the joint venture would have sufficiently sophisticated knowledge of UK competition law to know which responses might lead to the joint venture being blocked. We considered that respondents would need to know: at what level of price increase we would be concerned with switching; what stated proportion of their journeys switched would cause us to be concerned; and what stated diversion options would or would not cause us concern. We considered it highly unlikely that respondents would have sufficient knowledge to be able to 'game' their responses in such a way, even if they held a negative view of the joint venture.

77. The parties expressed concern that telephone interview respondents would not be able to choose between unfamiliar diversion options quickly. We note that the survey script was designed first to establish which mode options a passenger had previously used or was familiar with, then to establish which was the passenger's primary diversion option.

78. In conclusion, within the practical limitations imposed by having to conduct the fieldwork only within a three-week period in April, after the joint venture had been implemented, the survey results provide a sound basis for the estimation of stated passenger diversion intentions and price sensitivity.

Parties' concern 5: The assumption of symmetry was not satisfied in practice

79. The parties told us that the two pre-joint-venture operators were clearly not symmetric, and it was highly likely that the diversion ratios were not symmetric either,

[24]These bases were: 48 passengers travelling for work purposes; 59 for education; and 244 for leisure or personal business.

again raising questions about the validity of the approach taken. They stated that they did not believe this was remedied by using ranges, which could be ‘equally wrong’, nor by the argument that the same approach has been used in previous CC inquiries.

80. The parties did not offer any explanation as to why they considered that the operator elasticities and diversion ratios should not be symmetric, or indeed what difference this might make to our analysis.

81. We considered that pre-joint-venture, the coach services of the parties were the closest available substitutes to each other, in terms of both price and product characteristics. The next closest substitutes would be either the limited coach operations of National Express, which operated at far lower frequency than the parties, or rail, which represented a substantially different product. Thus it did not seem unreasonable to us that for a small change in prices (for example, a 5 per cent change, representing about a 15p difference on a £3 fare) that the diversion of passengers from one party to the other would be symmetric.