Subject	Provision of market research for value of travel time savings and reliability
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Appendix A

Microeconomic framework

Contents

A1 Non-work

The economic theory relating to the valuation of travel time (VTT) changes evolved from the pioneering work of Becker (1965)[1] with notable further contributions from, among others, DeSerpa (1971)[2] and Evans (1972)[3]. These were codified in the course of the first UK Study and set out in section 3.3 of MVA et al (1987)[4]. It is assumed that an individual's utility U is composed of a vector of commodities x, plus a vector of time spent in various activities, t, and that this is maximised subject to a set of constraints relating to both time and money. The key conclusion is what MVA et al describe as "the fundamental property of time value" (their equation (3.9)):

Value of saving time in activity i		(ψ_i/λ)
=	Resource value of time	(μ/λ)
–	Marginal valuation of time spent in activity i	$((\partial U/\partial t_i)/\lambda)$

This implies that the VTT could vary because of a) the income of the individual (λ), b) the extent to which the individual is time constrained (μ) and c) the (marginal) utility of the time spent travelling ($\partial U/\partial t_i$), which will be affected by factors such as comfort, and the opportunity to undertake other activities. In most transport problems, the marginal valuation of time is expected to be negative, because travel time contributes to **dis**utility. However, recent technological developments (mobile phones etc.) can be considered to have an important impact in reducing this disutility.

While this remains the generally accepted theory (see, for example, Small and Verhoef (2007)[5]), Mackie et al (2001)[6] suggest that it still lacks two other dimensions – possible variation in goods consumption through substitution of travel for other activities, and the possibility of re-timing activities (to deal with what MVA et al described as the "constrained transferability of time").

The economic theory outlined is strictly neo-classical in nature. As Small and Verhoef point out, there are further extensions which owe more to prospect theory (Kahneman and Tversky, 1979)[7], and in particular the concept of "reference dependence". This in turn leads to the phenomenon of "loss aversion" (essentially, a discontinuity in the derivative around the current "reference point"). In the

[1] Becker, G. (1965) A theory of the allocation of time. The Economic Journal 75, pp493-517.

[2] DeSerpa, A. (1971) A theory of the economics of time. The Economic Journal 81, pp828-846.

[3] Evans, A. (1972) On the theory of the valuation and allocation of time. Scottish Journal of Political Economy 19, pp1-17.

[4] MVA, ITS and TSU (1987) The Value of Travel Time Savings, Policy Journals, 1987.

[5] Small, K.A. and Verhoef, E.T. (2007) The Economics of Urban Transportation, Routledge.

[6] Mackie, P.J., Jara-Diaz, S. and Fowkes, A.S. (2001) The Value of Travel Time Savings in Evaluation, Transportation Research E, Vol. 37, pp91-106.

[7] Kahneman, D. and Tversky, A. (1979) Prospect Theory: An Analysis of Decision under Risk, Econometrica, 47, pp263-92.

context of VTT, a particularly important contribution is that of de Borger and Fosgerau (2008)[8], as will be discussed later in **Chapter 4**.

Although it is now taken for granted, the use of discrete choice modelling techniques for the empirical measurement of VTT was also part of the MVA et al codification (previously there had been no attempt to link the neoclassical utility theory with the utility concept underlying random utility models). The same study pioneered the use of Stated Preference data, which has also now become more or less standard. For the simpler neo-classical version, appropriate values can be estimated directly (allowing for segmentation) from trade-offs between time and cost, analysed as a discrete choice. This was the general practice at least till c.2005, though attempts had been made to investigate "sign and size effects" (a form of reference dependence).

As Small and Verhoef (p49) note, "the kind of loss aversion applied to an individual, in a hypothetical situation with a very clear reference scenario (a recent actual trip), need not apply to a proposed change to a transportation system affecting thousands of people in varying and changing circumstances." They suggest that a model along the lines of de Borger and Fosgerau is more useful for interpreting stated preference results, rather than directly for public policy assessment.

In addition, as Mackie et al point out: "There is no reason for the value that the individual is willing to pay to reduce travel time to be equal to the value that society as a whole attaches to the reassignment of time of that individual to other activities." Thus, as we will see in **Chapter 7**, there are further considerations to translating what we may regard as individual VTT to appropriate values for appraisal.

A2 Business

While the above theory could also be used for trips carried out for the purpose of employer's business from the point of view of the individual, the general view has been that – at the least – there are two "agents" in such trips: the employee and the employer. As recently reviewed by Wardman et al (2015)[9], early approaches viewed the time of the employee while on business as being owned by the employer, and on this basis it was considered appropriate to value a unit of time transferred between travelling and working as equal to the marginal gross cost of labour (or, given competitive conditions in the labour and product markets, the value of the marginal product of labour [MPL]), thus:

$$VTT = MPL = w + c \qquad (A.1)$$

where:

w is the gross wage rate (inclusive of tax etc.)

c is the marginal non-wage cost per unit time of employing labour (the "on-cost")

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[8] de Borger, B. and Fosgerau, M. (2008) The trade-off between money and travel time: A test of the theory of reference-dependent preferences, J. of Urban Economics, Vol. 64, pp101-115.

[9] Wardman, M., Batley, R.P., Laird, J.J., Mackie, P.M. and Bates, J.J. (2015) 'How Should Business Travel Time Savings be Valued?' Economics of Transportation (in review).

This approach has become known as the “Cost Saving Approach” (CSA). In contrast to the theoretical approach presented above, this does not require any explicit empirical analysis – merely data on wage rates and the on-cost.

However, for the approach to be valid, a number of well documented assumptions need to be made (e.g. Harrison, 1974)[10]: in particular, that all released time goes into work not leisure, and that travel time changes do not displace work done during travel. These assumptions do not seem unreasonable in relation to professional drivers, but they are much more questionable in relation to those who are travelling to transact business (often referred to as “briefcase” travellers).

One of the best known challenges was that made by Hensher (1977)[11], which proposed a number of modifications to the straightforward CSA formula above (though the codification of the “Hensher” formula is actually due to Fowkes et al. (1986)[12]). Of particular importance was the proportion (“r”) of the travel time saved which was actually used for leisure. If $r \neq 0$, we are open to the possibility of there being two parts to business VTT – a part relating to the employer (which, with some modifications, continues to represent the MPL) and a part relating to the employee, to which the earlier neo-classical model, and its subsequent modifications, can apply.

The standard form of the Hensher equation is

$$VTT = (1-r-pq)\,MPL + MPF + (1-r)\,VW + rVL \qquad (A.2)$$

where:

r is the proportion of travel time saved that is used for leisure

p is the proportion of travel time saved that is at the expense of work done while travelling

q is the relative productivity of work done while travelling relative to at the workplace

MPL is the value of the marginal product of labour

MPF is the value of extra output due to reduced (travel) fatigue

VW is the value to the employee of work time at the workplace relative to travel time

VL is the value to the employee of leisure time relative to travel time[13]

In this formula, the terms (1–r–pq) MPL + MPF may be considered to relate to the value of time to the employer, while the terms (1–r) VW + rVL relate to the employee.

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[10] Harrison, A.J. (1974) The Economics of Transport Appraisal. Croom Helm, London.

[11] Hensher, D.A. (1977) Value of Business Travel Time. Pergamon Press.

[12] Fowkes, A.S., Marks, P. and Nash, C.A. (1986) The Value of Business Travel Time Savings. Working Paper 214, Institute for Transport Studies, University of Leeds.

[13] VL is the behavioural value of non-work time for the relevant labour. Note that this is expected to be higher than the standard value of non-working time across the whole population on the grounds that business travellers have above average incomes.

In practice, despite a number of attempts, obtaining robust empirically determined values for all these parameters is demanding, though the recent SPURT research study (Mott MacDonald et al., 2009)[14] in the context of rail travel established a commendable protocol for this. The earlier work by Mackie et al (2003)[15] decided on balance that the evidence for p was not significantly different from 0, though – importantly – they were looking at data relating to car travel. While by contrast there was evidence for the value of r significantly greater than 0 (meaning that some of the time saved would not, according to the respondent, be used for productive work), they argued that this was essentially a short term constraint, and that market forces would not permit it to obtain in the longer term. This remains a controversial issue. Our view is that the SPURT study was a well conducted piece of work but that it is not at all easy to elicit robust long term values for p and r in this way.

Given the various issues, the Department commissioned a scoping study in 2012, which noted, on the basis of a review of the literature, international practice, and empirical results, that there was no consensus on the theoretical underpinnings of the business value of time (Wardman et al, 2013)[16]. It therefore recommended attempting to obtain empirical evidence which could complement the theoretical approach or even conceivably replace it.

As a result, in this study (unlike previous UK VTT studies), we have carried out work on employees’ values and employers’ values (though the latter are confined to briefcase travel). In addition, we have aimed at investigating how far employees understand company policy regarding business travel, and to what extent they have freedom of choice and attempt to reflect the interests of their employers.

[14] Mott MacDonald, Hugh Gunn Associates, TRI Napier University, Accent and Mark Bradley Research and Consulting (2009) Productive Use of Rail Travel Time and the Valuation of Travel Time Savings for Rail Business Travellers. Final Report to the Department for Transport.

[15] Mackie, P. J., Wardman, M., Fowkes, A.S., Whelan, G.A., Nellthorp, J. and Bates, J. (2003) The Value of Travel Time Savings in the UK. Prepared for the Department for Transport.

[16] Wardman, M., Batley, R.P., Laird, J. J., Mackie, P.J., Fowkes, A.S., Lyons, G., Bates, J.J. and Eliasson, J. (2013) Valuation of Travel Time Savings for Business Travellers, Main Report, Prepared for the Department for Transport.

Appendix B

Survey locations

Contents

Table B1: Intercept locations for pilot SP and RP surveys

		No. of shifts	
		Wave 1	Wave 2
Rail			
London Long	Birmingham New Street		4
	Newcastle	3	3
Non London Long	Carlisle	2	3
	Birmingham New Street		2
Non London Short	Bristol Temple Meads 2	3	2
	Leeds	3	3
South East Outer	Wokingham		4
	Peterborough 2	2	2
South East Inner	Blackfriars	1	1
	Fenchurch Street		1
	Waterloo 3	3	3
'Other PT'			
Tram: Sheffield Supertram	Sheffield Station/Hallam University	2	2
	Castle Square 1	3	3
London Underground	Acton Town	2	2
	Victoria	2	2
	Bank	1	1
Light Rail: Tyne & Wear Metro	Monument		2
	Central	2	2
	Haymarket		1
Car			
Motorways	South West: M5 between Birmingham and Bristol 2	0	1
	South East: M40 Junction 8a Waterstock	1	1
	South East: M40 Junction 2, Beaconsfield 1	1	1
	South East: M40 Junction 10, Cherwell Valley	1	1
	West Midlands: M6 between J14 and J15	1	0
A Roads	North East: A1 between Darlington and Washington	1	1
	South East: A27 Worthing to Brighton – on street	1	1
	East: A1M J17 Peterborough	1	1

		No. of shifts	
		Wave 1	Wave 2
	East: A14 Cambridge	1	0
London Urban - Inner & Outer	Kingston Hams Cross	1	0
	Midway Service Station – on street	1	1
	Ilford – on street	1	1
Other Urban Congested	Great Barr (Sandwell)	0	1
	Hunts Cross (Liverpool) – on street	1	1
	A14 (M11) Cambridge	0	1
	Princess Parkway (Manchester) – on street	1	1
Other Urban Uncongested	Huntingdon, Cambridgeshire	0	1
	Pontefract (Wakefield) – on street	1	1
	Crompton Way (Oldham) – on street	1	1
Rural	Crosshands (Gloucestershire) – on street	1	1
	Knutsford (Cheshire) – on street	1	1
	New Romney (Kent) – on street	1	1
Bus			
London	Chiswick High Road	2	4
	Shepherds Bush	1	1
Metropolitan/PTE	Birmingham City Centre	1	2
	Newcastle City Centre	1	1
Large Urban Area	Bristol	1	2
	Leeds	1	0
County Town/Rural	Wokingham	1	1
	Bishop's Stortford	0	1
	Peterborough	1	0

Table B2: Intercept locations for car SP field survey (n.b. survey took place at both origin and destination)

Segment	Dist miles	Indicative journeys	AADF Data 2013[1]							Congestion[2]				Reliability[3]				Rationale
			Road	Direction	StartJn	EndJn	Dist miles	Motor vehicles	Decile	Local Authority	Direction	%	%ile	Link description		%	%ile	
I-Urban 30	26.1	Darlington to Chester-le-Street	A1(M)	N	LA Boundary	60/A689	4.5	22703	90	N/A				A1(M) J59 to 60	N	81	80th	Commute and business trips.
				S			4.5	21905	80					A1(M) J59 to 58	S	78	70th	
	20.1	Huntingdon to Cambridge	A14	E	A1096	A14	6.0	35614	90	Insufficient data				A14 btwn A1198 & A1096	E	79	70th	Good mix of trip purpose and journey length. Main West -East route between Birmingham and Felixstowe.
				W			6.0	34262	90					A14 btwn A1096 & A1198	W	80	70th	
	22.2	Bodmin to Launceston	A30	E	A30 spur to A38	A395	16.9	8766	50	Insufficient data				A30 btwn A395 & A388	E	71	30th	Other and business trips.
				W			16.9	9380	50					A30 btwn A388 & A395	W	66	10th	
		Chelmsford to Dagenham	A12	E	M25	A1023	4.5	34469	90	Essex	W	25.6	50th	A12 M25 & A1023	E	75	50th	Arterial route into London. Good mix of trip purpose and journey length.
				W				30383	90					A12 A1023 & M25	W	71	30th	
		Northampton to Watford	M1	N	8	9	4.4	78429	90	N/A				M1 J8 to 9	N	74	40th	Major north-south route into London. Good mix of trip purpose and journey length.
22.0				S	8	9		75971	90					M1 J9 to 8	S	73	40th	
I-Urban 60	49.6	Leeds-Manchester	M62	E	26	27	4.1	63503	90	N/A				M62 J26 to 27	E	61	0th	Good mix of journey length but on this section focussed on commute trips and business.
				W	26	27	4.1	63075	90					M62 J27 to 26	W	63	0th	
	47.5	Pboro to Stevenage	A1	N	A421 Chawston	A428/A1 Jn	1.4	26569	90	Insufficient data				A1(M) J14 to 15	N	87	90th	Good mix of trip purpose and journey length.
				S			1.4	25134	90					A1(M) J15 to 14	S	81	70th	
		Glasgow to Edinburgh	M8	E	2	1	4	31500	90	N/A				N/A				Commute and business.
				W	2	1	4	31631	90									
	43.1	Bristol to Cardiff via Toll Bridge	M4	E	29	28	2.1	52216	90	N/A				M4 J22 to 21	E	82	80th	Mixture of trip lengths and all purposes.
47.3				W	29	28	2.1	53111	90					M4 J21 to 22	W	81	80th	
Urban 15	5.5	Bham to W. Bromwich	A457	E	A4168	A4030	0.5	18232	80	Bham	E	12.4	0th	N/A				Busy urban route in WM; large commute flows.
				W			0.5	16918	80		W	14.9	10th					
	5.1	Stretford to Manchester	A56	N	A5014	A5081	1.1	13521	70	Manchester	N	11.6	0th	N/A				Busy urban route in GM; large commute flows.
				S			1.1	12579	70		S	13.0	10th					
	5.2	Middleton to Manchester	A664	N	A6010	A6104	2.3	8548	50	Manchester	N	17.5	20th	N/A				Busy urban route in GM; large commute flows.
				S			2.3	8382	50		S	14.3	10th					
Urban 30	15.6	Birmingham to Wolverhampton	M6	N	9	10	1.5	68614	90	Insufficient data				M6 J9 to J10	N	69	20th	Longer urban corridor in WM; all purposes. Good comparator against shorter trips in GM.
				S			1.5	57769	90					M6 J10 to J9	S	61	0th	
	13.2	Worthing to Brighton	A27	E	A2025	A283	1.6	26128	90	Insufficient data				A27 btwn A2025 & A283	E	66	10th	Business and commute.
				W			1.6	25308	90					A27 btwn A283 & A2025	W	64	0th	
	15.1	Manchester to Leigh	A580	E	A574	A572	3.3	14445	70	Salford	E	16.6	20th	N/A				Longer urban corridor in GM, good comparator against shorter trips in GM.
				W			3.3	14812	70		W	27.0	60th					
Rural 15	8.5	Spalding to Holbeach[5]	A151	E	A16(T)	A17	6.2	6631	30	Lincs	E	32.7	70th	N/A				Rural location, but with reasonable flow.
				W			6.2	6443	30		W	33.0	70th					
	5.9	Richmond to Catterick[5]	A6136	N	Catterick Rd	A1	1.9	3554	10	North Yorks	E	26.3	50th	N/A				Rural location but with reasonable flow.
				S			1.9	4173	20		W	24.5	50th					

Notes: 1. Average Annual Daily Flow Data 2013; 2. Congestion - Av.speeds (mph) in weekday peak on locally managed a roads. Annual average apr13-mar14; 3. Road congestion is measured by estimating the average speed achieved by vehicles during the weekday morning peak, from 7am to 10am. Average speeds are presented at national, regional and local highway authority level; 4. Reliability: Percentage of journeys on Highways Agency roads that are 'on time': Av. Jun13-may14. A roads on Strategic Network; 5. Due to low traffic volumes, only one end of journey will be surveyed in these cases.

Table B3: Intercept locations for 'other PT' SP field survey (n.b. survey took place at origin station)

Segment	Network	Indicative flows	Choice	Patronage[1]	Crowding[2]	Rationale
Tram	Manchester Metrolink	Ashton-Manchester Altrincham-Manchester Prestwich-Manchester Stretford-Manchester Bury-Manchester East Didsbury-Manchester	Tram vs. bus/rail Tram vs. bus/rail Tram vs. bus Tram vs. bus Tram vs. bus Tram vs. bus	29.2	36	Mode choice available. Business travel on some flows. Range of distances.
	Nottingham Express Transit	Hucknall-Nottingham Bulwell-Nottingham Beeston Centre-Nottingham Clifton South-Nottingham	Tram vs. bus/rail Tram vs. bus/rail Tram vs. bus/rail Tram vs. bus	7.9	32	Mode choice available. Range of distances.
	Sheffield Supertram	Meadowhall-Sheffield Halfway-Sheffield	Tram vs. bus/rail Tram vs. bus	12.6	37	Mode choice available. Range of distances
	Blackpool	Fleetwood-Blackpool	Tram vs. bus	4.3	22	Mode choice available.
	Midland Metro	West Bromwich Central-Birmingham Wolverhampton St. Georges-Birmingham	Tram vs. bus Tram vs. rail	4.7	30	Mode choice available.
UG	LU	Metropolitan Line (multiple stations) District Line (multiple stations) Other stations	UG vs. bus/rail UG vs. bus/rail UG vs. bus	1,229[3]	128.9[3]	Mode choice available. Business travel common. Metropolitan and District chosen for rail connection. Range of distances.
	Glasgow Subway	-	-	12.7	N/A	Scottish locations omitted.
Light Rail	Tyne and Wear Metro	Sunderland-Newcastle Gateshead-Newcastle Byker-Newcastle Four Lane Ends-Newcastle Regent Centre-Newcastle	Light rail vs. bus/rail Light rail vs. bus Light rail vs. bus Light rail vs. bus Light rail vs. bus	35.7	54	Mode choice available. Range of distances

Notes: 1. Passenger journeys (mill per year, 2013/14) on light rail/tram systems, table LRT0101, https://www.gov.uk/government/statistical-data-sets/lrt01-ocupancy-journeys-and-passenger-miles. No further disaggregation available; 2. Occupancy rates table LRT0108, https://www.gov.uk/government/statistical-data-sets/lrt01-ocupancy-journeys-and-passenger-miles. No further disaggregation available (2013/14); 3. Taken from Figure 3.3 Travel in London Report 6, 2014, https://www.tfl.gov.uk/corporate/publications-and-reports/travel-in-london-reports

Table B4: Intercept locations for bus SP field survey

Segment	Specific locations	Population (thousands)[10]	Patronage per head (annual, [1]	Punctuality (Frequent services)[2]	Punctuality (Non-frequent services)[3]	Crowding Occupancy Bus0304[4]	Rationale
England		53000	83	N/A	N/A	N/A	
London[5]		8170	279	N/A	83.0	20.3	
Central	Oxford St/Regent St	-	0.5 (per day)[6]	N/A	N/A	N/A	Inner/outer &
	Victoria	-	-				distance
Inner	Wood Green	-	0.5 (per day)				effects.
	Hackney	-	-				
	Harlesden	-	-				Range of
	Shepherd's Bush	-	-				socio-
Outer	Bromley	-	0.3 (per day)				demographics.
	Kingston	-	-				
	Hounslow	-	-				
	Ealing Broadway	-	-				
Metropolitan/PTE		-		N/A	80.6	10.4	
WMPTE	Birmingham City Centre	1085	100.1	1.2	74.0	N/A	Focussed on
SYPTE	Sheffield City Centre	551	78.5	2.0	79.0		English PTEs.
	Chapeltown[9]	-	-	-	-		
	Dore[9]	-	-	-	-		In case of
	Rotherham[9]	-	-	-	-		concessionary
WYPTE	Leeds City Centre	87 751	69.2	1.2	84.0		traffic, micro-
	Wakefield Kirkgate[9]	-	-	-	-		locations
	Horsforth/Holt Park[9]	-	-	-	-		identified in
	Crossgates[9]	-	-	-	-		consultation
T&W	Newcastle City Centre	282	111.4	0.8	87.0		with PTEG to
	Gateshead	-	-	-	-		ensure mode
	Byker	-	-	-	-		choice.
	Four Lane Ends	-	-	-	-		
Merseyside	Liverpool City Centre	465	94.3	1.3	81.0		
GMPTE	Manchester City Centre	510	77.6	0.6	83.0		
Freestanding Large Urban Areas			38	N/A	83.9	9.4[7]	
Nottingham	Nottingham City Centre	305	157.7	0.7	91.0	N/A	Broad user
Bristol	Bristol City Centre[9]	437	63.6	1.1	71.0		mix/good
Brighton	Brighton City Centre[9]	247	163.9	0.7	88.0		operators,
Derby	-	248	58.3	N/A	84.0		challenging
Leicester	Leicester City Centre	281	82.3	0.8	67.0		markets,
Southampton	Southampton City Centre	237	74.3	1.8	79.0		socio-
Stoke	-	249	50.8	N/A	81.0		economic mix,
Norwich[8]	-	351	33.1	N/A	84.0		quality of
Warrington	-	152	48.1	1.0	82.0		buses.

Segment	Specific locations	Population (thousands)[10]	Patronage per head (annual, [1]	Punctuality (Frequent services)[2]	Punctuality (Non-frequent services)[3]	Crowding Occupancy Bus0304[4]	Rationale
Oxford[8] Plymouth	- Plymouth City Centre	151 256	61.1 77.5	1.5 0.9	76.0 91.0		
Market Towns/Rural Hinterland			N/A	N/A	N/A	N/A	
Gloucester[8] Worcester[8] Lancaster[8] Shrewsbury[8] Canterbury[8] Wokingham[8] Peterborough[8]	- - Lancaster Town Centre - Canterbury Town Centre - Peterborough Town Centre	118 99 138 70 150 156 186	34.7 27.2 45.1 19.8 40.7 14.0 56.3	1.3 1.0 0.7 0.7 N/A 1.4 1.5	96.0 75.0 86.0 83.0 95.0 72.0 73.0	N/A	'Typical' market town with good hinterland and range of congestion

Notes:

1. Based on figures for 2012-13 taken from table Bus0110 on Local Bus Passenger Journeys found at https://www.gov.uk/government/collections/bus-statistics. Disaggregated London figures taken from TFLs LTDS workbook excel sheet and reported as per day.
2. Punctuality figures for frequent services, based on average excess wait times from 2012-13 (or most recent figures available), taken from table Bus0903 on Frequency and Waiting Times found at https://www.gov.uk/government/collections/bus-statistics
3. Punctuality figures for non-frequent services, based on %age buses running on time, 2012-13 (or most recent figures available).
4. Crowding figures only available at level of London, English Metropolitan and Non-Metropolitan areas, Scotland and Wales. Taken from Bus0304 on Passenger Distance Travelled found at https://www.gov.uk/government/collections/bus-statistics. Calculated as average bus occupancy from passenger miles divided by vehicle miles.
5. TfL website suggests punctuality by borough exist but did not appear available at time of compilation.
6. Daily trip rates for bus /tram from TFL's LTDS workbook excel sheet, *https://www.tfl.gov.uk/cdn/static/cms/documents/ltds-workbook-2013.xlsx*
7. Non metropolitan areas outside London.
8. Only available at the county level.
9. Location for bus concessionary survey.
10. Based on latest available census data on local authority website.

Table B5: Intercept locations for rail SP field survey (n.b. survey took place at origin station)

	Indicative flows			Reliability						Crowding[4]				Rationale
Segment	**From**	**To**	**Daily return pass**	**Operator**	**Sector**	**Sub-operator**	**PPM %[1]**	**RT%[2]**	**CaSL%[3]**	**Station Measured**	**Num. services**	**PiXC[5]**	**Passengers standing**	
London Long	Birmingham NS	London	1376	Virgin Trains	Long Distance	London- West Mids	89%	50%	2%	Birmingham	180	0%	7%	Operator choice. complements RP. Business travel common.
				London Midland	London & SE	LSE	86%	58%	3%	Euston	61	1%	12%	
	Salisbury	London	981	South Western	London & SE	Mainline	89%	67%	3%	Waterloo	148	5%	28%	Long distance London commute.
	Leeds	London	954	East Coast	Long Distance	London-Leeds & NE	91%	66%	2%	Leeds	113	2%	13%	Generally business and leisure. Range of distances within PDFH flow types.
										Kings Cross	48	0%	2%	
	Norwich	London	900	Greater Anglia	Long Distance	Intercity	80%	31%	6%	Liverpool St	159	4%	14%	
	Nottingham	London	821	East Midlands	Long Distance	Long Distance	92%	59%	2%	Nottingham	34	0%	3%	
										St. Pancras	67	2%	9%	
	Newcastle	London	697	East Coast	Long Distance	London-Leeds & NE	91%	66%	2%	Newcastle	33	0%	2%	
										Kings Cross	48	0%	2%	
	Stoke	London	171	London Midland	London & SE	LSE	86%	58%	3%	Euston	61	1%	12%	Operator choice. complements RP.
				Virgin Trains	Long Distance	London- West Mids	89%	50%	2%					
Non-London Long	Newcastle	Birmingham	67	CrossCountry	Long Distance		87%	45%	4%	Newcastle	33	0%	2%	Non-London business and leisure. Range of flow types
										Birmingham	180	0%	7%	
	Leeds	Birmingham	91	CrossCountry	Long Distance		87%	45%	4%	Leeds	113	2%	13%	
										Birmingham	180	0%	7%	
	Birmingham	Liverpool BR	110	London Midland	Regional		91%	67%	2%	Birmingham	180	0%		
										Liverpool	126	0% 7%	4%	
	Cardiff Cent.	Birmingham	64	CrossCountry	Long Distance		87%	45%	4%	Cardiff	114	1%	7%	
										Birmingham	180	0%	7%	
	Edinburgh	Glasgow	1988	FirstScotRail	Scotland	Express	91%	64%	2%	NA				

Non London Short	Bristol TM	Bath Spa	847	First Great Western	Regional	West	90%	75%	3%	Bristol	52	1%	6%	Non-London urban, mainly commute and leisure. Range of flow types suggested.
	Longbridge	Birmingham	1338	London Midland	Regional	Regional	91%	67%	2%	Birmingham	180	0%	7%	
	Bridgend	Cardiff Central	406	Arriva Wales	Regional	Regional	91%	77%	2%	Cardiff	114	1%	7%	
	Leeds	Bradford	890	Northern Rail	Regional	West & North Yorks	92%	77%	2%	Leeds	113	2%	13%	
	Bolton	Manchester	957	First Transpennine	Long Distance	South Transpennine	89%	69%	6%	Manchester	176	2%	11%	
	Lowestoft	Norwich	172	Greater Anglia	London & SE	GE Outer	87%	64%	3%	NA				
SE Outer	Sidcup	London	6643	Southeastern	London & SE	Mainline & high speed	92%	68%	2%	St. Pancras	67	2%	9%	SE Outer. Range of distances within PDFH flow types.
	Chelmsford	London	5245	Greater Anglia	Long Distance	Intercity	80%	31%	6%	Liverpool St	159	4%	14%	
	Brighton	London	4131	Southeastern	London & SE	Mainline & high speed	92%	68%	2%	Victoria	128	5%	20%	
	Epsom	London	4089	Southern	London & SE	Sussex coast	90%	61%	3%	Victoria	128	5%	20%	
				South Western	London & SE	Mainline	89%	67%	3%	Waterloo	148	5%	28%	
	Peterborough	London	1537	East Coast FCC	Long Distance London & SE	London-Leeds & NE Great Northern	91% 92%	66% 70%	2% 2%	Kings Cross	48	0%	2%	
	Liverpool St.	Chingford Enfield Town	3877 3032	Greater Anglia	London & SE	GE Outer	87%	64%	3%	Liverpool St	159	4%	14%	
	Rugby	London		Virgin Trains London Midland	Long Distance London & SE	London- West Midlands LSE	89% 86%	50% 58%	2% 3%	Euston	61	1%	12%	Operator Choice complements RP.
SE Inner	London Bridge	Hayes[6]	1305	Southeastern	London & SE	Mainline & high speed	92%	68%	2%	London Brg	209	3%	23%	SE Inner. Range of distances within PDFH flow types.
	Waterloo	Hampton Court Chessington South	NA 815	South Western	London & SE	Mainline	89%	67%	3%	Waterloo	148	5%	28%	
	Charing Cross	Hayes[6]	1305	Southeastern	London & SE	Mainline & high speed	92%	68%	2%	Waterloo	148	5%	28%	

Notes:
1. The public performance measure (PPM) shows the percentage of trains which arrive at their terminating station on time.
2. Right-time performance measures the percentage of trains arriving at their terminating station early or within 59 seconds of schedule.
3. Cancellation and significant lateness (CaSL).
A train is counted as being significantly late if it arrives at its terminating station 30 minutes or more late.
A train is counted as being cancelled if: it is cancelled at origin; it is cancelled en route; the originating station is changed; it is diverted.
4. AM peak arrivals (07:00-09:59).
5. Passengers in excess of capacity.
6. Includes to all London stations.

Table B6: Intercept locations for rail RP field survey (n.b. survey took place at origin and intermediate stations)

Indicative flows			Specific stations to be surveyed	Reliability						Crowding[4]				Rationale
From	To	Daily return pass		Operator	Sector	Sub-operator	PPM%[1]	RT%[2]	CaSL%[3]	Station Measured	Num. services	PiXC[5]	Passengers standing	
Birmingham	London	1376	Brum New St. Brum Moor Street Brum Snow Hill	Virgin Trains	Long Distance	London- West Mids	89%	50%	2%	Birmingham	180	0%	7%	3-way operator choice. Business travellers do choose Chiltern cheaper option
				London Midland	London & SE	LSE	86%	58%	3%	Euston	61	1%	12%	
				Chiltern	London & SE	London-Bham/Oxford	95%	85%	1%					
Stoke	London	171	Stoke Stafford Rugby	London Midland	London & SE	LSE	86%	58%	3%	Euston	61	1%	12%	2-way operator choice. Range of time-cost trade-offs as move towards London
				Virgin Trains	Long Distance	London- West Mids	89%	50%	2%					
Peterborough	London	1537	Peterborough	East Coast FCC	Long Distance London & SE	London-Leeds & NE Great Northern	91% 92%	66% 70%	2% 2%	Kings Cross	48	0%	2%	2-way operator choice. Important for commuting.

Notes:
1. The public performance measure (PPM) shows the percentage of trains which arrive at their terminating station on time.
2. Right-time performance measures the percentage of trains arriving at their terminating station early or within 59 seconds of schedule.
3. Cancellation and significant lateness (CaSL).
A train is counted as being significantly late if it arrives at its terminating station 30 minutes or more late.
A train is counted as being cancelled if: it is cancelled at origin; it is cancelled en route; the originating station is changed; it is diverted.
4. AM peak arrivals (07:00-09:59).
5. Passengers in excess of capacity.

Appendix C

Additional market research results

Contents

C1 Introduction

Following from **Chapter 3**, this appendix sets out further market research findings from the following survey elements:

- General public SP commute and non-work
- Employees' and employers' business SP
- RP

C2 General public SP commute and non-work

C2.1 Respondent characteristics

Employment status

Forty five per cent of other non-work travellers were employed and 19% were students. 92% of commuters were employed and 5% were students.

Table C1: Employment status by purpose

	Commute %	Other non-work %
Full time paid employment	70	26
Part time paid employment	16	13
Full time self-employment	5	4
Part time self-employment	1	2
Student	5	19
Waiting to take up a job		2
Unemployed		5
Unable to work		2
Retired		20
Looking after home/family		6
Other		2
Sample size	**2,997**	**3,352**

A third of the other non-work car sample was retired, as compared to 17% of train, 18% of bus and just 3% of the 'other PT'.

Table C2: Employment status by mode and purpose

	Car		Train		Bus		'Other PT'	
	Com-mute %	Other non-work %	Com-mute %	Other non-work %	Com-mute %	Other non-work %	Com-mute %	Other non-work %
Full time paid employment	71	29	71	29	62	17	70	28
Part time paid employment	17	13	11	12	24	14	16	13

	Car		Train		Bus		'Other PT'	
	Com-mute %	Other non-work %	Com-mute %	Other non-work %	Com-mute %	Other non-work %	Com-mute %	Other non-work %
Full time self-employment	7	6	6	3	1	1	4	4
Part time self-employment	2	3	2	3	*	2	1	1
Student	*	2	7	27	8	25	7	30
Waiting to take up a job		1		2		1		3
Unemployed		2		3		9		7
Unable to work		2		*		4		2
Retired		33		17		18		3
Looking after home/family		7		3		7		7
Other	3	3	3	1	5	2	2	1
Sample size	**1,025**	**1,030**	**993**	**1,113**	**367**	**668**	**611**	**535**

* = less than 0.5%

C2.2 Trip characteristics

Leg of trip

54% of the commuter sample and 52% of the other non-work sample were on the outward leg of the trip, 41% of the commuter sample and 42% of the other non-work sample were on the return leg of the trip, and 5% of the commuter sample and 7% of the other non-work sample were on single leg trips only.

There was little difference in the leg of the trip for the car and train samples. The bus and 'other PT' commute samples were more likely to be on the outward leg of the trip than the other non-work samples:

- Bus: 58% commuter and 45% other non-work on outward leg
- 'Other PT': 64% commuter and 57% other non-work on outward leg.

Table C3: Trip leg by mode and purpose

	Car		Train		Bus		'Other PT'	
	Com-mute %	Other non-work %	Com-mute %	Other non-work %	Com-mute %	Other non-work %	Com-mute %	Other non-work %
Outward	51	51	51	53	58	45	64	57
Return	45	46	46	40	34	45	31	34
Single trip only	4	3	3	7	8	10	6	9
Sample size	**1,025**	**1,030**	**993**	**1,113**	**367**	**668**	**611**	**535**

Day of week

The intercept sample (which represented 89% of the general public SP sample) was recruited on weekdays whereas the telephone sample was recruited both on weekdays and weekends. Therefore, the great majority of trips were made on weekdays: 96% commute and 90% other non-work. The distribution by day of week is shown in **Table C4**.

Table C4: Day of week by purpose

	Commute %	Other non-work %
Monday	22	15
Tuesday	18	18
Wednesday	23	21
Thursday	19	19
Friday	15	16
Saturday	3	8
Sunday	1	2
Sample size	**2,997**	**3,352**

Time of day of trip

Commuters and other non-work travellers were asked at what time they started their trip and at what time they reached their destination. The times have been banded in the tables below. Travellers could be in the outward or return leg of their trip.

57% of commuters start their trips and 54% end their trips in the peak (defined as between 07:00-09:29 and 16:30-19:29). For the other non-work sample, 69% both start and finish in the interpeak (09:30-16:29).

Table C5: Time started and reached destination by purpose

Time started	Commute %	Other non-work %
0:00 to 6.59	9	3
7:00 to 09:29	40	19
09:30 to 16:29	33	69
16:30 to 19:29	17	8
19:30 to 24:00	1	1
Time reached destination		
0:00 to 6.59	3	1
7:00 to 09:29	31	6
09:30 to 16:29	38	69
16:30 to 19:29	23	18
19:30 to 24:00	5	6
Sample size	**2,997**	**3,352**

The time started for commute and other non-work was compared to the NTS data for these purposes for weekdays for England[1]. It should be noted that the NTS data is for all modes including walk, cycle, taxi and coach.

Table C6: Time started by purpose: SP compared to the NTS

	Commute		Other non-work	
	SP %	NTS %	SP %	NTS %
0:00 to 6.59	9	11	3	1
7:00 to 09:29	40	32	19	17
09:30 to 16:29	33	23	69	54
16:30 to 19:29	17	28	8	18
19:30 to 24:00	1	6	1	9

The SP commute sample has larger proportions starting the trip in the morning peak than the NTS. Both the SP commute and other non-work samples have larger proportions starting the trip in the inter-peak and smaller proportions starting in the afternoon peak and after 19:30. The differences will be largely driven by to the intercept recruitment hours which were between 07:00 and 19:00.

'Other PT' commuters were most likely to start their trips during the peak and car commuters least likely: 60% 'other PT', 57% bus and train compared to 54% car.

Table C7: Reported time started and reached destination by mode and purpose

	Car		Train		Bus		'Other PT'	
Time started	**Com-mute %**	**Other non-work %**	**Com-mute %**	**Other non-work %**	**Com-mute %**	**Other non-work %**	**Com-mute %**	**Other non-work %**
0:00 to 6.59	11	3	9	3	8	2	7	2
7:00 to 09:29	37	15	36	22	44	18	49	22
09:30 to 16:29	34	74	33	63	33	73	32	67
16:30 to 19:29	17	8	21	11	13	6	11	7
19:30 to 24:00	2	1	1	2	1	1	*	1
Time reached destination								
0:00 to 6.59	6	1	1	1	2	1	1	1
7:00 to 09:29	30	4	25	5	37	10	43	10
09:30 to 16:29	36	72	38	63	40	74	38	72
16:30 to 19:29	24	16	29	23	19	12	15	17
19:30 to 24:00	5	6	8	8	2	3	3	1
Sample size	**1,025**	**1,030**	**993**	**1,113**	**367**	**668**	**611**	**535**

* = less than 0.5%

[1] Table NTS0503: Trip purpose by trip start time (Monday to Friday only): England, 2009/13

Day trip

90% of commuters and 78% of other non-workers trips were on day trips.

Table C8: Nights away by purpose

	Commute %	Other non-work %
Day trip	90	78
1 night away	4	7
2 nights away	2	6
3 nights away	1	4
4-7 nights away	2	4
8+ nights away	*	*
Sample size	**2,997**	**3,352**

* = less than 0.5%

The bus and 'other PT' commuters were most likely to be on day trips: 94% bus and 96% 'other PT' compared to 89% for car and 86% for rail.

The rail and car other non-work samples were most likely to spend one or more nights away: 35% and 24% compared to 7% for bus and 'other PT'.

Table C9: Nights away by mode and purpose

	Car		Train		Bus		'Other PT'	
	Com-mute %	Other non-work %	Com-mute %	Other non-work %	Com-mute %	Other non-work %	Com-mute %	Other non-work %
Day trip	89	76	86	65	94	93	96	93
1 night away	4	7	5	11	2	2	2	4
2 nights away	2	7	3	9	1	2	1	2
3 nights away	2	5	2	6	1	1	*	2
4-7 nights away	2	4	3	8	1	1	*	2
8+ nights away	*	1	*	1	*	*	*	*
Sample size	**1,025**	**1,030**	**993**	**1,113**	**367**	**668**	**611**	**535**

* = less than 0.5%

C2.3 PT-specific results

Access and egress

Access and egress modes were dominated by walk particularly for bus:

- 91% of bus users walked to the bus stop and 92-93% of bus users used walk as their egress mode
- Around two thirds of 'other PT' walked to the stop/station and over three quarters used walk as their egress mode (86% commute, 78% other non-work)

- 54% of rail commuters and 44% of rail other non-work walked to the rail station and 64% of rail commuters and 50% of rail other non-work used walk as their egress mode.

Bus was used as the access mode by about a sixth of train and 'other PT' users, and car (driven or given a lift) was used by about a fifth of train and a tenth of 'other PT' users. See **Table C10**.

Table C10: Access and egress modes by mode and purpose

	Train		**Bus**		**'Other PT'**	
Access mode	**Commute %**	**Other non-work %**	**Commute %**	**Other non-work %**	**Commute %**	**Other non-work %**
Walk	54	44	91	91	68	66
Cycle	3	1	0	*	0	*
Taxi	6	7	0	*	*	1
Drove Car	11	10	*	1	7	10
Lift	7	12	1	1	4	4
Bus	12	16	4	4	16	15
Other	8	9	3	1	5	5
Egress mode						
Walk	64	50	93	92	86	78
Cycle	3	1	*		*	*
Taxi	4	7	*	*	*	*
Drove Car	5	7	1	1	2	3
Lift	2	8	1	1	2	1
Bus	8	10	3	4	8	11
Other	15	18	1	2	2	7
Sample size	**993**	**1,113**	**367**	**668**	**611**	**535**

* = less than 0.5%

The mean access and egress times are shown in **Table C11**. Bus users had the shortest access times and train users the longest access times.

Table C11: Mean access and egress times

	Train		**Bus**		**'Other PT'**	
	Commute %	**Other non-work %**	**Commute %**	**Other non-work %**	**Commute %**	**Other non-work %**
Access	18	23	10	10	15	17
Egress	25	32	17	17	16	24
Sample size	**993**	**1,113**	**367**	**668**	**611**	**535**

Frequency

The frequency of the service at the time it was caught was probed.

The median train frequency was every 30 minutes for both commuters and other non-work travellers.

The median bus and 'other PT' frequency was every 10 minutes for both commuters and other non-work travellers.

For about a third of 'other PT' users, the frequency was every five minutes or more frequent.

Table C12: Frequency of service at time caught

	Train		Bus		'Other PT'	
Access mode	**Com-mute %**	**Other non-work %**	**Com-mute %**	**Other non-work %**	**Com-mute %**	**Other non-work %**
More frequent than every 5 minutes			5	3	20	18
Every 5 minutes			6	6	13	16
Every 7/8 minutes			10	10	23	17
Every 10 minutes	10	8	25	29	27	30
Every 15 minutes	19	13	18	15	10	10
Every 20 minutes	18	15	12	11	3	2
Every 30 minutes	31	27	13	10	*	1
Every hour	12	14	7	9	0	0
Every two hours	*	1	0	1	0	0
Less frequent than every two hours	1	1	*	0	0	0
Don't know	10	23	4	5	3	8
Sample size	**993**	**1,113**	**367**	**668**	**611**	**535**

* = less than 0.5%

Wait time

The mean wait time to board the service was 10 minutes for commuters and 13 minutes for other non-work travellers. Mean wait times were shortest for 'other PT' users and longest for train other non-work users:

- Train Commute 13 minutes
- Train Other non-work 17 minutes
- Bus Commute 12 minutes
- Bus Other non-work 11 minutes
- 'Other PT' Commute 7 minutes
- 'Other PT' Other non-work 7 minutes.

Interchange

Between about a third and a quarter of public transport users' trips involved one or more interchanges.

The highest proportion of interchanges was made by the train other non-work sample: 31% made one or more interchanges.

The lowest proportion of interchanges was made by the ‘other PT’ and bus other non-work samples: 24% and 25% respectively made one or more interchanges.

Table C13: Interchange by mode and purpose

Access mode	Train		Bus		‘Other PT’	
	Com-mute %	Other non-work %	Com-mute %	Other non-work %	Com-mute %	Other non-work %
Yes, one interchange	19	22	28	21	23	19
Yes, two interchanges	6	7	4	3	3	3
Yes, three or more interchanges	1	1	2	1	*	1
No	74	69	67	75	73	76
Sample size	**993**	**1,113**	**367**	**668**	**611**	**535**

* = less than 0.5%

Single / multi-mode

Bus and ‘other PT’ users were asked whether the mode they were being asked about was the only means of travel or was part of longer trip.

Nearly two thirds (65%) of commuters and 70% of the other non-work sample said it was their only means of travel.

The bus sample was much more likely than the ‘other PT’ sample to only use one mode for their trip.

Table C14: Whether only means of travel or part of longer trip

	Bus	Bus	‘Other PT’	‘Other PT’
	Commute %	Other non-work %	Commute %	Other non-work %
Only means of travel	81	84	55	54
As part of longer trip	19	16	45	46
Sample size	**367**	**668**	**611**	**535**

The NTS shows mean number of stages (i.e. two stages could be two buses or a bus and a tram). By assuming that part of a longer trip is 2.5 stages, we can calculate average number of stages for the SP data. This shows a reasonable match with the NTS as shown below:

- Bus commute mean stages: 1.28 for SP, 1.16 for the NTS
- Bus other non-work mean stages: 1.24 for SP, 1.11 for the NTS
- ‘Other PT’ commute mean stages: 1.68 for SP, 1.66 for the NTS
- ‘Other PT’ other non-work mean stages: 1.69 for SP, 1.53 for the NTS.

C3 Employees' and employers' business SP

C3.1 Business characteristics

Region

The distribution of businesses for the employers business by region is shown in **Table C15**. Quotas were set for region – which were broadly met[2].

Table C15: Region

	%
North East	6
North West	9
Yorkshire and the Humber	10
East Midlands	6
West Midlands	7
East of England	6
London	21
South East	13
South West	13
Sample size	**400**

Type of organisation

The type of organisation for the samples of businesses and employees is shown in **Table C16**.

The employer sample had a higher proportion of limited companies and smaller proportions of public sector organisations and Public Limited Companies than the employee sample.

Table C16: Type of Organisation

	Employees %	**Employers %**
Sole trader	8	3
Partnership	6	4
Limited company	43	66
Public Limited Company	15	8
Charitable organisation	6	8
Public Sector organisation	17	8
Other	5	4
Sample size	**1,486**	**400**

The industry area for the samples of businesses and employees is shown in **Table C17.** The employer sample had higher proportions in the Other Service Activities, Manufacturing and Human Health and Social Work Activities industry

[2] North East was 1% higher and South East 3% lower than target

areas and smaller proportions in the Financial and Insurance Activities, Professional, Scientific and Technical Activities and Information and Communication industry areas than the employee sample.

Table C17: Industry area

	Employees %	Employers %
Agriculture, Forestry and Fishing	1	2
Mining and Quarrying; Electricity, Gas and Air Conditioning Supply; Water Supply; Sewerage, Waste Management and Remedial	*	3
Manufacturing	5	12
Construction	7	6
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	4	6
Transportation and Storage	5	4
Accommodation and Food Service Activities	1	3
Information and Communication		6
Financial and Insurance Activities	9	5
Real Estate Activities	2	6
Professional, Scientific and Technical Activities	9	4
Administrative and Support Service Activities	2	3
Education	7	6
Human Health and Social Work Activities	7	11
Arts, Entertainment and Recreation	4	4
Other Service Activities	3	22
Electricity, gas, steam and air conditioning supply	2	n/a
Water supply; sewerage, waste management and remediation activities	1	n/a
Public administration and defence; compulsory social security	4	n/a
Information and communication	8	n/a
Other	18	n/a
Sample size	**2,160**	**400**

Sites

The employers sample was asked how many sites their organisation works from.

Nearly two thirds (63%) operated from multiple sites:

- Single site 37%
- Multiple sites in UK 44%
- Single site in UK but other sites abroad 4%
- Multiple sites in UK and other sites abroad 15%

C3.2 Employee characteristics

Age and gender

The age and gender for the employees sample by mode are shown in **Table C18**and **Table C19** respectively.

The median age range for the three modes was 40-49 years old.

Table C18: Age by mode

	Car %	Train %	'Other PT' %
17-20	*	1	1
21-29	9	15	22
30-39	22	24	21
40-49	32	29	31
50-59	27	23	17
60-69	9	7	6
70+	1	1	1
Sample size	**948**	**1,004**	**242**

* = less than 0.5%

The car sample was more likely to be male than the train and 'other PT' samples.

Table C19: Gender by mode

	Car %	Train %	'Other PT' %
Male	77	59	61
Female	22	41	39
Sample size	**948**	**1,004**	**242**

C3.3 Trip characteristics

Group size

For the employer survey, car travellers were more likely to travel alone than in the employee survey: 84% compared to 78%. There was little difference in group size for train.

Table C20: Group size

	Employees		Employers	
	Car %	Train %	Car %	Train %
None	84	80	78	80
1 other adult	13	14	16	13
2 or more other adults	3	6	6	6
Sample size	**948**	**1,004**	**244**	**143**

Leg of trip

For the employer survey, the leg of the trip was randomly assigned. In practice, 53% were outward and 47% return. For the employee survey, 59% were on the outward leg, 38% on the return leg and 3% on a single leg trip.

Class of rail travel

The class of travel for rail was similar for both surveys:

- 12% First Class for employees survey
- 11% First Class for employers survey

C3.4 Travel policy

Monitoring of company travel policy

Employers were asked whether the company audits or monitors whether company travel policy on the following was adhered to on:

- Mileage claims
- Class of travel
- Overnight stays
- How staff use their time on business trips
- Whether staff work while travelling

Almost all (89%) said they audited or monitored mileage claims, with 61% saying this was done strictly. Class of travel and overnight stays were also audited or monitored by at least four-fifths of companies. Use of travel time and whether employees work while travelling was much less likely to be audited or monitored. See **Table C21**.

Table C21: Whether company travel policy audited or monitored (row percents)

	Yes, strictly	Yes, partially	No	Don't know
Mileage claims	61%	28%	6%	1%
Class of travel	51%	31%	13%	3%
Overnight stays	49%	33%	12%	1%
How staff use their time on business trips	25%	33%	37%	2%
Whether staff work while travelling	18%	30%	44%	4%

C4 RP market research results

C4.1 Respondent characteristics

Employment status

63% of other non-work travellers were employed and 11% were students. 17% of the other non-work sample was retired.

85% of commuters were employed and 12% were students.

9% of those on employees' business were self-employed.

Table C22: Employment status by purpose (RP compared to SP)

	Employees' business		Commute		Other non-work	
	RP %	SP %	RP %	SP %	RP %	SP %
Full time paid employment	81	82	70	82	38	34
Part time paid employment	7	3	4	3	13	10
Full time self-employment	7	8	9	4	8	2
Part time self-employment	2	5	2	3	4	3
Student	1	1	12	4	11	21
Waiting to take up a job	1	1	*	2	1	2
Unemployed	*	0	*	0	3	0
Unable to work	0	0	0	0	2	0
Retired	*	1	1	0	17	22
Looking after home/family	*	0	*	0	2	4
Other	1	0	1	2	2	1
Sample size	**1,311**	**167**	**451**	**99**	**884**	**145**

* = less than 0.5%

There was little difference between the RP and SP samples for employees' business. For commute, the SP sample has a significantly higher proportion in full time employment than the RP sample. For other non-work, there were significantly more students in the SP sample than in the RP sample. All other differences were not statistically significant.

C4.2 Trip characteristics

Leg of trip

There was little difference between the three purpose samples with about two-thirds on the outward leg and three-tenths on the return leg of the rail trip.

Table C23: Trip leg by purpose (RP compared to SP)

	Employees' business		Commute		Other non-work	
	RP %	SP %	RP %	SP %	RP %	SP %
Outward	67	65	69	64	68	64
Return	30	32	29	35	27	32
Single trip only	3	3	2	1	5	4
Sample size	**1,311**	**167**	**451**	**99**	**884**	**145**

There were no statistically significant differences between the RP and SP samples with respect to leg of trip.

Ticket type

Half the other non-work sample, four-tenths of the employees' business sample and a quarter of the commuter sample held Advance tickets.

Relatively small proportions held full price day tickets: 25% employees' business, 20% commuters and 8% other non-work

29% of rail commuters held season tickets.

Table C24: Ticket type by purpose (RP compared to SP)

	Employees' business		Commute		Other non-work	
	RP %	SP %	RP %	SP %	RP %	SP %
Season	2	2	29	19	1	1
Anytime Ticket	25	16	20	21	8	12
Off-peak Ticket	29	27	22	25	36	41
Advance	41	53	26	23	51	41
Other	3	2	3	11	5	4
Sample size	**1,311**	**167**	**451**	**99**	**884**	**145**

For employees' business, there was a significantly higher proportion with Anytime tickets and a lower proportion with Advance tickets in the RP sample than in the SP sample. 9% more in the RP sample than the SP sample started their trip before 09:30, which correlates with a larger proportion of Anytime tickets.

For commute, there was a significantly higher proportion with season tickets and a lower proportion with other tickets in the RP sample than in the SP sample.

For other non-work, there was a significantly higher proportion with Advance tickets in the SP sample than in the RP sample.

The proportion of First Class tickets was 15% for employees' business, 10% for other non-work and 7% for commuters.

Time of day of trip

Respondents were asked at what time they started their trip, and the time they reached their destination. The times have been banded in the tables below.

54% of commuters start their trips and 34% end their trips in the peak (defined as between 07:00-09:29 and 16:30-19:29). 41% of the employees' business sample start their trips and 29% end their trips in the peak.

For the other non-work sample, 61% both start and 57% finish in the interpeak (09:30-16:29).

Table C25: Time started and reached destination by purpose (RP compared to SP)

Time started	Employees' business		Commute		Other non-work	
	RP %	SP %	RP %	SP %	RP %	SP %
0:00 to 6.59	12	8	16	11	5	1
7:00 to 09:29	36	31	43	36	25	28
09:30 to 16:29	44	53	29	40	61	59
16:30 to 19:29	7	8	11	11	7	10
19:30 to 24:00	*	0	*	1	2	1
Time reached destination						
0:00 to 6.59	5	0	5	0	11	1
7:00 to 09:29	8	5	20	14	2	2
09:30 to 16:29	57	61	50	54	57	63
16:30 to 19:29	21	20	14	19	20	22
19:30 to 24:00	9	14	11	13	10	12
Sample size	**1,311**	**167**	**451**	**99**	**884**	**145**

* = less than 0.5%

For both the employees' business and commute, there were significantly higher proportions in the SP samples who started their trip in the inter-peak than in the RP samples. For employees' business there was also a significantly higher proportion in the SP sample than in the RP sample who reached their destination after 19:30.

For other non-work, there were no statistically significant differences between the two samples.

Frequency of trip

As would be expected, the commuter sample made the trip much more frequently than the other samples. However, there are fairly large proportions of infrequent trips made by commuters. Some of these may be genuine infrequent commuters or users of a replacement mode, but some may also be misreporting either purpose or frequency.

Table C26: Frequency of trip by purpose (RP compared to SP)

	Employees' business		Commute		Other non-work	
	RP %	SP %	RP %	SP %	RP %	SP %
5+times a week	*	0	21	18	*	1
3-4 times a week	2	2	16	9	1	1
1-2 times a week	11	8	24	25	5	5
1-3 times a month	31	23	18	19	22	17
Less than once a month	38	42	15	23	55	49
First time	17	25	7	5	18	26
Sample size	**1,311**	**167**	**451**	**99**	**884**	**145**

* = less than 0.5%

For employees' business, there was a significantly higher proportion in the SP sample than in the RP sample who were making the trip for the first time and a significantly lower proportion in the SP sample than in the RP sample who made the trip 1-3 times a month.

For commute, there was a significantly higher proportion in the SP sample than in the RP sample who made the trip less than once a month.

For other non-work, there was a significantly higher proportion in the SP sample than in the RP sample who were making the trip for the first time.

Access and egress

The access mode was dominated by car: 46% employees' business, 43% commuter and 40% other non-work used a car (parked or driven away) to get to the station.

Table C27: Access and egress modes by purpose

Access mode	**Employees' business %**	**Commute %**	**Other non-work %**
Bus	4	7	12
Another train	14	14	18
Tram	*	*	*
Underground	3	3	2
Car (parked)	34	31	19
Car (driven away)	12	12	21
Walked all the way	19	20	15
Cycled	*	2	*
Taxi or minicab	12	10	9
Other	1	1	2
Egress mode			
Bus	3	5	6
Another train	17	12	15
Tram	*	0	*
Underground	58	54	56
Car (parked)	*	1	*
Car (driven away)	*	1	1
Walked all the way	13	19	12
Cycled	*	1	1
Taxi or minicab	7	4	6
Other	2	2	2
Sample size	**1,311**	**451**	**884**

* = less than 0.5%

Around a fifth of the employees' business and commuter samples walked to the station.

About a tenth of all there samples used a taxi or minicab to access the station.

As the destination for all respondents was a London terminal station, the egress mode was dominated by London Underground: 58% employees' business, 54% commuter and 56% other non-work.

The SP questionnaire did not include 'another train', 'tram' and 'Underground' as answer codes for access and egress modes so these questions are not directly comparable.

C4.3 Trip planning

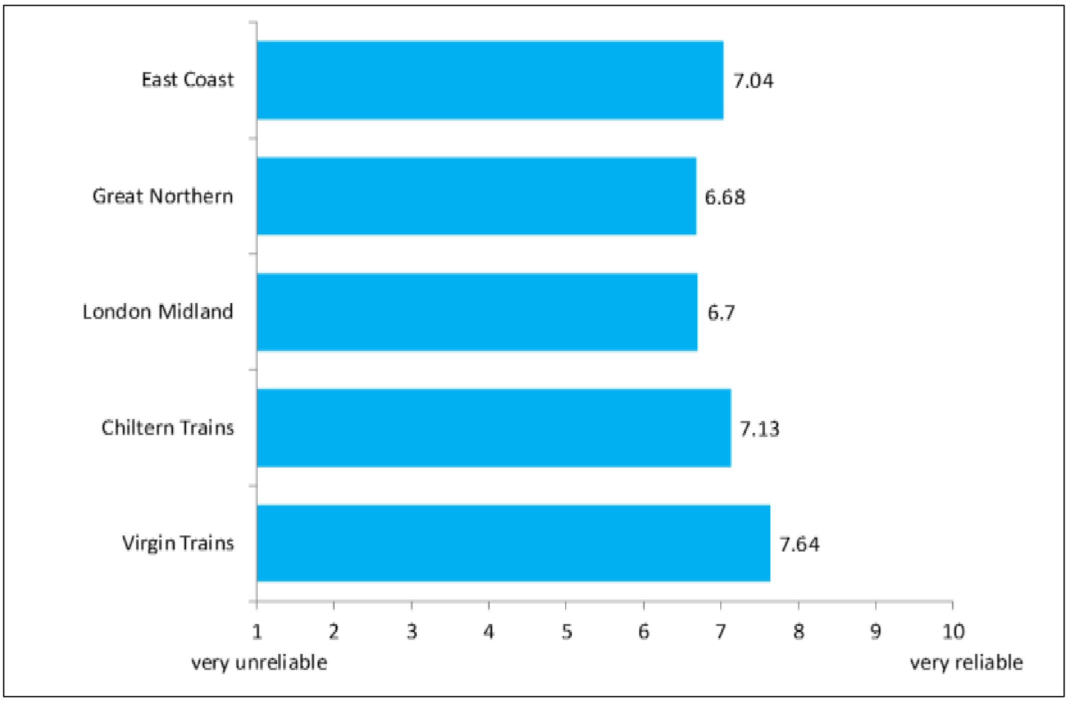
Perceived quality of competing operators

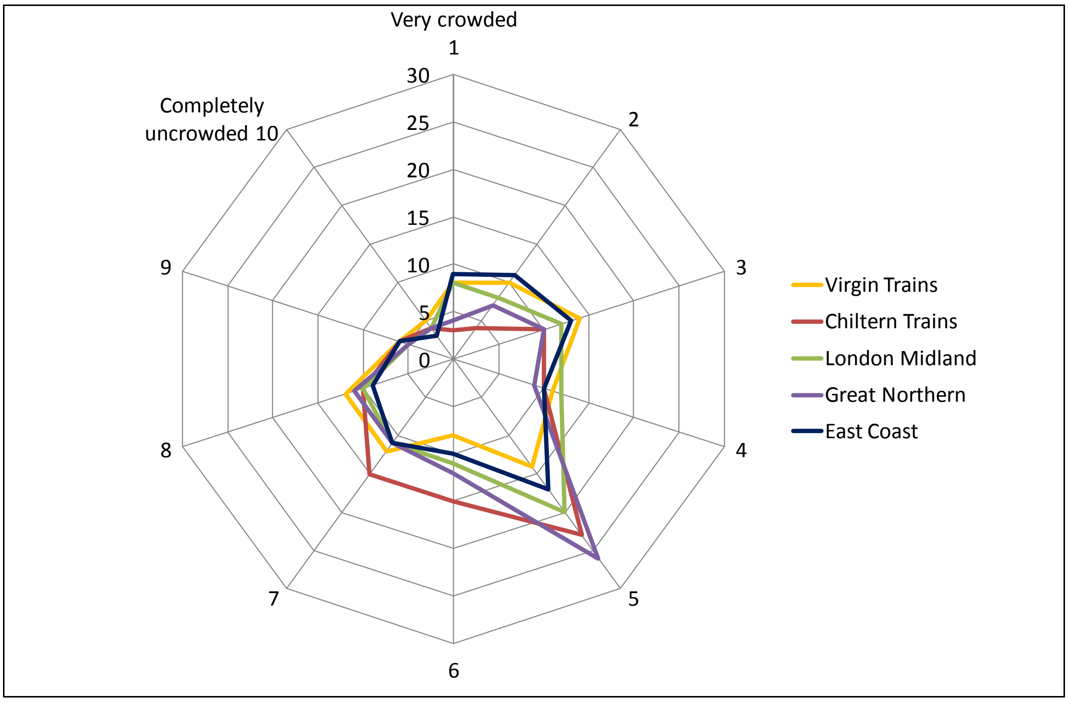
The RP sample were asked to assess the train operator they were using compared to the competing operators on the route with respect to punctuality, crowding and quality at the time they were travelling.

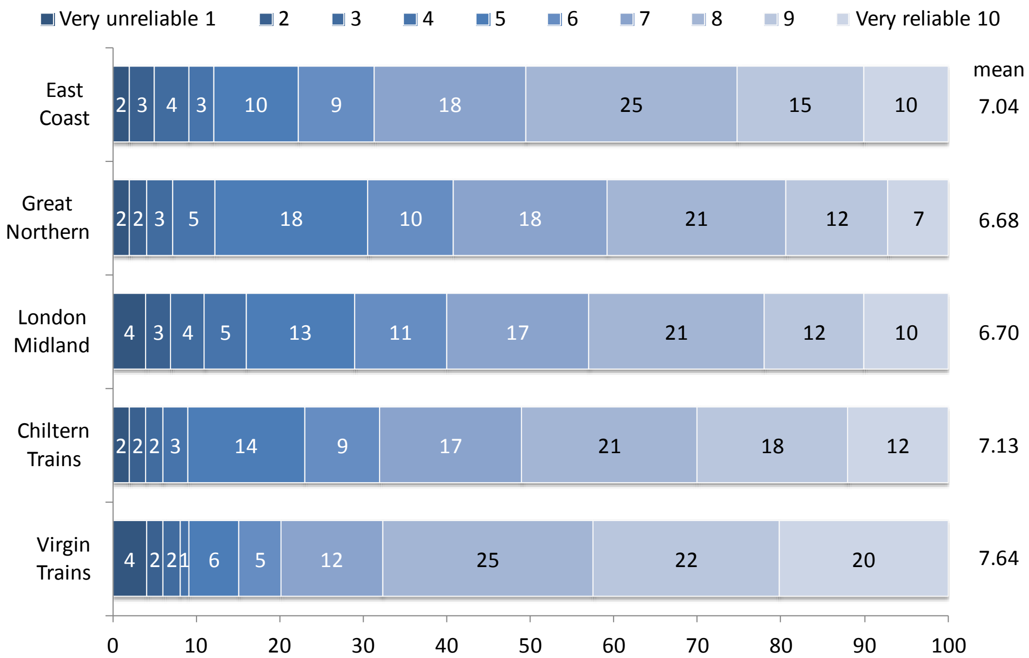
Travellers from Birmingham were asked to compare Virgin Trains, London Midland and/or Chiltern Railways. Travellers from Stoke, Stafford and Rugby were asked whether to compare Virgin Trains and London Midland. Travellers from Peterborough were asked to compare Great Northern and East Coast.

Punctuality was measured on a scale of 1-10, with 1 indicating very unreliable and 10 indicating very reliable. East Coast was rated best on services from Peterborough to London. Virgin Trains was rated best and London Midland worst on the services from Birmingham, Stoke, Stafford and Rugby to London.

Figure C1: Punctuality of train services (mean scores)

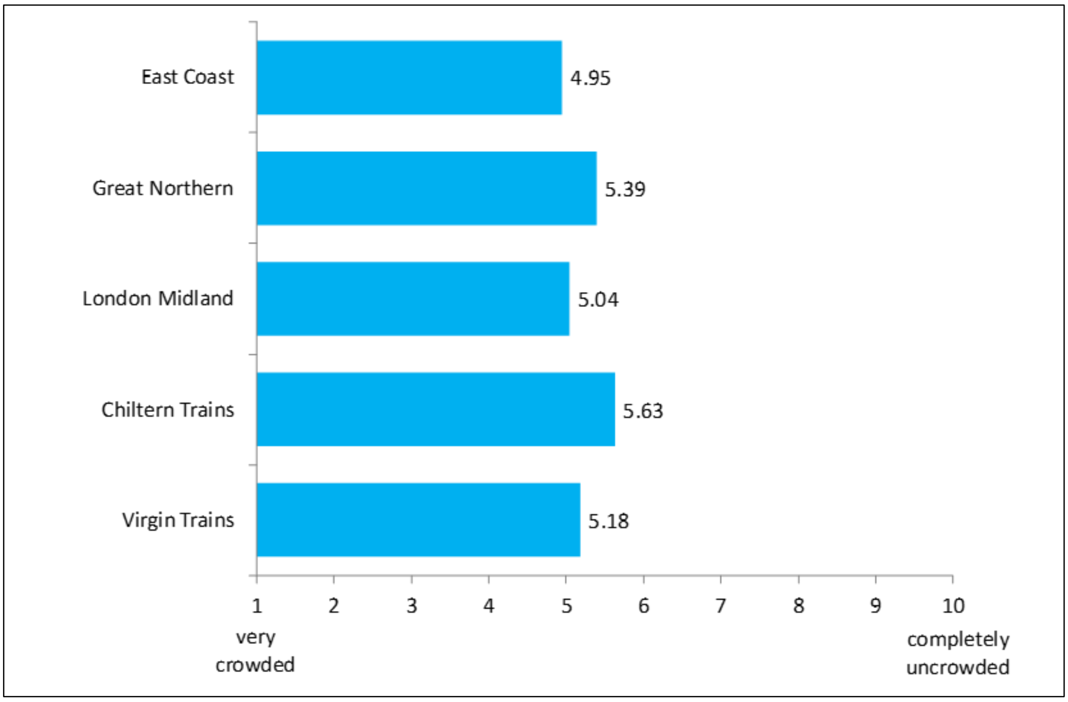


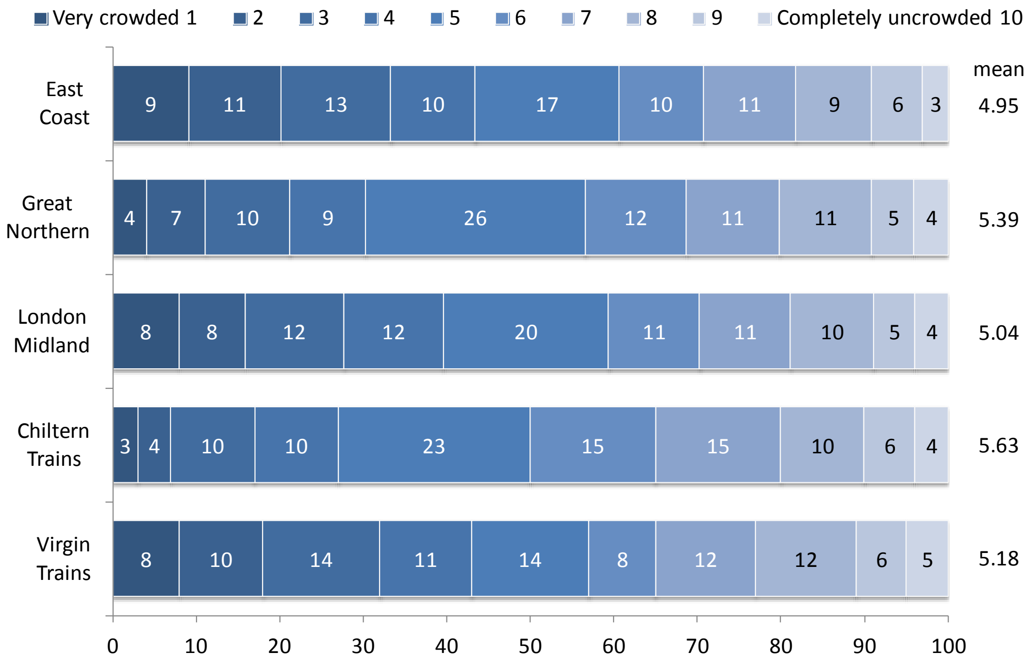




Crowding was measured on a scale of 1-10, with 1 indicating very crowded and 10 indicating completely uncrowded. Great Northern was rated best on services from Peterborough to London. Chiltern Trains was rated best and London Midland worst on the services from Birmingham, Stoke, Stafford and Rugby to London.

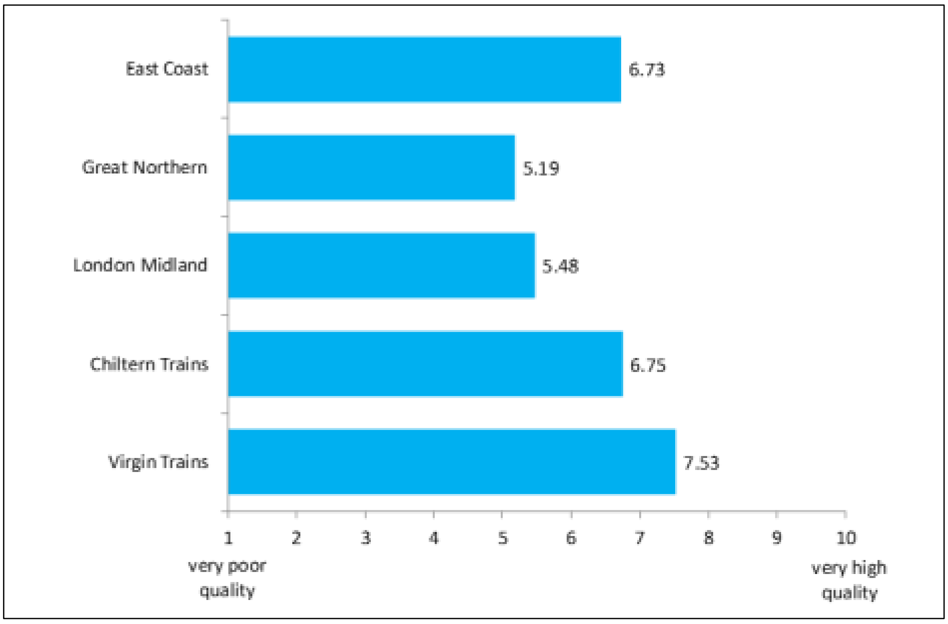
Figure C2: Crowding of train services (mean scores)

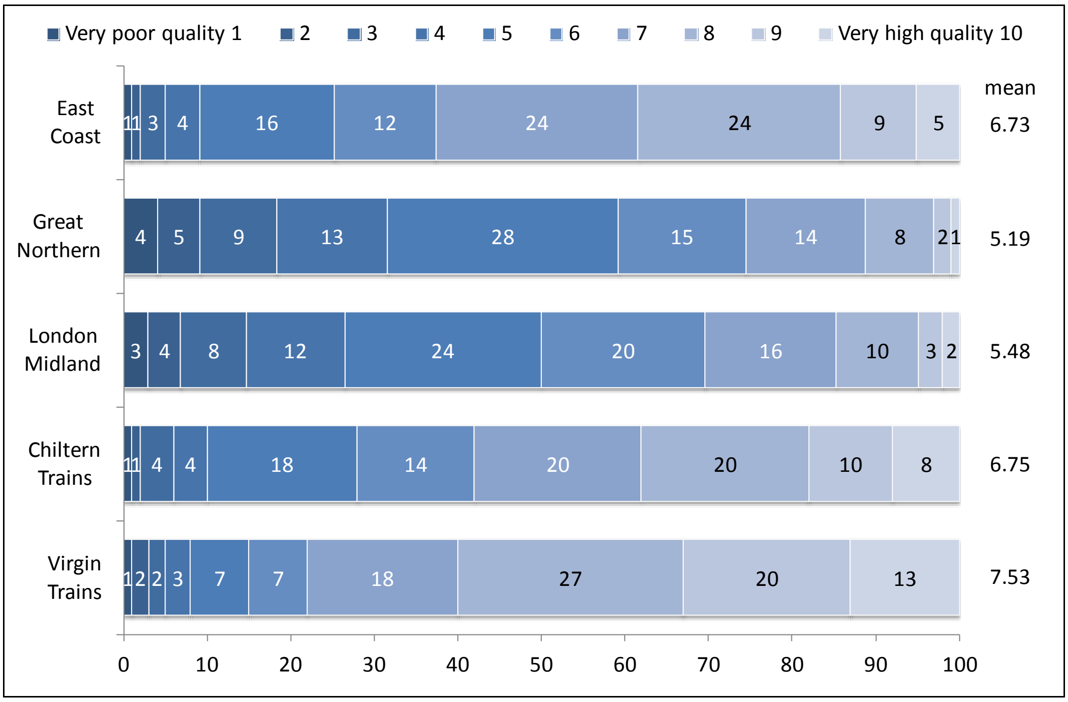




Quality was described as referring to things such as the comfort of seats, on-board facilities, interior décor etc. and was measured on a scale of 1-10, with 1 indicating very poor quality and 10 indicating very high quality. East Coast was rated best on services from Peterborough to London. Virgin Trains was rated best and London Midland worst on the services from Birmingham, Stoke, Stafford and Rugby to London.

Figure C3: Quality of train services (mean scores)





Appendix D

NTS vs. SP data descriptives

Contents

Table D1: Distribution of samples by age group and journey purpose (%)

Mode	NTS Data	SP Data
Car	87.0	32.4
Bus	8.6	16.3
Rail	2.8	33.2
'Other PT'	1.5	18.1
Total	**652053**	**100.0**

Table D2: Distribution of samples by age group and journey purpose (%)

	NTS Data			SP Data		
	Commute	Business	Other non-work	Commute	Business	Other non-work
17-20	4	2	5	7	1	15
21-29	20	11	11	23	13	20
30-39	22	20	17	26	23	14
40-49	25	31	21	21	31	15
50-59	20	25	16	18	24	14
60-69	7	10	16	6	8	15
70+	1	1	14	1	1	7

Table D3: Distribution of sample by gender and journey purpose (%)

			Male	Female	N
NTS Data	Car	Commute	58	42	108071
		Business	59	41	25577
		Other NW	45	55	433869
	Bus	Commute	46	54	12841
		Other NW	39	61	42094
	Train	Commute	64	36	8720
		Business	71	29	1573
		Other NW	47	53	8117
	‘Other PT’	Commute	59	42	4749
		Business	57	43	726
		Other NW	46	54	4506
SP Data	Car	Commute	55	44	1025
		Business	77	22	948
		Other NW	46	54	1030
	Bus	Commute	34	66	367
		Other NW	30	69	668
	Train	Commute	54	46	993
		Business	59	41	1004
		Other NW	38	62	1113
	‘Other PT’	Commute	47	52	611
		Business	59	41	242
		Other NW	35	65	535

Table D4: Distribution of sample by employment status and journey purpose (%)

	NTS			SP	
	Commute	Business	Other non-work	Commute	Other non-work
Full time paid employment	75	62	35	70	26
Part time paid employment	16	13	16	16	13
Full time self-employment	6	17	5	5	4
Part time self-employment	1	5	3	1	2
Student	1	0	3	5	19
Waiting to take up a job					2
Unemployed	0	1	3		5
Unable to work	0	0	3		2
Retired	0	1	25		20
Looking after home/family	0	0	6		6
Other	0	0	1		2
N	**134381**	**29085**	**488586**	**2,997**	**3,352**

Table D5: Distribution of sample by household income and journey purpose (%)

	NTS		SP	
	Commute	Other non-work	Commute	Other non-work
Under £10K	4	11	7	19
£10-20K	11	19	14	19
£20-30K	14	16	16	16
£30-40K	17	14	14	12
£40-50K	15	11	12	9
£50-75K	24	18	16	9
£75+	16	12	16	7
Don't know			1	3
Refusal			3	6
Not stated			1	1
N	**134382**	**488587**	**2,997**	**3,352**

Table D6: Distribution of average journey times by mode and journey purpose (mins)

Mode in VTT Categories		NTS Mean	NTS N	SP Mean	SP N
Car	Commute	23	108071	64	1025
	Business	37	25577	154	948
	Other NW	19	433869	99	1030
Bus	Commute	34	12841	37	367
	Other NW	27	42094	39	668
Rail	Commute	38	8720	63	993
	Business	61	1573	118	1004
	Other NW	50	8117	95	1113
'Other PT'	Commute	37	4749	31	611
	Other NW	29	4506	33	535

Table D7: Distribution of average journey costs by mode and journey purpose (£)

Mode in VTT Categories		NTS Mean	NTS N	SP Mean	SP N
Car	Commute	1.40	108071	6.40	1025
	Business	2.71	25577	11.31	948
	Other NW	1.15	433869	8.79	1030
Bus	Commute	1.31	12841	0.59	367
	Other NW	0.73	42094	0.32	668
Rail	Commute	4.56	8720	2.86	993
	Business	14.35	1573	72.63	1004
	Other NW	6.30	8117	0.40	1113
'Other PT'	Commute	2.16	4749	1.38	611
	Other NW	1.53	4506	0.59	535

Appendix F

Properties of the log uniform distribution

Contents

F1 Properties of the log uniform distribution

In the same way that a variate x has a lognormal distribution if y = log(x) is normally distributed, we define x as log-uniformly distributed if y = log(x) is uniformly distributed.

Define y as uniform over the range [a, a+b], where a is thus the lower bound and b is the width of the range: these are the two coefficients which will be estimated. Note that while b is not the standard deviation of the distribution, it is proportional to it: the standard deviation of the uniform distribution is b/√(12). The probability density function (pdf) of the uniform distribution is:

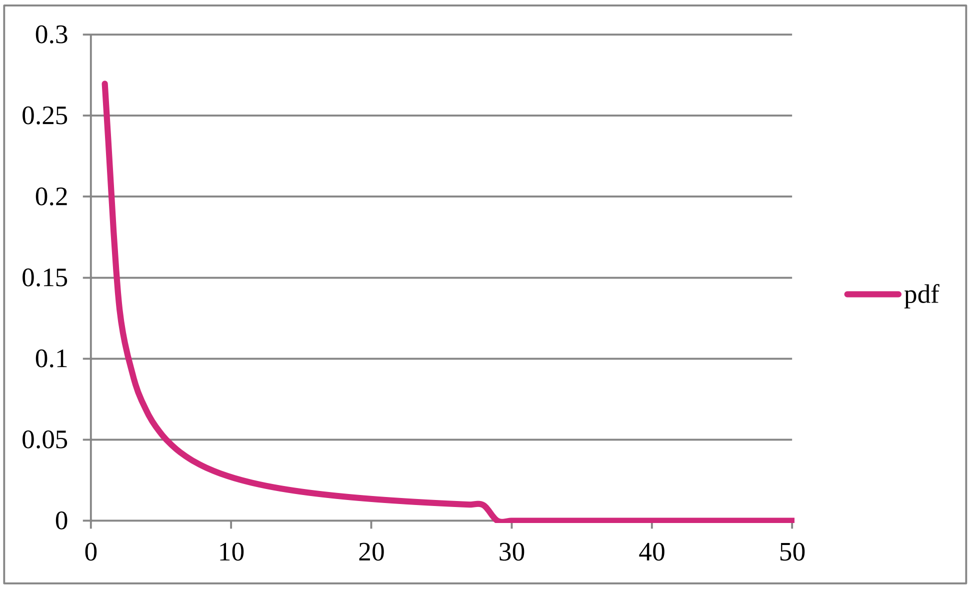
$$pdf(y) = \frac{1}{b}\ for\ a \le y \le a + b \qquad \text{(F.1)}$$

By a standard property of the pdf, if $y = f(x)$ then $pdf(x)dx = pdf(y)dy$. Since $y = \log(x)$, $dy = \frac{dx}{x}$. Hence the $pdf(x)$ for the log-uniform distribution is:

$$pdf(y) = \frac{1}{bx}\ for\ \exp(a) \le x \le \exp(a + b) \qquad \text{(F.2)}$$

This has the general shape shown below:

Figure F1: pdf of the log uniform distribution



To keep down the notation burden, write A = exp(a) and B = exp (B). Then exp(a+b) = AB.

The mean is given as

$$E(x) = \frac{1}{b}\int_{A}^{AB} x\,\frac{1}{x}\,\mathrm{d}x = \frac{AB-A}{b} = \exp(a)\,\frac{\exp(b)-1}{b} \qquad \text{(F.3)}$$

The variance is given as

$$Var(x) = E(x^2) - \left(E(x)\right)^2 = \exp(2a)\left[\frac{(\exp(2b)-1)}{2b} - \frac{(\exp(b)-1)^2}{b^2}\right] \qquad \text{(F.4)}$$

Appendix G

Detailed calculations of derivatives for mean VTT

Contents

G1 Detailed calculations of derivatives for mean VTT

The calculations of **Chapter 4** and **Appendix F** indicate that the expected VTT for a given record is

$$E(VTT) = \exp(\kappa a)\frac{(\exp(\kappa b)-1)}{\kappa b}\prod_i z_i^{\lambda_i}\prod_j \zeta_j^{z_j}.|\Delta t|^{\kappa-1} \quad (G.1)$$

where a and b refer to the estimates of respectively the lower bound and the spread of the uniform distribution underlying the log uniform distribution as discussed in **Appendix F** and $\kappa = \frac{1-\beta_t}{1-\beta_c}$

For the delta method we need to differentiate VTT with respect to all the estimated parameters. This appendix gives the formulae for those derivatives.

$$\frac{\partial VTT}{\partial a} = \kappa VTT \quad (G.2)$$

$$\frac{\partial VTT}{\partial \zeta_j} = z_n \frac{VTT}{\zeta_j} \quad (G.3)$$

$$\frac{\partial VTT}{\partial \lambda_i} = VTT \log z_i \quad (G.4)$$

Defining $R = \frac{\exp(\kappa b)-1}{\kappa b}$

$$\frac{\partial VTT}{\partial b} = \frac{VTT}{R}\frac{\partial R}{\partial b} = \frac{VTT}{R}\left\{ {\exp(\kappa b)}/{b} - {R}/{b} \right\} = \frac{\kappa VTT \exp(\kappa b)}{\exp(\kappa b)-1} - b \quad (G.5)$$

Derivatives with respect to κ have three components:

$$\frac{\partial VTT}{\partial \kappa} = \kappa_1 + \kappa_2 + \kappa_3 \quad (G.6)$$

Where

$$\kappa_1 = aVTT \quad (G.7)$$

$$\kappa_2 = \frac{\partial VTT}{\partial b}\frac{b}{\kappa} \quad (G.8)$$

$$\kappa_3 = VTT \log(|\Delta t|) \quad (G.9)$$

The derivatives of κ can be calculated as follows

$$\frac{\partial\kappa}{\partial\beta_t} = \frac{-1}{1-\beta_c} \tag{G.10}$$

$$\frac{\partial\kappa}{\partial\beta_c} = \frac{\kappa}{1-\beta_c} \tag{G.11}$$

Appendix H

Evidence on the 'Hensher' parameters

Contents

H1 Introduction

In the course of the employer SP and employee RP surveys, we asked questions about the productive use of time, the relative efficiency of time and the use to which the time saved was put – and we now summarise the findings.

The answers to these questions allow population of the so-called 'Hensher' parameters, namely:

r is the proportion of travel time saved that is used for leisure

p is the proportion of travel time saved that is at the expense of work done while travelling

q is the relative productivity of work done while travelling relative to at the workplace

We also collected information on the related parameters:

r^* which is the proportion of a trip spent in own time

p^* which is the average amount of time spent working while travelling.

Given the challenges faced in accurately estimate p and r, studies that have used the Hensher equation have tended to approximate them with p^* and r^*.

Note however that due to a routing problem in the employee questionnaire, the Hensher parameter questions were not asked, and the evidence that follows is therefore restricted to employer SP and employee RP.

H2 The Hensher parameters: employer SP data

The employers' business questions focused on a specific category of staff, termed senior, middle or junior, and the employer answered questions for a typical member of the selected category of staff. In what follows, we distinguish by category of staff and trip duration since both can be expected to impact on the Hensher parameters.

Table H1 and **Table H2** report how long employers thought the target employees would work during a trip on each leg for car and rail respectively.

As expected, there is a much greater propensity to work on train than in car, whilst for rail the figures, again as expected, are lower for the return leg. And for rail there is a clear pattern that more senior staff do more work. There is some suggestion that longer rail trips lead to more work being undertaken.

Table H1: Proportion (p*) of trip spent working (car)

CAR	Outward	Return
All	0.07 (0.22) [210]	0.07 (0.21) [210]
Senior	0.06 (0.17) [114]	0.05 (0.15) [114]
Middle	0.08 (0.24) [80]	0.08 (0.25) [80]
Junior	0.13 (0.34) [16]	0.13 (0.34) [16]
<60m	0.05 (0.16) [80]	0.04 (0.15) [80]
60-119m	0.10 (0.26) [50]	0.09 (0.24) [50]
120m+	0.09 (0.23) [80]	0.09 (0.25) [80]

Note: In this and following tables, the three sets of figures represent the mean, the standard deviation ( ), and the number of observations [ ].

Table H2: Proportion (p*) of trip spent working (rail)

RAIL	Outward	Return
All	0.45 (0.33) [138]	0.33 (0.33) [138]
Senior	0.49 (0.34) [87]	0.37 (0.35) [87]
Middle	0.40 (0.32) [39]	0.31 (0.31) [39]
Junior	0.33 (0.34) [12]	0.16 (0.24) [12]
<60m	0.36 (0.37) [26]	0.28 (0.37) [26]
60-119m	0.39 (0.34) [30]	0.26 (0.32) [30]
120m+	0.50 (0.31) [82]	0.38 (0.32) [82]

Table H3 reports whether employers felt that the employee would have worked in ten minutes of time saved. For rail these *p* figures are broadly similar to the p^* figures of **Table H2** and denote that there would be significant loss of work time as a result of a time saving. What is surprising though is that the *p* values for car are somewhat larger than p^*. This seems odd. On reflection, the question is ambiguous. Employers were asked whether the “employee would have worked or not in the time saved”. This could be interpreted that the travel time saved would be converted to work time or that work would have been done in the time saved.

Table H3: Would have worked in 10 minute time saved (p)

	Car	Rail
All	0.40 (0.49) [210]	0.45 (0.50) [138]
Outward	0.40 (0.49) [114]	0.50 (0.50) [72]
Return	0.40 (0.49) [96]	0.39 (0.49) [66]
Senior	0.33 (0.47) [114]	0.54 (0.50) [87]
Middle	0.48 (0.50) [80]	0.31 (0.47) [39]
Junior	0.50 (0.52) [16]	0.25 (0.45) [12]
<60m	0.45 (0.50) [80]	0.38 (0.50) [26]
60-119m	0.42 (0.50) [50]	0.47 (0.51) [30]
120m	0.34 (0.48) [80]	0.46 (0.50) [82]

The proportion of the trip made in the employee's own time (r^*) is reported in **Table H4** for car and **Table H5** for rail. The column headed 'Re-imbursed' recodes any time spent travelling in own time to zero where the respondent would actually be compensated for that time through time in lieu or overtime payments.

The figures for car tend to be low and to vary little, with some evidence that, as expected, senior people are more likely to undertake business trips in their own time.

For rail, the figures are somewhat larger. This does not seem to be because rail trips tend to be longer, because there is no strong distance effect apparent.

Table H4: Proportion of trip (r*) made in own time (car)

CAR	All		Re-imbursed	
	Outward	Return	Outward	Return
All	0.12 (0.27) [210]	0.10 (0.25) [210]	0.08 (0.23) [210]	0.07 (0.21) [210]
Senior	0.15 (0.30) [114]	0.11 (0.27) [114]	0.12 (0.28) [114]	0.10 (0.26) [114]
Middle	0.09 (0.24) [80]	0.09 (0.24) [80]	0.04 (0.15) [80]	0.04 (0.15) [80]
Junior	0.03 (0.07) [16]	0.02 (0.05) [16]	0.01(0.05) [16]	0.01 (0.05) [16]
<60m	0.04 (0.19) [80]	0.03 (0.16) [80]	0.04 (0.19) [80]	0.03 (0.16) [80]
60-119m	0.19 (0.34) [50]	0.17 (0.35) [50]	0.14 (0.29) [50]	0.12 (0.30) [50]
120m+	0.15 (0.26) [80]	0.12 (0.24) [80]	0.10 (0.22) [80]	0.08 (0.19) [80]

Table H5: Proportion of trip (r*) made in own time (rail)

RAIL	All		Re-imbursed	
	Outward	Return	Outward	Return
All	0.29 (0.38) [138]	0.30 (0.39) [138]	0.19 (0.34) [138]	0.21 (0.35) [138]
Senior	0.30 (0.40) [87]	0.33 (0.40) [87]	0.23 (0.38) [87]	0.25 (0.39) [87]
Middle	0.22 (0.30) [39]	0.22 (0.34) [39]	0.09 (0.18) [39]	0.11 (0.25) [39]
Junior	0.40 (0.43) [12]	0.34 (0.40) [12]	0.24 (0.40) [12]	0.18 (0.33) [12]
<60m	0.24 (0.43) [26]	0.28 (0.45) [26]	0.12 (0.32) [26]	0.12 (0.32) [26]
60-119m	0.35 (0.44) [30]	0.28 (0.42) [30]	0.31 (0.44) [30]	0.28 (0.43) [30]
120m+	0.28 (0.34) [82]	0.31 (0.35) [82]	0.17 (0.30) [82]	0.21 (0.33) [82]

The relative productivity (q) figures are presented in **Table H6**. As is often the case, these figures are not far from one. Surprisingly though the rail figures are lower than those for car.

Table H6: Relative productivity (q) of time working while travelling

	Car	Rail
All	0.92 (0.23) [31]	0.87 (0.27) [108]
Senior	0.91 (0.28) [19]	0.88 (0.24) [71]
Middle	0.93 (0.16) [10]	0.86 (0.31) [30]
Junior	1.00 (0.00) [2]	0.77 (0.35) [7]
<60m	0.93 (0.36) [9]	0.79 (0.24) [17]
60-119m	0.98 (0.07) [9]	0.84 (0.29) [21]
120m+	0.87 (0.19) [13]	0.89 (0.26) [70]

(Q11i) and (Q11j) asked about the proportion of business trip time undertaken in own time and spent doing work as an average across all staff in a particular category, rather than by a specific employee on a specific mode as reported above.

Only 6% and 5% respectively provided answers to the questions about on average how long their employees spend on trips in their own time and how much time they spent working while travelling that varied with the length of the trip. Thus the figures reported in **Table H7** are based on the responses to (Q11i) and (Q11j) that do *not* vary with trip length.

57% stated that none of their employees of the particular category made business trips in their own time. Senior staff were more likely to make trips in their own time but there is not a great deal of difference across staff category. And nor is there much difference in the proportion of time spent working, which fits between the previously reported p^* figures for rail and car.

Table H7: Average proportion of travel time spent in own time (r*) and working (p*)

	Own Time (r^*)	Working (p^*)
All	0.16 (0.26) [364]	0.24 (0.33) [366]
Senior	0.20 (0.29) [212]	0.27 (0.33) [211]
Middle	0.10 (0.19) [122]	0.20 (0.31) [122]
Junior	0.14 (0.28) [30]	0.16 (0.31) [33]

H3 The Hensher parameters: employee RP data

This is based on the sample of those in paid employment and making a round trip, and amounted to 916 individuals. We lose 15 observations with missing data.
On the outward leg, 22% reported doing no work with 9% stating they worked the entire trip. For the return leg, the corresponding figures were 38% and 5%. We might expect less work on the return leg and this is also borne out in the mean figures reported in **Table H8**. The values of p^* in **Table H8** are broadly similar to the values in **Table H2** as perceived by employers.

Table H8: Proportion of trip spent working (p*)

	Outward	Return
All	0.50 (0.35) [901]	0.35 (0.35) [901]
<60m	0.54 (0.35) [336]	0.33 (0.35) [336]
60-119m	0.49 (0.35) [507]	0.36 (0.35) [507]
120m+	0.42 (0.36) [58]	0.31 (0.35) [58]

Turning to relative productivity, we lose some who did not reply, as well as the question not being relevant for those who did no work. **Table H9** reports q values which are very much in line with those typically recovered, indicating that work on the train has the same level of productivity as work at the normal workplace.

Table H9: Relative productivity (q)

	Outward	Return
All	0.98 (0.46) [709]	1.04 (0.86) [558]
<60m	0.96 (0.45) [272]	0.98 (0.54) [205]
60-119m	1.00 (0.48) [396]	1.08 (1.04) [320]
120m+	0.95 (0.42) [41]	1.04 (0.44) [33]

As expected, the proportion of the trip made in own time is greater on the return leg as is apparent in **Table H10**. Again there is a high degree of correspondence with the figures reported here and those perceived by employers and reported in **Table H10**.

Table H10: Proportion of trip made in own time (r*)

	All		Re-imbursed	
	Outward	Return	Outward	Return
All	0.31 (0.40) [916]	0.43 (0.44) [916]	0.25 (0.38) [916]	0.35 (0.43) [916]
<60m	0.31 (0.42) [339]	0.44 (0.46) [339]	0.26 (0.40) [339]	0.37 (0.45) [916]
60-119m	0.31 (0.38) [518]	0.43 (0.43) [518]	0.25 (0.37) [518]	0.33 (0.42) [518]
120m+	0.34 (0.39) [59]	0.40 (0.41) [59]	0.23 (0.36) [59]	0.29 (0.40) [59]

To determine p (as opposed to p^*) we focussed on the difference between the chosen operator and the other operator. The difference in reported trip times was calculated and the respondent was asked whether, if they had used the other operator, the same amount of work-related activity would be undertaken, more such activity or less.

For those choosing a quicker operator and answering the question, we have 745 observations. This is reduced to 716 when time savings of less than 10 minutes are ignored, to 702 when we remove those with p values greater than 1, and to 631 when we remove those who said they would work less even on a longer trip.

We also have 158 answering the question who had chosen the slower operator. This is reduced to 131 after removing time differences of less than 10 minutes. When we remove those who would spend more time working on a longer trip, we have 117 observations.

What is quite noticeable is that for the vast majority, there is no change in the amount of working time, i.e. p=0. That is to say, for 501 out of the 631 who had chosen the quickest option and 103 of the 117 who had chosen the slower option stated that they would work the same time. **Table H11** reveals the p values to be low, somewhat lower than the p^* values reported above.

Table H11: *p* values based on operator choice

	Quicker	Slower
All	0.16 (0.33) [631]	0.09 (0.26) [117]
Outward	0.16 (0.34) [453]	0.08 (0.24) [88]
Return	0.16 (0.31) [178]	0.11 (0.29) [29]
<60m	0.16 (0.34) [250]	0.00 (0.00) [2]
60-119m	0.16 (0.32) [375]	0.07 (0.24) [73]
120m+	0.02 (0.03) [6]	0.12 (0.28) [42]

We used the same approach based around the time differences between operators to determine whether the saved or lost time would add to or be taken from personal time (r). The figures are reported in **Table H12**. These are larger than the r^* values reported in **Table H5** for employers and **Table H10** for the RP data. We would expect the marginal figure (r) to exceed the average (r^*).

Table H12: r values based on operator choice

	Quicker	Slower
All	0.60 (0.49) [764]	0.56 (0.50) [171]
Outward	0.58 (0.49) [559]	0.55 (0.50) [124]
Return	0.66 (0.47) [205]	0.57 (0.50) [47]
<60m	0.56 (0.50) [326]	0.74 (0.45) [19]
60-119m	0.63 (0.48) [432]	0.56 (0.50) [99]
120m+	0.50 (0.54) [6]	0.49 (0.50) [53]

Appendix I

User instructions for the Implementation Tool

Contents

I1 Structure of the Implementation Tool

The Tool is based around two main files:

1. The Excel master sheet (Tool_master_sheet.xlsx)
2. The R file (VTT_tool_vX.r)

I1.1 The Excel master sheet

The Excel master sheet enables the user to specify values for:

- Δt (maximum of 10 different values in a particular run).
- Whether distance weights are applied or not.
- A fixed income for all users at a user defined level (to filter out income effects) for personal and household income – this corresponds to option (2).
- Green Book weighting of household income, such that lower income households receive a higher weight than higher income groups in deriving average VTT – this corresponds to option (4). Weights are defined based on the five income quintiles, where the lowest income quintile gets a weight of respectively 2.2, the second quintile a weight of 1.4, and the weights for the subsequent quintiles are 1, 0.8 and 0.5. These weights are applied to non-work only.
- Where appropriate, these weights are multiplied with the trip (and distance) weights w_n to arrive at the new weighted average VTT.
- Values are always reported for each purpose and across purposes. The user can also select for which modes the Tool produces VTT outputs, in which case the aggregate VTT measures will only account for the included modes.

The Excel sheet also allows the user to select a population segment of interest by defining ranges to be used from the NTS data. To impose a filter on a particular NTS variable, the user needs to enter a '1' into the filter column and specify the respective upper/lower bound for the relevant variable. Similar selection criteria are included for categorical and dummy variables. Instructions are provided in the comment boxes in the Excel file.

After defining the relevant population segment (and other run settings), the user exports the segmentation.

I1.2 The R file

I1.2.1 Software requirements and installation

The R-file needs to be opened with 'R', or preferably 'R-studio'. The user needs to install both software packages in order to be able to run the Tool through R-studio. In addition, some basic packages need to be installed by typing in the R-console the following[1]:

```
install.packages("xlsx")

install.packages("pracma")
```

I1.2.2 Running instructions

The working directory should be set to where the Tool is located – preferably not a 'My Documents' location:

```
setwd('C:/Tool/Model_Variables/VersionX/')
```

The user should select all lines in the R script and press CTRL+ ENTER to run.

The Tool reads the NTS_data directly from the .csv source file and opens a range of output files. It then applies the segmentation criteria provided by the user to select only the relevant lines from the NTS data file. After some labelling exercises, the eleven mode-purpose combinations (three purposes and four modes, but no bus use for employees' business) are defined.

The Tool then reads in the other run settings, such as the Δt effect, distance weighting and income settings, and applies the necessary weight corrections. Then the mode specific SP model results are loaded. The relevant covariates are selected from the NTS data and the income, distance, time and cost elasticities are calculated for each mode and purpose. For the purpose of calculating standard errors around the VTT, due to estimation imprecision, the relevant covariance matrices of parameter estimates are also loaded and reshaped.

Then the R code starts a loop across levels of Δt and derives record-specific VTT for each mode and purpose based on the relevant SP models using the general specification, where the products in the middle represent the covariates defined before.

In **Chapter 4** it is explained that the necessary calculation to derive the VTT for a record n is

$$VTT_n = {\theta_n}^{\kappa} \prod_i z_i^{\lambda_i} \prod_j \zeta_j^{z_j} . |\Delta t|^{\kappa-1} \quad \text{(I.1)}$$

In this equation "i" relates to covariates which are treated as elasticities while "j" relates to covariates which impose a multiplier on the reference value of VTT. The corresponding vectors λ and ζ are the coefficients associated with these two subsets of covariates which together constitute the vector **z** of covariates referred to in the opening section of this chapter.

The implemented models, using a mixed logit formulation, do not produce a single estimate of VTT for a particular individual but rather a distribution. For the purpose of the Tool, the mean and standard deviation of the distribution are used to represent the distribution. Weighted sample averages across the subset are than

[1] If the Tool is executed on a 64-bit machine, please ensure that a 64-bit version of Java is available for the xslx package to work. See www.java.com/en/download/manual.jsp and download and install the windows offline (64 bit) version.

used to derive the VTT per mode and purpose. These outputs are printed to the output files 'VTT_output_means.txt' and several other output files producing information related to estimation error and sampling error in the NTS sample.

Chapter 4 similarly gives the mean and variance of the record-specific VTT as:

$$E(VTT) = \exp(\kappa a)\frac{(\exp(\kappa b)-1)}{\kappa b}\prod_i z_i^{\lambda_i}\prod_j \zeta_j^{z_j}.|\Delta t|^{\kappa-1} \quad (I.2)$$

$$Var(VTT) = \exp(2\kappa a)\left[\frac{(\exp(2\kappa b)-1)}{2\kappa b} - \frac{(\exp(\kappa b)-1)^2}{\kappa^2 b^2}\right]$$
$$\left(\prod_i z_i^{\lambda_i}\prod_j \zeta_j^{z_j}.|\Delta t|^{\kappa-1}\right)^2 \quad (I.3)$$

These two formulae underly the exploitation of the log uniform distribution in the Tool. Note that this measure of variance does not yet relate to estimation uncertainty and sampling error, but only to unobserved heterogeneity in preferences across the population.

These functional forms give a zero VTT for trips which have a zero cost (e.g. concessionary fare travellers). However, for appraisal purposes, the current Department convention is to assume that concessionary fare travellers have the same VTT as other travellers. In an attempt to place this convention on a stronger footing, the approach we have adopted is to use the sample without zero trip cost to estimate a regression model explaining cost using distance, time and geographical area as the explanatory variables. Regression models were mode and purpose specific. Zero cost observations are then replaced by the expected cost.

I2 Parameterising the Implementation Tool

I2.1 Manipulation of NTS data

NTS data is hierarchical in nature and records are collated at a number of levels including households, vehicles, individuals, trips and stages.

Identifying variables for each of these levels allow linkages to be made across the levels so that, for example, individual and household characteristics can be identified for each trip.

Within the NTS, a 'trip' is defined as a one-way course of travel having a single main purpose, e.g. a trip to work without any break in travel. A trip consists of one or more 'stages'. A new stage is defined when there is a change in the form of transport or when there is a change of vehicle requiring a separate ticket.

In the SP, each respondent made choices relating to one stage of their trip only, with an indication whether this was an access mode or the main mode. However, the averaging process requires a single value of time for each trip, and we, therefore, included only the main mode 'stage' information from each trip (e.g. stage time and stage cost) in the Tool. A full description of variables used in the Tool is shown in **Table I1** below, whilst **Appendix D** provides detailed descriptive statistics on the NTS dataset which populates the Tool.

The Tool needs to recognise three types of covariates. The set of model covariates (**z**), which in any case varies by mode and purpose, consists of some variables which are represented in the NTS and others which are not: in the latter case, it is necessary to make an assumption about the appropriate value to use for a given individual record *n*.

In addition to these two sets, there are other variables of interest in the NTS which do not form part of any model. Although the VTT will not vary with respect to these, it may still be of interest to estimate mean values etc. for sub-samples based on these variables.

The following three sub-sections discuss each type of covariate.

I2.2 Tool variables available in the NTS

The variables which were present in both the NTS and SP datasets were as follows:

Household records

- Household composition
- Area type
- Household vehicle access
- Household income

Individual records

- Gender
- Age
- Employment status
- Part-time/full-time
- Personal income

Trip records

- Trip distance
- Origin/destination

Stage records

- Time
- Distance
- Party size
- Fare/ticket cost
- Main mode of trip indicator
- Part of multi-stage trip indicator

I2.3 Tool variables not available in the NTS

As well as the matching variables, there were a number of variables which were not observable in the NTS data but which were covariates in the modelling. These included:

- Nights away
- Payee
- Frequency of trips
- One way
- Crowding measures
- Congested conditions
- Access trips (we only included main mode of the trip)
- Cost sharing indicators
- Road type

For these variables, sample averages from the SP sample were used in the Tool.

I2.4 Additional variables available for analysis in the Tool

A number of variables – although not in the models – were included in the Tool, for purposes of examining the impact of correlations between covariates and the model variables. These included:

- Time of day
- Day of week
- Occupation

Output is available across the full range of compatible variables within the NTS definition, even when these variables were defined on a more restrictive basis in the SP sample – e.g. only certain age group dummies were included in the modelling, whereas in the Tool the output can be specified across the full range of age groups.

I2.5 Compatibility issues

There were a number of compatibility issues which are discussed below.

- In the SP survey, fuel cost was based on road type. The NTS trip/stage data contains no information on road type. Instead fuel cost was imputed using times and distances for an 'average' vehicle type, using the parameters given in WebTAG Unit A1.3[2].
- In the NTS the vehicle access variable was at the level of the household, whereas in the SP survey it was at the individual level.
- There was missing information in the NTS on some public transport costs (around 10%) which meant that these observations were dropped from the Tool sample. The trip weighting factor for these modes was uplifted to re-balance the profile of public and private modes.
- Household and personal income were modelled as continuous variables but only collected in the NTS as 23 banded variables (e.g. £50,000-54,999). To convert them into a continuous form, we took the average income for each

[2] DfT (2014) TAG UNIT A1.3. User and Provider Impacts. November 2014.

income band, aside from the lowest and highest bands where the median was used, from Family Resource Survey data (mean and medians were supplied by the Department).

- A number of modes were judged to be out of scope for the modelling. These included trips made by walking, bicycle, private hire bus, motorcycle, other private transport, express coach, excursion bus, air, taxi and minicab.
- The NTS records only whether a respondent was a driver or passenger, whereas in the SP data collection and modelling shared driving was included. In the NTS data, we assumed that reported drivers did not share the driving.

I3 Sample enumeration

I3.1 Mean and variance of VTT

Based on the foregoing, VTT estimates have been calculated by sample enumeration using a sample of trips drawn from the NTS. The NTS trips are weighted by expansion factors provided with the survey and the trips can additionally be distance weighted, so that the VTT represents the VTT for an average kilometre.

This approach implies calculating the distance weighted VTT for a given population segment, given values of θ and fixed Δt by:

$$\overline{VTT_S}(\Delta t) = \frac{\sum_{n \in S} w_n l_n VTT_n(\theta_n, \Delta t)}{\sum_{n \in S} w_n l_n} \qquad \text{(I.4)}$$

taking the sum over every NTS trip n in the segment S, where

w is the NTS expansion weight for the trip

l is the relevant trip length

VTT is the value of travel time for the relevant trip, given θ and Δt; this value depends on the covariates for record n, so that there is variation over the records.

If a trip weighted VTT is required, the term l is omitted from both numerator and denominator (or set to 1).

VTT depends on Δt but for simplicity of notation we omit this dependence from the formulations where possible. The VTT for a specific record n also depends on θ_n, which varies randomly in the mixed logit model, with a distribution *for each record*; in this case we assume a log uniform distribution. To calculate the overall mean VTT we need to calculate the average over records, as in the equation above, but also the mean for each record. This implies looking at the moments of the log uniform distribution, which are set out in **Appendix F**. The term $VTT_n(\theta_n, \Delta t)$ in equation (I.2) is replaced by the mean of the corresponding log uniform distribution.

In discussing the variation of VTT we need to distinguish carefully between the variation of VTT in the population, which we describe in our model, and the error arising in the model because the parameters are estimated with error. First we focus on the population variance T of VTT, which comprises the within-record variance T_1 and the between-record variance T_2, so that $T = T_1 + T_2$. The within-record variance is generated by the mixed logit model and is similarly dependent on the log uniform distribution. The within-record variance measure T_1 was already defined in equation (I.3). To bring T_1 from the record to the population level, its weighted average is used across the records.

The between-record variance can be calculated as

$$T_2 = \frac{\sum_{k \in S} w_k l_k \left(VTT_k(\Delta t) - \overline{VTT_S(\Delta t)}\right)^2}{\sum_{n \in S} w_n l_n} = \frac{\sum_{k \in S} w_k l_k VTT_k(\Delta t)^2}{\sum_{n \in S} w_n l_n} - \overline{VTT_S(\Delta t)}^2 \qquad \text{(I.5)}$$

This is a relatively straightforward calculation when the mean is also being accumulated.

In the following sections, we give the formulae for calculating error in the estimates of mean VTT. This is then followed by the procedure to be used for dealing with error relating to the NTS sample.

I3.2 Error in the mean

To calculate error in the mean VTT estimate for a segment, we apply the 'delta method' for the variance of a function of random variables, which can be shown to be in some respects optimal when applied to maximum likelihood estimates[3]. The error in $\overline{VTT_S}$ is calculated by

$$var(\overline{VTT_S}) = \Phi' \Psi \Phi \qquad \text{(I.6)}$$

where Φ is the vector of first derivatives of $\overline{VTT_S}$ with respect to the estimated parameters and Ψ is the covariance matrix of those parameters.

Given the form of the equation for $\overline{VTT_S}$, it is clear that

$$\Phi = \frac{\sum_{n \in S} w_n l_n \phi_n}{\sum_{n \in S} w_n l_n} \qquad \text{(I.7)}$$

where ϕ is the vector of first derivatives of VTT for the specific record n.

For calculation, therefore, we need to accumulate the components of ϕ at the same time, and with the same weights, as we accumulate the VTT itself. The specific calculations of derivatives are shown in **Appendix G**.

I3.3 Error in the NTS sample: 'bootstrapping'

The NTS sample used in this study is large, so that it should give a reliable picture of the total population. Further, weights are provided with the data that should correct for several biases, such as differential response by specific population groups. However, it remains a sample survey and is thus subject to error. Moreover, some of the segments of interest are small fractions of the total population, so that for these segments the sample error may be larger. It is,

[3] Daly, A., Hess, S. and de Jong, G. (2012) 'Calculating errors for measures derived from choice modelling estimates'. Transportation Research B, 6, pp333-341.

therefore, useful to develop methods for estimating the error arising because of the sample nature of the NTS data.

The method being used for this calculation is the 'bootstrap'. This method works by 'resampling', that is, constructing a sample that is of the same magnitude as the estimation sample, drawn from the same population, but different from the estimation sample. By drawing such samples repeatedly we can determine how much the statistics of interest vary between samples and hence what the sampling error is.

However, because we do not have another sample, the bootstrap method works by constructing different samples from the original sample. This is done by drawing samples of the original size from the original sample, *with replacement*, so that some records may be sampled several times and others not at all. The well-researched literature on the bootstrap method assures us that the variation across these samples gives a good and unbiased representation of the true variation due to sampling.

In practice we apply a quick calculation procedure originally developed for use with the ALOGIT software. A little experimentation is needed to find the appropriate number of samples to draw: usually around 50 is suitable.

This approach is applied to find the NTS sampling error in the mean and standard deviation of the VTT.

I4 Validating the Implementation Tool

'R' is an object oriented programming language which reads in the NTS data and relevant model parameters. The R script selects the relevant columns in the NTS data needed for calculating the expected Value of Travel Time *for a specific record 'n'* (denoted here 'VTTn') given the mode-purpose combination for this particular record.

I4.1 Record level validation

In calculating the expected VTT, R exactly follows the formulae derived in **Section I3** above. This allows for directly validating the Tool output at the record level. For this purpose, a single record was extracted from the NTS data and subsequently replicated and altered such that each mode-purpose combination was present in the dataset leaving all other trip- and respondent characteristics constant. For each of the eleven records (i.e. mode/purpose combinations), the corresponding choice model was consulted to obtain the relevant parameters of:

i) the log-uniform distribution

ii) size and sign effects to define kappa

iii) income, cost, time and distance elasticities

iv) SP game multipliers; and

v) other covariates.

After setting Δt, the relevant calculations were conducted in Excel to replicate the VTT for each record.

Varying the selection of SP game multipliers randomly across the records, the following conclusions can be reached:

- The Tool reads the input file correctly
- The Tool correctly manipulates the data for the eleven consulted records
- VTT has been identically replicated each time using Excel

I4.2 Comparison based on SP data

A similar validation exercise was conducted based on the SP data, focussing on the car mode. The SP data for this mode were transformed into the NTS data format (on the relevant variables) and processed by the Tool. This produced a population weighted estimate of VTT. These outputs were then compared to average VTT approximations provided by the Ox-based code used for estimating the behavioural models in **Chapter 4**. Given that the Tool is based on analytical (exact) VTT, but the Ox code relies on simulation, some small discrepancies were found between the R-model output and Ox VTT approximations. The discrepancies are small enough such that they can be attributed to simulation error. Again this supports the validity of the Tool.

I4.3 Additional validation exercises

Apart from cross-referencing the output of the Tool, a simulation approach was also used to validate whether the formulae for mean, error and population variance in VTT were implemented correctly. This was conducted in parallel to developing the Tool, and helped to identify and eliminate bugs.

Table I1: NTS variables used in the Tool

Name	Definition	Class of variable	Nature of variable	Range	Model covariate
Mode in VTT Categories	Mode; 1 = Car; 2= Bus; 3= Rail; 4 = Other				
TripDistIncSW	Distance by car for the O-D pair in miles (including short walks)	Reference	Continuous	0-	Y
StageTime	Stage travel time - minutes - actual time		Continuous	0-	Y
Cost	Fuel or PT stage cost (one way) in £			0-	Y
HH_income	HH income at midpoint of categories	Income	Continuous	5K-125K £ per year	Y
Pers_income	Personal income at midpoint of categories		Continuous	5K-125K £ per year	Y
HH_Inc_Quintile	Household income quintile		Categorical	1-5	N
mult_one_van_VTT	1 = regular access to one van , 0= no van access, or multiple vans	Vehicle access	dummy		Y
mult_one_plus_car_VTT	1 = regular access to one or more cars , 0= no car access		dummy		Y
mult_2plus_motos_owned_VTT	1= regular access to two or more motors, 0= otherwise		dummy		Y
mult_part_time	1 = part time employed ; 0 = otherwise	Employment	dummy		Y
XSOC2000_B02ID	Occupation (SOC 2000 main group)		Categorical	1-9	N
mult_self_empl	1= self employed ; 0= otherwise		dummy		Y
mult_part_time	1 = other type of employment; 0 = otherwise		dummy		Y
econ_inac_not_retired	1=economically inactive but not retired; 0 = otherwise		dummy		Y
mult_self_empl_briefcase	1= paid employed_briefcase, traveller; 0 = otherwise		dummy		Y
mult_self_empl_briefcase	1 = self employed ‘bluecollar’ traveller; 0 = otherwise		dummy		Y
mult_hh_1_child	1= one child <=17 in the house, 0= otherwise	Household composition	dummy		Y
mult_hh_2_adults	1= two adults in the house, 0= otherwise		dummy		Y
mult_hh_2_children	1= two children<=17 in the house, 0= otherwise		dummy		Y
mult_hh_2pls_adults	1= two or more adults in the house, 0= otherwise		dummy		Y
mult_hh_3plus_adults	1= three or more adults in the house, 0= otherwise		dummy		Y
mult_hh_3plus_children	1= three or more children<=17 in the house, 0= otherwise		dummy		Y

Name	Definition	Class of variable	Nature of variable	Range	Model covariate
mult_hh_children	1= children>0 ; 0=otherwise		dummy		Y
mult_age_17_20	1= Age between 17-20 0= otherwise	Age	dummy		Y
mult_age_17_29	1= Age between 17-29 0= otherwise		dummy		Y
mult_age_17_39	1= Age between 17-39 0= otherwise		dummy		Y
mult_age_21_29	1= Age between 21-29 0= otherwise		dummy		Y
Age_B01ID	Age		Continuous	17-	N
mult_female_VTT	1= Female , 0= male	Gender	dummy		Y
mult_geogr_1	1=London<>London, 0 = otherwise	Flow type	dummy		Y
mult_geogr_2	1=Urban<>London, 0 = otherwise		dummy		N
mult_geogr_3	1=Urban<>Urban (20miles or less), 0 = otherwise		dummy		N
mult_geogr_4	1=Urban<>Urban (>20miles), 0 = otherwise		dummy		N
mult_geogr_5	1=Rural<>Rural/Urban, 0 = otherwise		dummy		Y
mult_access_journey	1= part of a longer journey using other modes, 0= main / only mode of transport		dummy		Y
mult_additional_travellers_VTT	1= Party size >1, 0 = Party size = 1		dummy		Y
mult_share_or_no_driving	1= driving is shared or person is not driving		dummy		Y