

The Impact of Fare Policy Changes on Public Transport Demand in London to 2011

This note is based on Nihit Jain's Master's dissertation which advanced TfL's bus and Underground demand analysis for the period 1970 to 2000 to the end of 2009 and also examined the first year of the extension of PAYG to National Rail services in London from January 2010.

Summary

The Jain research indicates that London bus and Underground fares and economy elasticities have not changed significantly since 2000.

With respect to the impact of the introduction of Oyster PAYG on TfL services, the Jain research found that demand increased by 4.7% on the Underground and 2% to 3%, on the buses. The increase on the buses was not statistically significant at 95% confidence level.

Analysis of the impact of extending PAYG to National Rail showed that, after controlling for other changes, rail demand rose by between 3% and 4% in the first year to January 2011.

TfL Price Elasticities

Table 1 below presents the main bus demand fare elasticities and economy impacts from the study by Mitrani analysing 1970 to 2000 data and shows the equivalent estimates from Jain's study using data to 2009. Table 2 presents these parameters for the Underground.

Table 1: Bus demand comparable fare elasticities and economy impacts

	Nihit Jain (1970-2009)	Mitrani (1970-2000)	Notes
Bus Fares Elasticity			
Own bus fare	-0.63	-0.64	Reduction in bus demand if bus fares alone rise
Cross bus demand with U/G fares	0.12	0.13	Immediate switch in demand to buses resulting from an increase in Underground fares
Cross bus demand with NR fares	+0.17	+0.16	Immediate increase in bus demand resulting from an increase in National Rail fares
Conditional bus fare	-0.35	-0.35	Immediate reduction in bus demand from a proportional change in all PT fares
Smoothed bus fare	-0.17	-0.17	Long term further reduction in bus demand from a proportional change in all PT fares
Economy impact, %			
Unemployment	-0.49	-0.42	Effect of a 10% increase in Greater London unemployment
Consumer spending	+0.86	+0.78	Effect of a 10% increase in retail sales
Population	+10.0	+10.0	Effect of a 10% increase in population in Greater London
Cars per head	-8.8	-8.5	Effect of a 10% increase in Car per head in Greater London

The bus and Underground demand variables (i.e. the dependent variables in the models) were constructed using 4-weekly bus and Underground revenues deflated by ex-ante fares indices to derive revenue at constant fares – essentially proxies for bus and Underground journeys. The bus demand series was then further deflated by London population. For the

Underground demand variable, London population was weighted by 0.45 to represent 45% of Underground demand directly related to the size of Greater London's population and not to work purposes. These adjustments were made, as in previous studies, because London population is highly correlated with other exogenous variables and therefore could not be modelled independently. This however meant that fixed population elasticities of 1 and 0.45 were imposed on the bus and Underground demand models respectively.

Another caveat in this formulation of demand using the ex-ante price indices is that it implicitly assumes there will be no switching between ticket types from one year to the next, though adjustments were made if new ticket types are introduced or others eliminated.

Table 2: Underground demand comparable fare elasticities and economy impacts

	Nihit Jain (1970-2009)	Mitrani (1970-2000)	Notes
Tube Fares Elasticity			
Own Tube fare	-0.43	-0.49	Reduction in Underground demand if Tube fares alone rise
Cross Tube demand with Bus fares	0.13	0.20	Immediate switch in demand to the Tube resulting from an increase in bus fares
Cross Tube demand with NR fares	+0.11	+0.08	Immediate increase in Tube demand resulting from an increase in NR fares
Conditional Tube fare	-0.19	-0.20	Immediate reduction in Underground demand from a proportional change in all PT fares
Smoothed Tube fare	-0.04	-0.03	Long term further reduction in Underground demand from a proportional change in all PT fares
Economy impact, %			
Employment	+6.1	7.1	Effect of a 10% increase in Greater London employment
Consumer spending	+0.7	+1.8	Effect of a 10% increase in retail sales
Population	+4.5	+4.5	Effect of a 10% increase in population in Greater London
Tourism	+0.4	+0.6	Effect of a 10% increase in tourism
Car per head	-4.1	-5.3	Effect of a 10% increase in Car per head in Greater London

The independent variables representing the demand impact of fares changes were based on the ex-ante fares indices described above but were deflated by either retail prices or an index of average earnings. Earnings are thought to be a better indicator of fares affordability and result in more stable elasticity estimates over long periods.

As presented in Table 1, the modelled fares elasticities mean that for buses a 10% increase in bus fares alone will reduce bus demand by 6%. If bus fares rise in line with fares across all public transport modes a 10% increase will reduce demand by 3.5% immediately and by a further 1.7% in the long term, a year after the initial increase, resulting in a total reduction of 5.2%. The long term fares elasticity was modelled by exponentially smoothing the own fare variable.

The modelled elasticities mean that for the Underground a 10% increase in Tube fares alone will reduce Tube demand by 4% (see Table 2). If Tube fares rise in line with all public transport modes a 10% increase will reduce demand by 1.9% immediately and by a further 0.4% in the long term – resulting in a total reduction of 2.3%.

The bus and Underground model derived results from the 1970-2009 dataset were similar to those produced by the previous study using 1970-2000 data. The demand impacts of the economic drivers are described in the Notes column of Tables 1 and 2 above.

Bus demand impact of PAYG and free travel for children

The bus model's best estimate of the effect of PAYG on buses was a demand increase of 2% to 3%, which was not statistically significant at 95% confidence intervals but was at 90%. The model suggested the policy of providing free travel for children under 16 years old decreased revenue by 6%, while separate analysis showed the actual number of journeys made by this market segment was 19% of all journeys by the end of 2009.

Underground demand impact of PAYG

The model suggested that PAYG increased demand on the Underground by a statistically significant 4.7%, within the 95% confidence range of +0.8% to +8.8%. The model further suggested that large cash fare increases in 2006 reduced demand by 4.2%.

Estimated impact of Oyster PAYG on National Rail

Table 3 below shows that after allowing for seasonal variation and controlling for network wide year on year growth in demand, NR journeys in London rose by 6.6% more than expected following the main phase of PAYG implementation in January 2010. This growth was accompanied by large decreases in TOC single Tickets (55%) and Point to Point Seasons (16%) as well as Off- Peak Travelcards (6%).

Table3: Control factor adjusted National Rail journeys comparison

Ticket Detail	4-10 Oct 2009 with 5% growth (millions)	26 Sept - 2 Oct 2010 (millions)	Change (millions)	Change (per cent)	Change as % of PAYG
TOC Single and Return Tickets	1.22	0.54	-0.68	-55.7	-42.8
TOC Point to Point Seasons	1.06	0.89	-0.17	-16.0	-10.7
Off-Peak Day Travelcards	1.45	1.36	-0.09	-6.2	-5.7
Anytime Day Travelcards	0.43	0.39	-0.04	-9.3	-2.5
7 Day Travelcard seasons	1.99	2.05	0.06	3.0	3.8
Monthly Travelcard seasons	1.51	1.49	-0.02	-1.3	-1.3
Annual Travelcard seasons	1.20	1.17	-0.03	-2.5	-1.9
Pay-as-you-Go	0.47	2.06	1.59	338.3	100.0
Total	9.33	9.95	0.62	6.6	39.0
Less demand impact of the ELL			(0.19 to 0.26)		
OXNR			0.36 to 0.43		

Note: Errors were discovered in Nihit Jain's equivalent table which have been corrected in the above.

After further allowing for the estimated increase in demand from the newly extended East London Line, the PAYG extension was estimated to have increased demand on London rail services by 4% to 5%. Continuing growth in PAYG usage on National Rail since then indicates that the impact on demand may be up to 10% - worth around £100m pa in round terms.