

Cash or prepay: understanding passenger choice for different products

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Abstract

Growing cashless services in the Sydney metropolitan region is motivated by the clear supply-side benefits associated with the prepayment of public transport fares. This paper examines the effect on prepay following the 'MyZone' fare and ticket reform in NSW introduced in April 2010. 'MyZone', introduced two new discounted and standardised prepay products, including a new, multi-modal ticket. Whilst these changes had implications for all public transport providers in the Sydney metropolitan area, it had significant ramifications for the many private bus operators who, for the first time, could provide and accept tickets which integrated their services with the state run rail, ferry and bus network.

This paper reports the results of passenger surveys, undertaken 'before' and 'after' MyZone implementation, of a private bus operator in northern Sydney. The results show there are significant differences in the characteristics of passengers using multi-modal versus pay-as-you-go tickets and that this difference is driven largely by age, income and interchange. Prior to MyZone, prepay users were easily predicted and the fare and ticket reform was successful in transitioning some cash users to prepay but following MyZone's introduction prepay users were no longer predictable unless separated into prepay product groups. Passengers who continued to pay cash after the fare and ticket reform showed high sensitivity to public transport cost and are those passengers with the lowest incomes. This suggests that there is no 'one size fits all' with public transport prepay ticketing and that passengers' different motivations must be considered when designing prepay ticket products.

1. Introduction

The benefits derived from the prepayment of public transport fares have resulted in many operators and local authorities encouraging passengers to use prepaid tickets. Driven mainly by supply-side benefits, including a reduction in dwell times and cash handling, passengers have been encouraged, and often incentivised through discounts, to utilise prepay products. Following the introduction of 'MyZone' ticketing by the New South Wales Government in Australia in April 2010 the number of prepay products at the disposal of bus, train and ferry passengers across the Sydney metropolitan region increased. A range of new standardised prepay ticket products were developed which included a multi-modal (MyMulti) ticket, accepted on all public transport services in the region, as well as a new pay-as-you-go (MyBus) ticket. Whilst these changes had implications for all public transport providers in the Sydney metropolitan area it had significant ramifications for the many private bus operators who, for the first time, could provide tickets which integrated with the state run rail, ferry and bus network. Many private bus operators had previously offered operator-specific

discounted prepay tickets, to grow patronage and improve service quality but following this fare reform the new integrated MyZone tickets were the only discounted prepay tickets approved for sale.

This study analyses the effect that the new fare types had on passenger payment methods at one private bus operator in New South Wales in order to better understand passengers' ticket choice. The results clearly show that socio-economic and demographic variables significantly influence this choice with the market for pay-as-you-go and multi-modal products segmented across these variables. Whilst offering these different prepay products better addresses market need the results of this study suggest that there is still a substantial group of frequent passengers who, as a result of upfront costs, will continue to forgo prepay and pay cash for their tickets. By better understanding these different motivations operators and local authorities may be able to further develop their product offering in order to ensure that prepay usage continues to grow and the benefits to the supply-side increase.

2. Literature

A number of studies have explored the appeal of different fare types for different customers. This paper builds on the existing literature by analysing the impact on passenger payment method following the unprecedented reform of the public transport fare and ticket system to MyZone in New South Wales which was part of an overall policy to reduce cashless fares.

2.1 Appeal of fare types

Wardman & Hine (2000) assessed the appeal of multiple mode tickets by analysing the market for interchange in the West Midlands region of the UK. Citing a 1993 report by the West Midlands Integrated Transport Authority (Centro) they argued that journey purpose influenced propensity to interchange with interchange being viewed as too unreliable for time sensitive trips such as journeys to work. Furthermore interchangers were disproportionately more likely to be younger and less affluent than the average public transport user. Without a multi-modal ticket these passengers were more likely to pay cash than use operator or mode-specific prepay. Ipsos MORI's (2010) assessment of support for integrated ticketing across three UK cities suggested its appeal to similar groups. Survey results indicated the intermodal, day ticket, valid across all operators appealed most to younger individuals who did not have a car available for their journey and who made frequent trips across multiple modes.

Whilst this paper analyses the effect on fare paying behaviour following the introduction of a multiple mode ticket the results of Nuworsoo *et al.* (2009) are relevant despite considering the reverse policy of the potential impact of removing unlimited multi-modal travel passes from passengers' ticket options. Against a background of large budget shortfalls on the Alameda–Contra Costa Transit, California, this paper argued that abolishing this ticket would adversely affect low income travellers who were more likely to use unlimited ride passes and make an interchange than more affluent riders. This broadly agrees with the characteristics of interchanging passengers described by Wardman & Hine (2000) and Ipsos MORI (2010).

The MyZone fare and ticket reform effectively replaced an operator-specific discounted pay-as-you-go ticket with an integrated discounted pay-as-you-go product in the form of the MyBus TravelTen. This type of pay-as-you-go fare has been identified by McCollum and Pratt's (2004) empirical study, citing 1994 work by Oram and Schwenk, as appealing to passengers who do not travel frequently enough to reach the break-even point for unlimited travel passes. White (2009) agreed with this describing London's pay-as-you-go Oyster product as attractive for less frequent travellers with socio-economic and demographic characteristics being a significant driver for these products too. Cervero (1990) confirms this in an analysis of the 'Deep Discount Fares' in Allentown PA, (very similar to the MyBus

TravelTen concept) as appealing to young, non public transport captive and relatively affluent passengers.

While the fare and ticket reform changed the composition of the discounted prepay products available for passengers in NSW, cash fares continued to be available for passengers. McCollum and Pratt (2004) argue that not all passengers are attracted by discounted fares and cited 1998 work by Fleishman which asserted that the upfront costs involved in purchasing prepaid fares may dissuade some riders from using prepay. They also identified concerns that less frequent passengers have with prepay products in terms of wanting to be able to utilise the credit within a reasonable amount of time.

So despite the different geographies the literature highlights similarities in the appeal of different ticket products for different groups of passengers. Passenger income is identified as one of the key drivers in influencing this appeal. While the upfront costs of prepay can drive low-income passengers away from prepay altogether, affluence can also influence the selection of specific prepay product. Pay-as-you-go fare products are identified as appealing to higher income passengers while the unlimited pass multi-modal products appeal to less affluent riders. The need to interchange is associated with increased multi-modal ticket use which is unsurprising given these reduce the financial penalties of interchanging. A number of the studies (for example Wardman & Hine, 2000) argue that the market for interchange is dominated by younger and less affluent passengers with low levels of car ownership. Pay-as-you-go ticket types appear to appeal to very different users. The use of pay-as-you-go ticket products is associated with more affluent passengers, with higher car availability who do not make an interchange. While journey characteristics separate multi-modal and prepay ticket users, the literature, suggests that age is a unifying factor between these two groups. Both prepay fare types are associated with younger passengers suggesting whilst age may not be an important determinant of specific prepay products, it is associated with overall prepay use.

In summary, the literature suggests that to investigate which travellers use different fare and ticket types, it is important to take account of journey purpose, the need or otherwise to interchange, income and age.

2.2 Attitudes to travel

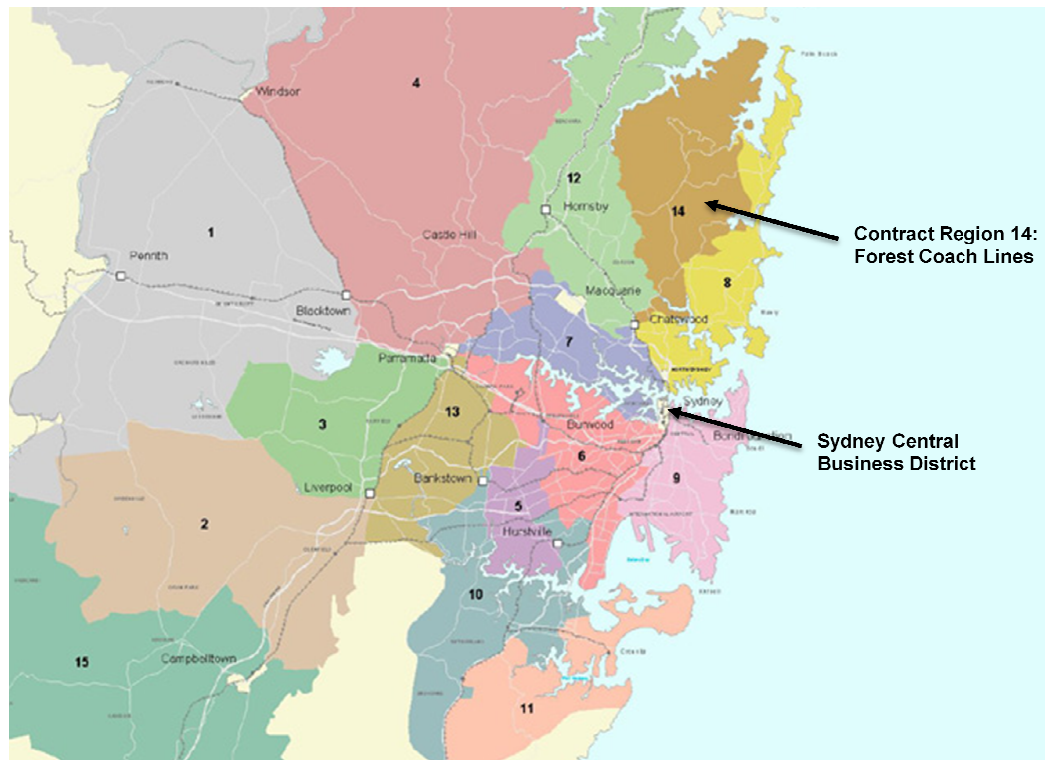
While travel time has traditionally been regarded as a burden or disutility for the traveller, there is evidence (for example Jain and Lyons, 2008) that travel time can have a positive utility for the traveller with Mokhtarian and Chen (2004) discussing the concept of a travel time budget. While the literature in the previous section has highlighted the importance of socio-economic and demographic variables in influencing fare and ticket choice, the role of attitudes in travel behaviour is absent, travel time and its valuation is likely to vary between passengers with travel time savings being likely to be more important for wealthier passengers. In addition, higher proportions of prepay passengers can shorten vehicle dwell time, making overall journey times lower for all passengers. So the link between attitudes and fare choice may be important from a number of perspectives. Firstly it reinforces, or otherwise, economic factors, such as travel time valuation, in fare and ticket choice. Secondly, for frequent bus users, where knowledge of the fare and ticket system is likely to be best informed, you would expect ticket choice to minimise disutility. So although the literature does not link attitudes to fare choice it is important that they are included in a study which looks at the characteristics of passengers exhibiting different fare and ticket choices.

3. Methodology

The empirical data comes from two surveys of passengers of a private bus operator in northern Sydney, Forest Coach Lines (Forest). Forest is contracted to provide services in

contract region 14 in northern Sydney and services are provided both within this contract region and to the Central Business District of Sydney, both of which are shown in Figure 1.

Figure 1: Sydney metropolitan contract regions



Two on-board surveys were conducted on a cross-section of Forest services operating in the morning peak. Questionnaires were handed to passengers on boarding and collected when they alighted. 183 responses were collected two weeks prior to the fare and ticket reform and this process was repeated, across the same range of services, six weeks after MyZone's introduction when a further 295 surveys were collected from passengers. The targeting of morning peak hour services was a deliberate attempt to survey frequent passengers making a journey to work, thus standardising for journey purpose and capturing passengers whose knowledge of the fare and ticket types was likely to be most informed. Prior to MyZone Forest passengers had two discounted prepay options – the Faresaver and Weekly ticket. Faresaver was a stored-value card onto which credit could be loaded and then redeemed for discounted tickets. The Weekly ticket, was priced at eight single cash trips and provided unlimited travel between a set origin and destination for seven consecutive days. Whilst these ticket types were retained post-MyZone, they were no longer associated with discounted fares and their use declined significantly – in particular the Weekly ticket for which there were no recorded users in the post-MyZone survey.

The questionnaire was designed to elicit information about trip purpose, frequency and type (e.g. whether an interchange was made) as well as information about the ticket being used. The section seeking to understand passengers' attitudes to travel was adapted from Handy *et al.* (2005) and adjusted to an Australian and public transport context. These general attitudes pertained to 'pro-travel' (or 'utility from travel'), 'pro-public transport' and 'pro-car' attitudes in addition to statements relating to cost, or 'economic travel'. Socio-economic variables, including questions on the respondents' age, income, gender and car availability were included. This design ensured that the questionnaire responses would provide information identified by the literature as being important in determining the characteristics of travellers fare payment and ticket purchasing behaviour.

4. Results

Data from the surveys was collected and analysed to assess the impact that the fare reform had on the fare paying and ticket purchasing behaviour of the *frequent* Forest passengers – defined here as passengers making at least two return trips per week using Forest bus services. The analysis of the before and after MyZone introduction revealed that although there was an absolute increase in percentage terms of prepay usage this increase was not statistically significant. 69.7% of passengers prepaid following the introduction of MyZone as compared to 60% before. The increase in prepay was largely at the expense of the no longer discounted operator specific prepay tickets which decreased from 60% to less than 10% and cash fares which decreased from 40% to 30%.

The following sections look first at the role of attitudes in ticket type purchase before turning to the results investigating the causal relationship between prepay use and passenger characteristics.

4.1 The role of attitudes

Influenced by literature, for example Handy et al.'s (2005) approach for identifying different attitudes to travel which identified a strong role for attitudes in determining travel behaviour, users were asked to respond to 20 attitudinal questions. Principal component analysis (PCA) was used as a data reduction technique in preference to common factor analysis since PCA does not make a priori hypotheses on the structure of the matrix of covariance (Diana, 2008). With varimax rotation the 20 statements were reduced into six factors which, taking the loadings into account, are interpreted as pertaining to *pro-bus use*, *sensitive to travel time*, *sensitive to public transport costs*, *finding utility from travel itself*, *content bus users* and *pro-car use*. The loadings of each statement are shown in Table 1 where a loading less than 0.4 has been excluded.

Table 1: Factor Loadings from principal component analysis on attitudes to travel

Factors (a)	Statements – variables	Loadings (b)
Pro-bus use	Taking the bus can sometimes be easier for me than driving.	.753
	Travelling provides a useful transition between home and my destination.	.750
	My local bus provides good value for money.	.673
	I think my local bus services have improved over the last year.	.646
	I think my local bus services will improve over the next year.	.644
	I enjoy travelling by bus.	.501
Sensitive to travel time	Getting to my destination is half the fun.	.407
	I would use my local bus more if journeys were faster.	.730
	The only good thing about travelling is arriving at my destination.	.692
	I don't use my local bus because journey times are too slow.	.687
	My travel time is generally wasted time.	.605
	I would use my local bus but I live too far from the nearest bus stop.	.529
Sensitive to public transport costs	Saving money on my travel is important to me.	.861
	I would use my local bus more if it was cheaper.	.768
	I would use train services or ferries more if they were cheaper.	.715

Factors (a)	Statements – variables	Loadings (b)
Utility from travel itself	I sometimes like to travel for travel's sake.	.697
	Getting to my destination is half the fun.	.656
	I would use my local bus but I live too far from the nearest bus stop.	.585
Content bus users	I think my local bus services will improve over the next year	.414
	I enjoy travelling by bus.	-.425
	I use my travel time productively.	-.710
Pro-car use	I only use the bus because I have to.	.419
	I enjoy driving.	.888
	I would always chose to use my car rather than take public transport if costs were the same.	.457
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. (a) rotation converged in 10 iterations. (b) Degree of association between factors and variables. Loading cut-off: 0.4.		

A one-way ANOVA was used to test whether significant differences in the normalised factor scores existed between cash and prepay respondents in relation to these factors. The results are shown in Table 2 which identifies that the results are statistically significant at the 5% level for two of the factors: cash users gain a higher utility from travel itself than prepay respondents and cash users are more pro-car than their prepay counterparts in their attitudes.

Table 2: ANOVA between cash and prepay users attitudes pre-MyZone

Factor	Average Prepay Respondents	Average Cash Respondents	p-value pooled data ^a
Pro-bus use	-0.01	0.01	0.90
Sensitive to travel time	-0.05	0.08	0.47
Sensitive to public transport costs	0.01	-0.02	0.86
Utility from travel itself	-0.18	0.29	0.01
Content bus users	-0.12	0.19	0.09
Pro-car use	-0.14	0.24	0.04

(a) p-value for F-statistics from analysis of variance (ANOVA)

p-value significant at 5%

Following the implementation of MyZone the statements were again reduced into their underlying factors which are reported in Table 3. The factors were similar to those pre-MyZone but the only statistically significant factor (at the 5% level) separating prepay and cash users was in relation to sensitivity to public transport costs with cash users displaying a high sensitivity to fares than prepay passengers.

Table 3: ANOVA between cash and prepay users attitudes post-MyZone

Factor	Average Prepay Respondents	Average Cash Respondents	p-value pooled data ^a
Pro-car use	-0.05	0.13	0.285
Utility from travel itself	-0.05	0.13	0.267
Sensitive to travel time	0.03	-0.08	0.53
Content bus users	-0.05	0.12	0.342
Sensitive to public transport costs	-0.13	0.32	0.008
Utility from travel time	0.00	0.00	0.987
Misc. priorities for travel	0.07	-0.19	0.125
(a) p-value for F-statistics from analysis of variance (ANOVA)			
p-value significant at 5%			

This difference between the attitudes of prepay and cash users before and after MyZone's implementation is shown in the comparison of attitudes between pre- and post-MyZone prepay passengers in Table 4. Prepay passengers post-MyZone gained significantly greater utility from travel itself and were more sensitive to travel time than their pre-MyZone counterparts and suggests in turn that the characteristics of prepay users has changed following the introduction of MyZone fare and ticket products.

Table 4: ANOVA between prepayers pre- and post-MyZone

Factor	Average Prepay Pre-MyZone	Average Prepay Post-MyZone	p-value pooled data ^a
Pro-bus use	0.05	-0.03	0.577
Sensitive to travel time	-0.29	0.18	0.001
Disutility from travel time	-0.04	0.02	0.661
Sensitive to public transport costs	0.00	0.00	0.973
Utility from travel itself	-0.30	0.19	0.001
Pro-car use	-0.07	0.04	0.426
(a) p-value for F-statistics from analysis of variance (ANOVA)			
p-value significant at 5%			

4.2 The characteristics of prepay passengers

4.2.1 Characteristics of prepay passengers before the introduction of MyZone fare and ticket reform

Literature and exploratory data analysis laid the foundation of establishing the best causal relationship to explain the propensity of passengers to prepay for their public transport journey in terms of passenger and journey characteristics. Using logistic regression models to explain prepay users the final model was a compromise between the inclusion of variables identified as important in the literature and model fit. The dependent variable was the dichotomous variable of prepay or not (i.e. prepay versus cash payment of fare). Importantly significant correlations between many of the variables were identified with the most relevant between interchange, age and income. The results are shown in Table 5.

Table 5: Pre-MyZone logistic regression model

Variable	B (SE)	Sig.	95% C.I. for EXP(B)		
			Lower	Odds Ratio Exp(B)	Upper
Travel frequency: daily	1.153* (0.545)	0.034	1.089	3.168	9.216
Factor 6: Pro-car use	0.529* (0.231)	0.022	1.08	1.697	2.667
Factor 4: Utility from travel itself	0.485* (0.228)	0.033	1.039	1.624	2.537
Salary: less than \$52,000	-1.318* (0.484)	0.006	0.104	0.268	0.691
Public transport interchange	-0.527 (0.501)	0.293	0.221	0.59	1.576
Constant	0.353 (0.487)	0.468		1.423	

$R^2 = .235$ (Cox & Snell), $.320$ (Nagelkerke), * $p < .05$

All variables identified as influencing prepay are significant within the model with the exception of public transport interchange. Exploratory analysis showed that 57.4% of passengers aged less than 31 interchanged, whereas 21.9% of passengers aged between 31 and 50 did so and just 7.7% of passengers aged more than 50 interchanged as part of their journey. Supporting research from Wardman & Hine (2000) suggesting that interchange was an important variable, cross-tabulations confirmed that interchangers were significantly ($p=.011$) more likely to pay for their fare with cash, with 54.2% of interchanging passengers paying cash compared to just 32.3% of non-interchangers doing so. Interchange is however highly correlated with the socio-economic / demographic variables of age ($-.406$) and income ($-.389$). Therefore the regression estimation will thus only imperfectly be able to attribute variability in the dependent variable to this interchange explanatory factor because of multicollinearity. Interchange was retained in the regression because, although insignificant, it improved the overall fit as shown by Cox & Snell and Nagelkerke R-square values. For interpretation purposes, it must be remembered that, some of the impact of public transport interchange will be captured in the reported parameter estimate for income. Age as an explanatory variable was removed following a similar rationale and its inclusion in the model reduced goodness of fit and increased all standard errors with income performing better than age as a socio-economic variable.

Attitudes to travel are statistically significant in the model and the results show those attitudes relating to utility from travel itself and pro-car use separate prepay and cash users and are significant in explaining fare choice within this logistic regression model. Passengers displaying a greater utility for travel itself and a more pro-car attitude were significantly more likely to use cash to pay their bus fare.

The results suggest that socio-economic characteristics, journey frequency and journey characteristics as well as attitudes to travel influence passengers' payment choice. Higher income earners (earning more than \$52,000 per year) are significantly more likely to be prepayers. These passengers are also likely to travel directly to their destination. Passengers making an interchange are significantly more likely to pay for their fare in cash with 54.2% of interchangers paying cash against just 32.2% of non-interchangers doing so. They are also younger and less affluent than non-interchangers. These variables – interchange, age and income – are themselves highly correlated with each other. More frequent passengers (those travelling daily) are significantly more inclined to use a prepay ticket. Furthermore the influence that attitudes have on payment choice is significant with pro-car and attitudes displaying greater utility for travel influencing the selection of a cash fare.

4.2.2 Characteristics of prepay passengers after the introduction of MyZone fare and ticket reform

Although the number of prepay users increased in absolute percentage terms the proportion of prepay passengers did not change significantly ($p = .071$) after the introduction of the new fare and ticket system. However the characteristics of the prepay and cash users altered substantially as suggested by the change in attitudes discussed in the previous section. The first approach to modelling was to replicate the model of the pre-MyZone prepay use. This had poor model fit ($R^2 = .122$ - Cox & Snell, $.176$ - Nagelkerke), with the only significant independent variables relating to passengers' sensitivity to public transport costs (including income variables and the factor from attitudes to travel relating to sensitivity to costs). The way in which the characteristics of prepayers cannot be explained and predicted with any great power post-MyZone is thought to be due to the diversity of prepay tickets introduced following MyZone. This was tested by modelling separate logistic regression models explaining and predicting passengers of pay-as-you-go fare types (MyBus TravelTen and Faresaver) and multi-modal (MyMulti) ticket holders.

The separate models display superior overall goodness of fit, as compared to the combined model, as well as having significant explanatory variables. The model explaining passengers using pay-as-you-go prepay products is shown in Table 6.

Table 6: Logistic regression model to explain pay-as-you-go users

Variable	B (SE)	Sig.	95% C.I. for EXP(B)		
			Lower	Odds Ratio Exp(B)	Upper
Interchange onto other public transport	1.605* (0.39)	0	2.319	4.978	10.687
Salary between \$31,200 - \$51,999	1.391* (0.575)	0.016	1.301	4.018	12.41
Salary between \$52,000 - \$83,199	0.168 (0.494)	0.734	0.449	1.183	3.113
Salary greater than \$83,200	-1.319* (0.521)	0.011	0.096	0.267	0.742
Car available for journey	-0.987* (0.404)	0.015	0.169	0.373	0.823
Constant	-0.87 (1.005)	0.387		0.419	

$R^2 = .309$ (Cox & Snell), $.413$ (Nagelkerke), * $p < .05$

Income variables, which dominate the model, have been included as a set of dummy variables with the lowest income bracket excluded from the model. These variables suggest that as passengers' salaries increase so does the likelihood of their use of pay-as-you-go tickets. Whilst a passenger with an income of between \$31,200 – \$51,999 per annum ($B = 1.391$) is less likely to use pay-as-you-go product than another ticket type a respondent earning over \$83,200 ($B = -1.319$) is more likely to be using one of these tickets than a passenger with a different income bracket. Interchange also influences this ticket choice with passengers making an interchange ($B = 1.605$) significantly less likely to be using this type of ticket product. Given that pay-as-you-go tickets do not remove interchange penalties and there is correlation between interchange and age/low income, this is not surprising. A further indication of the income effect of pay-as-you-go users is provided by the negative impact of the remaining significant variable in the model – car availability for the journey ($B = -0.987$).

Users of the multiple mode ticket product displayed quite different characteristics as shown by the results for the separate logistic regression model in Table 7.

Table 7: Logistic regression model to explain multi-modal users

Variable	B (SE)	Sig.	95% C.I. for EXP(B)		
			Lower	Odds Ratio Exp(B)	Upper
Interchange onto other public transport	-2.488* (0.403)	0	0.038	0.083	0.183
Journey Type - Journey to work	-1.099* (0.528)	0.037	0.118	0.333	0.938
Journey Frequency - Daily	-0.984* (0.419)	0.019	0.164	0.374	0.851
Constant	0.581 (0.287)	0.043		1.788	

$R^2 = .245$ (Cox & Snell), $.364$ (Nagelkerke), * $p < .05$

Interchange is the dominant factor in MyMulti use. Whereas interchange reduced the likelihood of passengers using a pay-as-you-go ticket it greatly increases use of the MyMulti ticket type ($B = -2.488$). MyMulti prepay tickets eliminate the financial penalty of interchange so this is not unexpected. Young users, post-MyZone as pre-MyZone, have high incidence of interchange as confirmed by the cross-tabulation, shown in Table 8, which suggests age and likelihood of interchange are inversely related.

Table 8: Cross tabulation – age range and interchange (post-MyZone)

		Counts	Public Transport Interchange	
			No	Yes
Age Range	30 or under	Count (expected count)	50 (65.6)	58 (42.4)
		% within category	46.30%	53.70%
	31 – 50	Count (expected count)	53 (45.0)	21 (29.0)
		% within category	71.60%	28.40%
	51 or over	Count (expected count)	24 (16.4)	3 (10.6)
		% within category	88.90%	11.10%

chi square = 22.099 at 2 df; significant difference ($p < .001$)

The statistical significant interchange variable in this model will also be capturing the way young users are likely to be MyMulti users as age and interchange are sufficiently correlated that a model including both variables exhibited multicollinearity.

Journey purpose ($B = -1.099$) and daily journey frequency ($B = -0.984$) are significant explanatory variables in predicting use of this multi-modal fare product with those travelling daily being significantly more likely to use this unlimited ticket. The results shown in Table 7 suggest that the characteristics of the prepay multi-modal ticket users are very different from the prepay pay-as-you-go ticket users. In many ways the characteristics of the multi-modal ticket users post-MyZone closely resemble cash users pre-MyZone. This is confirmed by the significant proportion ($p = .010$) of post-MyZone multi-modal ticket holders identifying themselves as cash payers pre-MyZone (44.2% of MyMulti users claimed to have previously used cash with the remainder being new passengers or transitioning from other prepay products). The similarity in characteristics explains why this model has lower overall goodness of fit as compared to the model for pay-as-you-go users.

It should be noted that post-MyZone, attitudes to travel are not significant in explaining users of the individual prepay products. This may be because attitudes within the separate prepay categories are more homogeneous.

5. Conclusions

The introduction of the multi-modal ticket appears to have segmented the market for prepay. Prior to the MyZone fare and ticket reform prepayers could be explained through a combination of socio-economic characteristics, interchange behaviour, frequency of travel and attitudes to travel. Prepay users were predominantly wealthy passengers who did not interchange onto other public transport as part of their journey. Furthermore they displayed different attitudes to travel than cash paying passengers gaining less utility from travel itself than cash passengers.

Following MyZone, the propensity to prepay could only be explained by separating out the different type of prepayment: pay as you go and multi-modal tickets. The multi-modal ticket effectively introduced a new market for prepay by moving previous cash passengers onto prepay. As a result multi-modal ticket users shared similar characteristics to the pre-MyZone cash users – being younger and more prone to make an interchange than pay-as-you-go prepay ticket holders. Given the most defining factor of the multi-modal ticket holder is their propensity to interchange and that interchange is synonymous with young passengers this raises interesting issues connected with the residential and labour markets. It suggests that the residential market is stickier than the labour market and that changes in employment status and location take time to be translated into new residential locations which leads to an often more arduous journey to work involving interchange.

Following the MyZone ticket reform cash passengers are fundamentally defined by their sensitivity to public transport costs. Not only does displaying this attitude greatly augment their likelihood to pay cash but high income levels also significantly influence prepay. This largely agrees with McCollum and Pratt's (2004) assertion that the upfront costs can dissuade lower income individuals from using prepay, despite the obvious benefits of prepay, with the discounted tickets, for these groups. Journey frequency provides the final variable influencing cash payment with those travelling less than daily being more likely to use cash than daily passengers, despite discounted despite pay-as-you-go fares being available. This, suggests a higher than break-even point in number of trips might be necessary to justify the investment in the prepay product agreeing with McCollum and Pratt (2004) that lower frequency travellers are more likely to be cash payers through fear of not utilising prepay credit in a reasonable amount of time.

The characteristics of the multi-modal, MyMulti, ticket users are more closely aligned to the cash passengers pre-MyZone than the pre-MyZone pay-as-you-go passengers. Whereas cash passengers pre-MyZone were significantly more likely to interchange this is now the trait of MyMulti users. With interchange associated with younger, lower income passengers this defines the market for those tickets and supports previous literature (Wardman & Hine, 2000, Nuworsoo et al., 2009 and Ipsos MORI, 2010). However, the multi-modal MyMulti users are significantly more likely to be daily passengers travelling on a journey to work which contrasts with results of a Centro report cited by Wardman & Hine (2000), where interchange was not a strong feature on time sensitive trips such as commuting trips. Pay-as-you-go passengers display very different characteristics. They predominantly do not interchange and are significantly more affluent than non pay-as-you-go passengers. Whereas the literature suggests that young passengers are attracted to both pay-as-you-go (Cervero, 1990) and multi-modal (Wardman & Hine, 2000) ticketing the results from this study indicate differently. Young individuals, more prone to interchanging, are attracted to the MyMulti product whereas the use of the pay-as-you-go tickets is linked to higher income passengers. Moreover, as higher incomes in this study correlate strongly to older passengers, this means users of the pay as you go tickets are older passengers. This suggests that when the alternatives are between pay as you go tickets or multi-modal unlimited tickets, the markets for different prepay tickets are more segmented and segmented along different demographic lines.

In conclusion, pre-MyZone when there was no multi-modal ticket, prepayers are predictable. The introduction of a multi-modal ticket alongside a pay as you go option has created a new and separate prepay market by attracting many former cash users, with their different socio-economic and demographic characteristics, onto prepay. With both prepay options available post-MyZone, passengers paying cash are passengers with high sensitivities to public transport cost – those passengers who are least able to afford public transport fares. There is clearly no 'one size fits all' with public transport prepay and the different motivations must be considered when designing prepay products. Understanding what influences ticket choice is important for authorities and operators who want to grow prepay use and enjoy the corresponding supply-side benefits.

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