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Quantifying the impact of attitudes on shift towards sustainable modes

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Abstract

Between 2004 and 2008, Melbourne experienced levels of public transport patronage growth that were not predicted by the four-step transport models. In 2008, the Department of Transport (DOT) (Victoria) undertook elasticity modelling of that patronage growth, which could explain most of the observed growth, but around 20% of growth on metropolitan trains remained 'unexplained'.

Market research plays a critical role in informing, guiding and challenging the forecasting undertaken by the various models. Market research between 2006 and 2009 broadly supported the elasticity modelling, but suggested the role of attitudinal change – particularly attitudes on the environment and health & fitness – may have been significant. In 2009/10, DOT undertook a market segmentation project to identify the key attitudinal segments in relation to mode choice in Melbourne – and in a second phase used a choice modelling methodology to quantify the impact of attitudes in driving the decision-making process in selecting a mode of travel. The results suggest that about one in five Melburnians claim to have attitudes that 'ideologically' align them to public transport, that attitudinal change most likely did play a role in the patronage surge, and that future patronage forecasts are likely to be sensitive to further changes in community attitudes.

Keywords: Sustainable modes, attitudes, drivers of patronage growth, modelling, patronage forecasts, environment, health and fitness, elasticities

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1. Introduction

Accurate forecasts of future public transport patronage are critical in forward planning, particularly because investments in rolling stock and infrastructure can be of considerable cost and can have long lead times in project delivery. Victoria's Department of Transport (DOT) has typically developed long-term patronage forecasts using strategic models, such as the four-step Melbourne Integrated Transport Model (MITM).

In 2004/05, DOT's official long-term patronage forecasts for public transport were 3.6% (metropolitan train), 2.7% (tram) and 4.0% (metropolitan bus). This gave an overall annual growth forecast of approximately 3.3% for metropolitan Melbourne.

The following four years saw an unprecedented and unpredicted spike in patronage, with year-on-year overall metropolitan public transport growth figures of 4.9%, 7.9%, 7.7% and

9.0%. By 2008/09 Melbourne's total patronage was at 491.5 million passenger trips per year – a figure that the strategic models had not predicted to be reached until 2012/13.

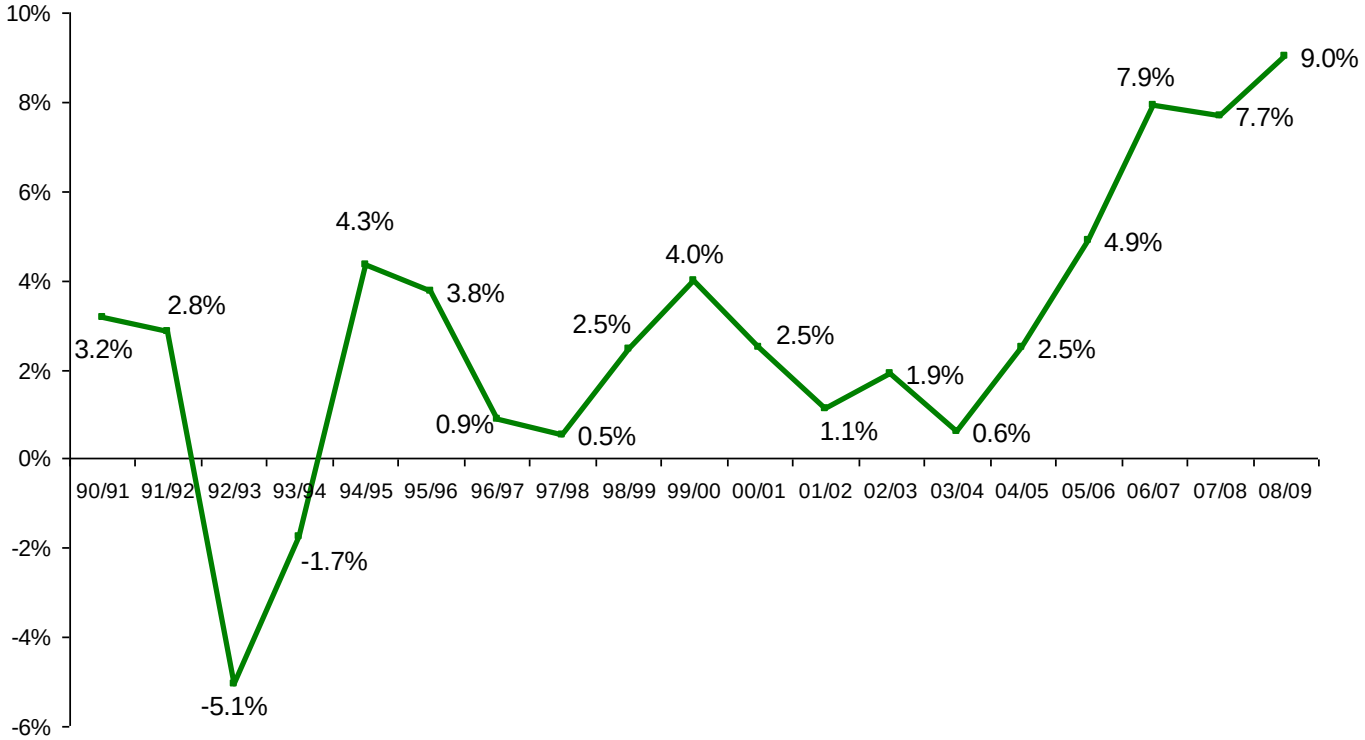
Some of the reasons behind the unexpectedly high patronage growth are obvious. Few had predicted the sharp spike in petrol prices seen during this period, nor the booming economy and record levels of population growth in Melbourne. Other reasons were more contentious. Had congestion on the road network reached a 'tipping point' for users? Had services improved making public transport relatively more attractive than other modes? And what role (if any) had attitudinal changes within the community – possibly driven by increased awareness of environmental issues and health & fitness trends – played in the patronage surge?

This paper summarises attempts made by DOT to understand the surge in patronage growth in Melbourne. It then outlines a two part research program that aimed to quantify the role attitudinal change had played.

2. Melbourne's surge in public transport patronage

In 2005/06 the pattern of relatively modest and predictable public transport patronage growth in Melbourne was broken in a sudden and unexpected way. Between 2005 and early 2009, Melbourne experienced unprecedented levels of growth in public transport usage, particularly on the metropolitan train network (Department of Transport, 2009). Figure 1 shows the sharp break with the patterns evident from about the mid 1990s of growth rates of between 0% and 4% compared with almost double-digit growth in 2008/09.

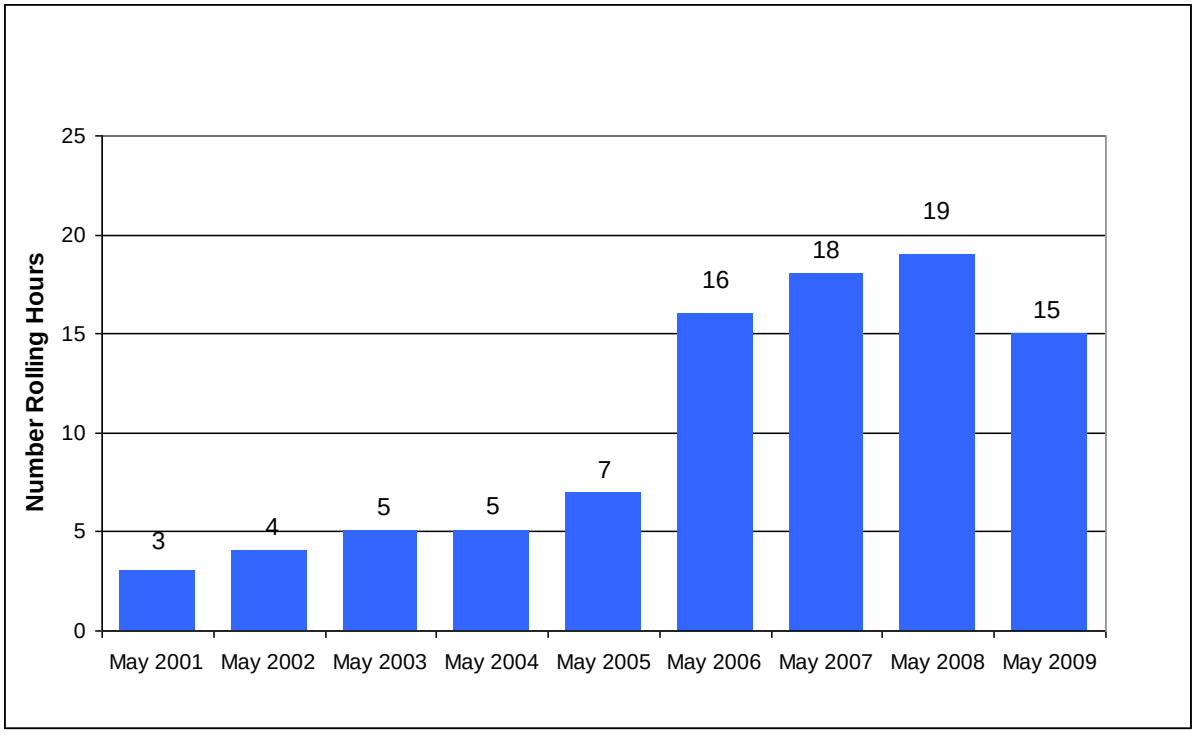
Figure 1. Melbourne's public transport annual growth rates: 1990/91 to 2008/09



The growth was particularly evident on Melbourne's metropolitan train network, which had patronage growth of 47% between 2004/05 and 2008/09. However, annual growth rates on both metropolitan trams and buses reached 12.5% (trams) and 9.0% (buses) in 2008/09 – actually a period when train growth had begun to moderate (Department of Transport, 2009).

The surge in public transport usage – seen both in peak and off-peak periods – placed considerable pressure on services, particularly during peak periods. Figure 2 shows, for example, the number of AM peak rolling hours with loads above desired load standards, reflecting the strong growth in peak patronage across much of the train network. The tram network also experienced increasing crowding problems during peak periods at this time. (Department of Transport, 2009)

Figure 2. AM Peak Rolling Hour Average Loads above Desired Load Standards on Melbourne metropolitan trains : 2001-2009



The network quickly began to feel the strain of the increased demand and customer satisfaction levels fell dramatically during this period, particularly for metropolitan train customers (Department of Transport, 2010). Measures to manage the growth were made in the short-term (e.g. Early Bird initiative of free pre-7am train travel, new maintenance procedures, new timetables) as the system awaited new rolling stock and improved infrastructure. However, catching up on the increased patronage proved to be difficult.

3. Understanding Melbourne's patronage growth

Significant past work has been undertaken both in Australia and overseas to understand the key drivers of public transport patronage. Many of the key factors identified in the research are relatively well understood and have been incorporated into the strategic models used to forecast patronage.

The relative cost of travel options is known to be a driver of mode choice. Melbourne has seen significant fare changes in the past decade, and analysis of these changes has shown that the elasticity of off-peak fares is significant, possibly as high as -0.6 or -0.7 (Webb, Martin & Le-Nguyen, 2007). Douglas & Karpouzis (2009) investigated the key drivers of Sydney rail patronage and concluded that there was a peak fare elasticity in that market of around -0.24.

Douglas & Karpouzis (2009) further explored the elasticity of rail patronage growth to other factors, such as central business district employment levels (0.6 to 0.7) and train kilometers of service provided (0.2 to 0.3). Currie & Phung (2006) extended this to cross elasticities

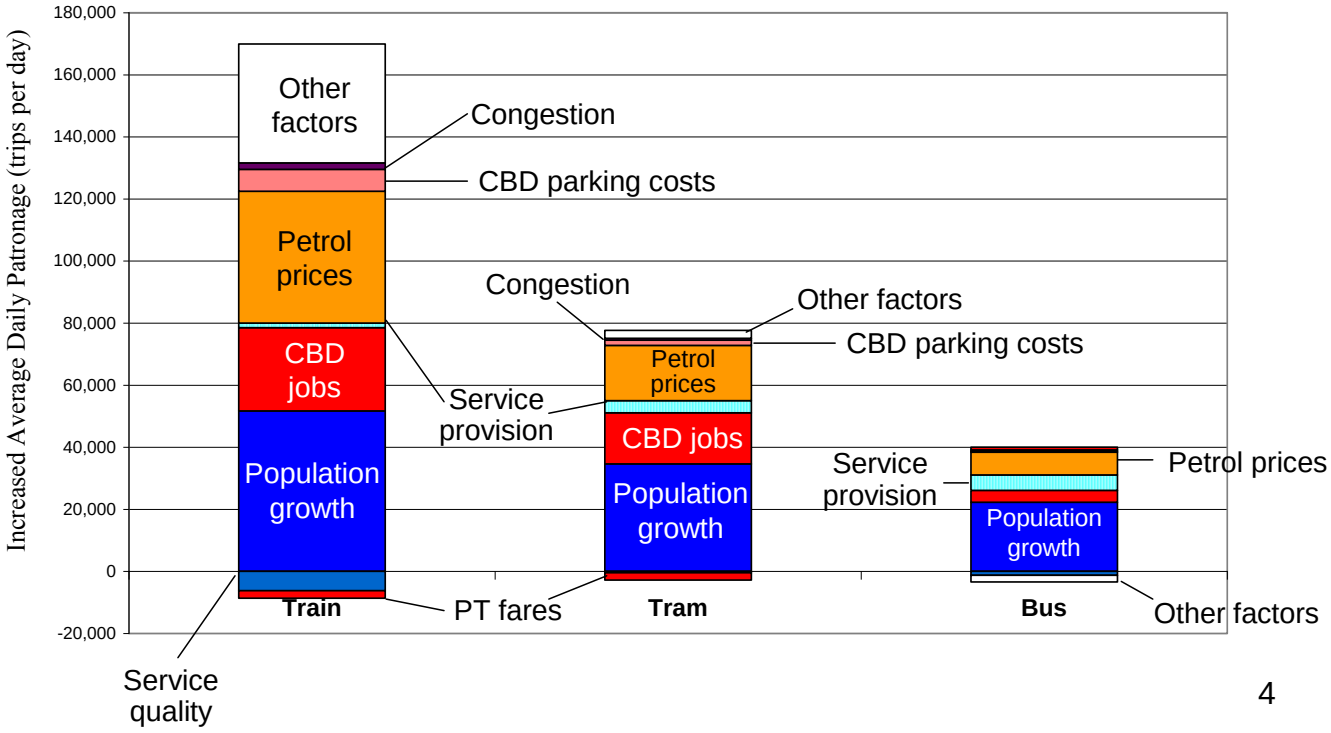
with petrol prices in Melbourne and found a result of -0.475. These are all critical results as between 2005-2009 there were substantial changes to the transport market in Melbourne in terms of fares, central business district employment, petrol prices and for buses in particular, service kilometers run.

Efforts were therefore made by DOT to understand why strategic models had significantly underestimated the growth in public transport patronage based on these well understood factors. A number of hypotheses were put forward:

- Inputs to the model were inaccurate. Strategic models rely on multiple inputs including population growth, land use and petrol price forecasts that proved not to be accurate. However, even once accurate data was inputted *post hoc*, the strategic models still did not forecast the levels of growth observed.
- Travel data used to calibrate the models was outdated. Strategic models rely on travel survey data to calibrate the models. In 2004/05, these models relied on data from the Victorian Activity and Travel Survey (VATS) which was largely undertaken in the 1990s. The most recent home interview travel survey (VISTA, 2007) can now be used to calibrate new models.
- Attitudes to public transport fundamentally changed leading to a market that was more receptive to public transport than was reflected in the model. The growth of community attitudes around environmental awareness and health & fitness may have led to increased use of public transport as drivers in their own right, or may have interacted with other factors to change the markets elasticity with respect to these other factors (i.e. perhaps the market was more sensitive to petrol price increases because a shift to public transport saved them money at the same time as fulfilling a desire to do more for the environment).

In 2008, DOT commissioned a piece of work that aimed to investigate the patronage growth, and to see if an elasticity approach to understanding the drivers of public transport patronage, utilising the elasticities from research such as that outlined above, could better explain the spike in patronage (Bell, 2008). This work took the patronage growth seen in metropolitan Melbourne between 2002 and 2007, and used known relationships between variables (e.g. growth in CBD employment, population) and elasticities to understand the patronage growth. The model developed was then employed to forecast by mode. The results are shown in Figure 3.

Figure 3. Factors affecting patronage growth in Melbourne: 2002-2007



The height of the columns in Figure 3 represent the size of the increase in average weekday patronage on each of the three modes of public transport in Melbourne between 2002 and 2007. Train patronage grew in this time by about 170,000 trips per day, tram by about 80,000 and bus by about 40,000 trips.

First, the analysis took population growth (and the location of that growth) to allocate a proportion of the patronage growth that could be attributed to population growth. Similarly, growth in CBD employment was taken (over and above population growth) as a separate driver of patronage growth, based on known proportions of CBD workers using public transport to access the CBD each day.

Second, the analysis used the most widely accepted cross elasticity values for petrol price, congestion, service quality, service provision, public transport fares and parking costs to allocate the remaining growth to these factors. Applying these values to the known changes in these variables led to further predicted patronage growth for each mode.

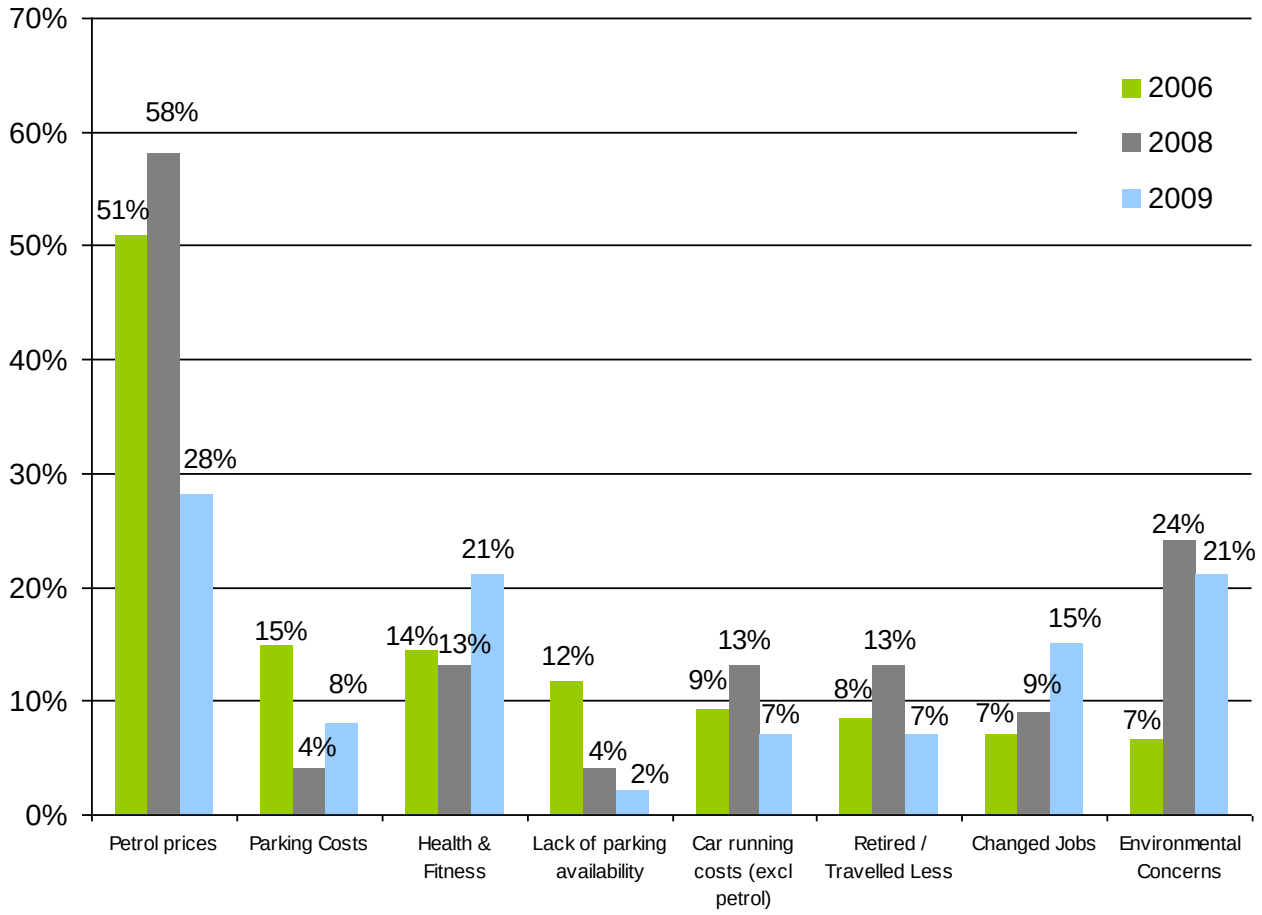
The results suggest that there were three main drivers of the patronage growth: population growth, CBD job growth and petrol price increases. Other factors had a relatively small impact on the period 2002-2007. (It should be noted that there was considerable patronage growth from 2007 to the end of 2008 on all modes which is not covered by this analysis).

In summary, the analysis was able to fairly accurately account for the observed growth in patronage on trams and buses, but there was a large proportion of the growth on metropolitan trains that was not explained and subsequently labeled “other factors”. There were several potential explanations for this unexplained growth:

1. The actual elasticities of the Melbourne market were higher than used in the analysis for metropolitan train – that is, the rising petrol prices had more of an effect in reality than had been predicted by this model.
2. The “interactive” effect of all of these factors operating simultaneously was greater than the sum of the parts – that is, the impact of rising petrol prices, improved services and increased road congestion together impacted more than they would have individually.
3. Community attitude change in favour of environmentally sustainable options and health & fitness choices drove some of the growth, but could not easily be tracked over time or incorporated in the model.

Market research undertaken by DOT (2006) and Metlink (2008, 2009) has tracked the stated reasons Melburnians gave for their behaviour change in this period. The results broadly support the analysis undertaken by Bell (2008), as well as the hypothesis that community attitude change was a potentially important aspect of the patronage surge on public transport. Figure 4 summarises the top eight reasons people gave for reducing their vehicle usage (and subsequently using public transport and walking & cycling on a more regular basis).

Figure 4. Top Eight Stated Reasons for Reduced Vehicle Usage (2006-2009) (multiple response allowed)
Base: Respondents who had indicated a recent reduction in private vehicle usage



Health & fitness was given as the second or third most stated reason for behaviour change. Environmental concerns was not given as a reason by many people (7%) in 2006, but became the second most stated reason by 2008. This suggests that (if you can believe what people say in surveys) community attitudes were a key driver of behaviour change in Melbourne's significant shift from private vehicle to other modes of transport.

Past research investigating the role of environmental consciousness in transport mode choice has suggested that this is a potential explanatory factor. Shen, Sakata and Hashimoto (2005) used a stated choice model of residents of Northern Osaka, and systematically varied the impact on the environment of car and bus modes relative to a monorail alternative. They found that respondents (in these hypothetical scenarios) did factor in environmental impact in their mode choices, in addition to known key determinants of mode choice such as travel time, frequency of service and cost.

The approach taken by Shen et al (2005) was to investigate the importance of environmental consciousness by systematically varying the environmental impact of each option in terms of CO2 emissions. That is, each mode, regardless of its actual current emission levels, had its emissions varied in each scenario relative to the monorail alternative. This means that some scenarios involved participants responding to scenarios that were "artificial" and do not currently exist in the "real world" – for example, imagining a car trip that has half the per person CO2 emissions of a monorail journey. This approach places at risk the predictive validity of the research, as respondents may struggle to accurately predict their own behaviour in scenarios so divorced from current reality.

Using a questionnaire based research approach, Hunecke et al (2001) also found that what they called “ecological norm orientation” was as strong a predictor of mode choice as fares in Germany.

Corpuz (2007) concluded in her work that although environmental reasons were provided by respondents in market research as a reason for mode shift (as was found in Melbourne shown in Figure 4 above), that they “are not as significant as other factors in the choice of public transport, but it is an emerging area that presents timely opportunities”. This research sought to grasp one of these opportunities to investigate this issue in more depth and to see if in 2009/10, environmental reasons had become a more important part of the mode choice equation.

4. An attitudinal segmentation of Melbourne (phase 1)

In 2009, DOT and Metlink embarked on an ambitious research program with two main goals:

1. To quantify the size of group within the Melbourne market which displays attitudes around environmental awareness and health & fitness that pre-disposed them to sustainable transport options; and
2. To measure the impact these attitudes have on transport mode choice (and by inference, the impact they had on the surge on public transport in Melbourne).

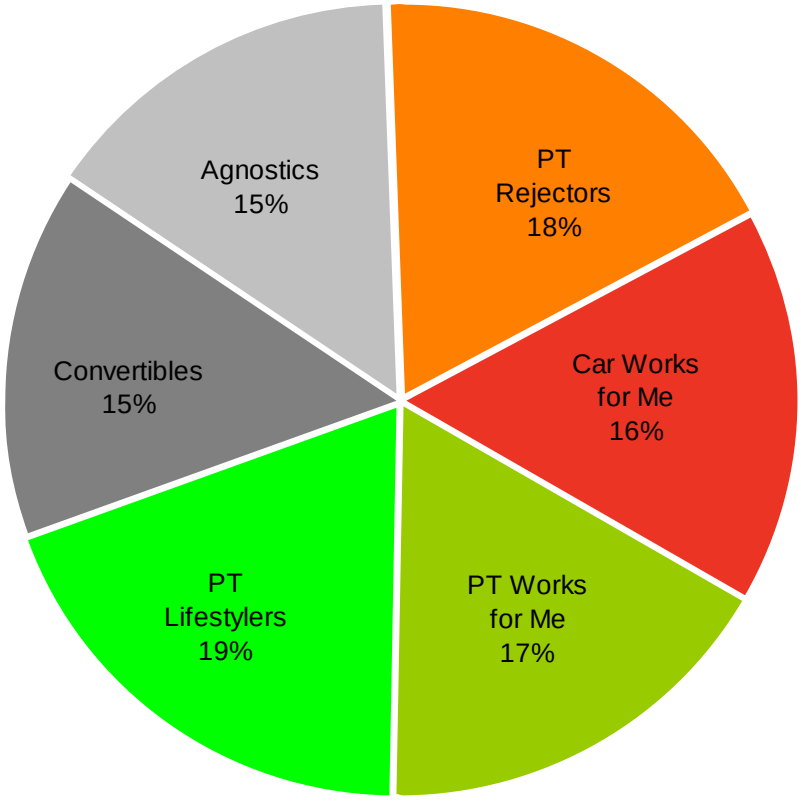
Phase 1 of the research was designed to address the first objective. In August 2009, a sample of 1,500 respondents representative of Melbourne’s population (over 16 years of age) was surveyed by telephone, and answered a 14 minute survey on travel attitudes and behaviours.

The surveyed included a detailed profile of current travel behaviours, including the frequency of use of public transport, walking and cycling. It also included 45 attitudinal questions relating to transport mode choice. These covered attitudes to selecting a mode of transport based on cost, convenience, environmental attitudes, travel time, health & fitness, safety, utility and stress. Respondents indicated their level of agreement with each statement from “strongly agree” to “strongly disagree” on a five point scale with a neutral point. Examples of the statements were:

- I like driving because I don’t like mixing with others when I am travelling
- If I take public transport, I feel like I’ve taken a step down in the world
- Road congestion makes me more open to using public transport
- Taking public transport is cheaper than travelling by car
- I always consider the environment when choosing what mode of transport to take

The statistical technique of cluster analysis was then used to determine the attitudinal segments that existed in the market regarding transport mode choice. The results are summarised in Figure 5.

Figure 5: Attitudinal segments from Melbourne market (2009)



The results suggest that there are six main attitudinal segments in the Melbourne market in relation to transport mode choice. There are two "public transport" aligned segments. "PT lifestylers" are attracted to public transport because it is a cleaner, greener way to travel. "PT works for me" are attracted to public transport because they enjoy the utility it offers – faster and easier travel, and the opportunity to undertake activities in transit (reading, sleeping, listening to music, answering emails on Blackberry, etc.).

There are two "car" aligned segments. "PT rejectors" prefer private vehicle travel so much that many of them would not even consider using public transport if it were free. They reject public transport as a slow, unsafe and unclean way of travel. The "Car works for me" segment enjoys the flexibility and speed associated with private vehicle travel based on the trips they have to make.

The remaining two segments are more neutral. "Convertibles" are potential users of public transport, but are waiting for significant improvements in service quality and frequency before they strongly consider it. "Agnostics" are not particularly engaged in the transport debate and do not hold strong views one way or the other.

The key attitudes expressed by each segment have been captured in an illustrative quote that summarises the attitudes expressed in the survey, as shown in Table 1.

Table 1: Attitudinal segments and illustrative quote

Segment	Illustrative Quote
PT Lifestylers (19%)	*"Using PT as much as possible is just the right thing to do. Apart from being a part of my basic day to day life, it has the advantage of being better for the environment when compared to other transport modes"*
PT works for me (17%)	*"I value the time I spend on public transport. I get things out of using public transport that I wouldn't with other modes"*
PT rejectors (18%)	*"I wouldn't use public transport even if it was free"*
Car works for me (16%)	*"Car is the most convenient and useful way for me to get around. It's not that I have a big problem with public transport; it's just that it doesn't suit me as much"*
Agnostics (15%)	*"I'm just not all that interested in the matter of how I get around. Some people are car people and some like public transport, but I'm not overly fussed either way. If you changed the public transport system, I probably wouldn't even notice"*
Convertibles (15%)	*"I use my car mainly but am actually pretty open to using public transport more … but it will need to improve before I do"*

There were several insights that were gained from this research. These included:

1. The size of the six segments identified in the research were all of roughly the same size each representing between 15% and 19% of the Melbourne market.
2. The segments had almost no relationship with any demographic variable. That is, each segment was not significantly skewed by age, gender, distance from the centre of Melbourne, education or income.
3. Segments did, however, report very different patterns of behaviour. As one might predict, the public transport aligned segments reported taking far more trips by public transport than did the car aligned segments. That said, there was still a proportion of the PT rejector segment (21%) who took public transport almost every day, and a proportion of the PT lifestylers (28%) who rarely took public transport. Presumably, due to life circumstances and the availability (and quality) of transport services, not everyone is able to convert attitudes to behaviour to the same extent.
4. The size of the segment (PT lifestylers) aligning itself with public transport due to a strong belief in environmental and sustainability issues, as well as a desire to live a healthy lifestyle, was estimated to be 19% (or almost one in five adult Melburnians). This segment agreed particularly strongly (and significantly more than the average) with statements such as "If possible, I try to walk or cycle because it has no environmental impact", "I am concerned about the environmental impact of using my car", "I always consider the environment when choosing what mode of transport to take" and "I like public transport because it means I get some exercise to and from my stop or station as part of my trip".

Unfortunately, as a cross-sectional piece of research, the results do not give any indication as to the rate at which the segments may have grown or shrunk over the past five years (thus potentially contributing to the observed growth in public transport).

The Living LOHAS Research Project (Mobium Group, 2009) presents the results of an ongoing Australia-wide study of the LOHAS segment. LOHAS stands for “Lifestyles of Health And Sustainability” and represents consumers who have strong concerns about personal, community and planetary health and sustainability issues which shape their values, worldviews and consumer decision-making (Mobium Group, 2009). The size of the LOHAS Leaders segment (actively undertaking consumer decision-making based on these principles) has grown from 8% in 2007 to 11% in 2009 (Mobium Group, 2009). There is a relatively close link between the PT Lifestylers segment and the LOHAS leaders segment, suggesting there may have been a growth in the PT Lifestylers segment over these years as well.

Although the research does support the notion that attitudes are associated with different patterns of travel behaviours and mode choice, it does not provide much evidence as to the value placed on each mode by the different segment, nor the sensitivity of each segment to various key travel demand variables. As such, a phase 2 was designed to provide insight into these issues, and to estimate the impact attitudinal change may have had in the 2004-2008 patronage surge.

5. Quantifying attitude impact on mode choice (phase 2)

Phase 2 of the research utilised a sample of 400+ respondents from each of the six segments (total sample was 3,010), and using an online survey, each respondent completed a choice modelling (or stated preference) task that modeled their mode choice for their journey to work or study under different scenarios. The factors that were systematically varied in the survey are summarised in Table 2.

The data collected and analysis conducted allow us to test the different sensitivities of each segment to each of the variables listed above with the aim of understanding the influence of attitudes on mode choice and the potential impact of attitudinal change in the future.

There is an enormous quantity of data generated by the study. For each individual variable, sensitivity by mode can be assessed, and for each mode, sensitivity by attitudinal segment can be profiled. The process can be repeated for any combination of variables. A selection of key findings is provided in the remainder of this section.

Table 2: Variables tested in phase 2 Market Segmentation project

Variable	Levels tested
Total travel time (all modes)	From 40% slower than usual to 40% faster than usual
Ticket cost (public transport options only)	From 40% cheaper than current to 40% more expensive than current
Chance of significant delay in travel (public transport and private vehicle options only)	From 1 day in 30 (on average) to 2 days in 5 (on average)
Petrol cost (private vehicle options only)	From 10% cheaper than current to 75% more expensive than current
Parking costs (car only)	From 10% cheaper than current to 40% more expensive than current
Tolls cost (private vehicle options only)	From 33% cheaper than current to 100% more expensive than current
Traffic congestion (road based transport only)	From “Mostly free flowing at or near the speed limit with few other cars” to “Mostly heavily congested and crawling well below the speed limit”
Passenger density (public transport options only)	From “Seats available” to “Not able to get on preferred service”

Key Finding #1: The choice to commute by car is extremely resilient to large changes in the travel experience unless there are underlying attitudes aligned with public transport and other sustainable modes.

The findings suggest that travel times for car commuters could get 40% worse, and there would be minimal defection to other modes (holding all other variables constant). Interestingly, however, is that the one segment that is somewhat sensitive to changes in travel time in car travel is the PT lifestylers (as shown in Figure 6).

Figure 6: Change in preference for car as preferred mode as a function of changing travel times by segment (holding all other variables constant)

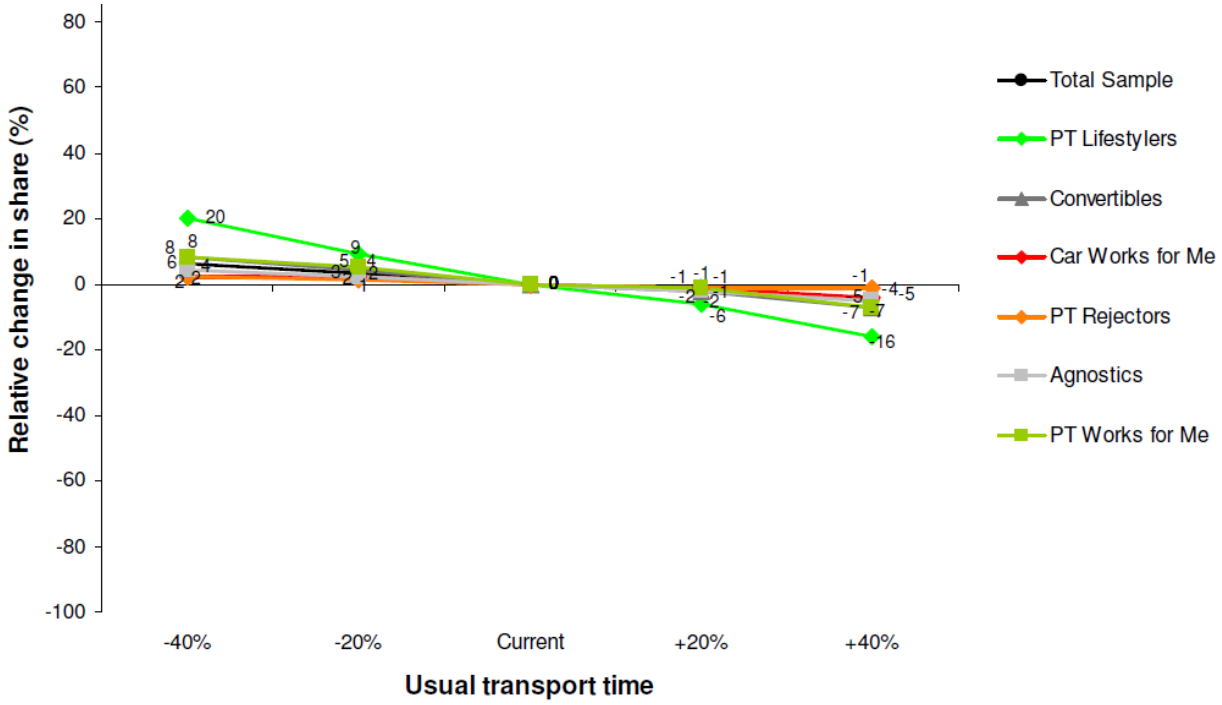


Figure 6 shows that with a 40% increase in travel time, preference for car overall declines by only 5%, but more than three times this per cent of PT lifestylers 'defect' from car to other modes (mainly walking & cycling). It should be noted that it is estimated from the research that only 24% of PT lifestylers most frequently use their car to travel to work or study (against a total sample average of 61%), but that if this segment grew simultaneously with a deterioration of travel times on the road, there would be a particular sensitivity to defection from car to other modes. A similarly high sensitivity was found to petrol prices for the 24% of PT lifestylers driving to work / study. This suggests that the attractiveness of car travel really only diminishes as the mode deteriorates in performance (cost, travel time) for those with a pre-disposition to public transport in the first place – but for whom the attitudes are clearly not strong enough to drive a switch in mode in and of themselves. For this sub-segment (PT lifestylers still driving to work), attitudes are seemingly acting as a "necessary but not sufficient" driver of switching to public transport. The Mobium Group (2009) talk about environmental attitudes frequently being a "tie breaker" in product choice, but rarely a unique driver of decisions. This is seemingly how environmental attitudes are operating for some consumers.

Key Finding #2: Improving the quality of public transport services will attract strong demand from certain segments, but there are significant differences in the way segments respond to different modes.

Figure 7: Change in preference for train as preferred mode as a function of changing travel reliability by segment (holding all other variables constant)

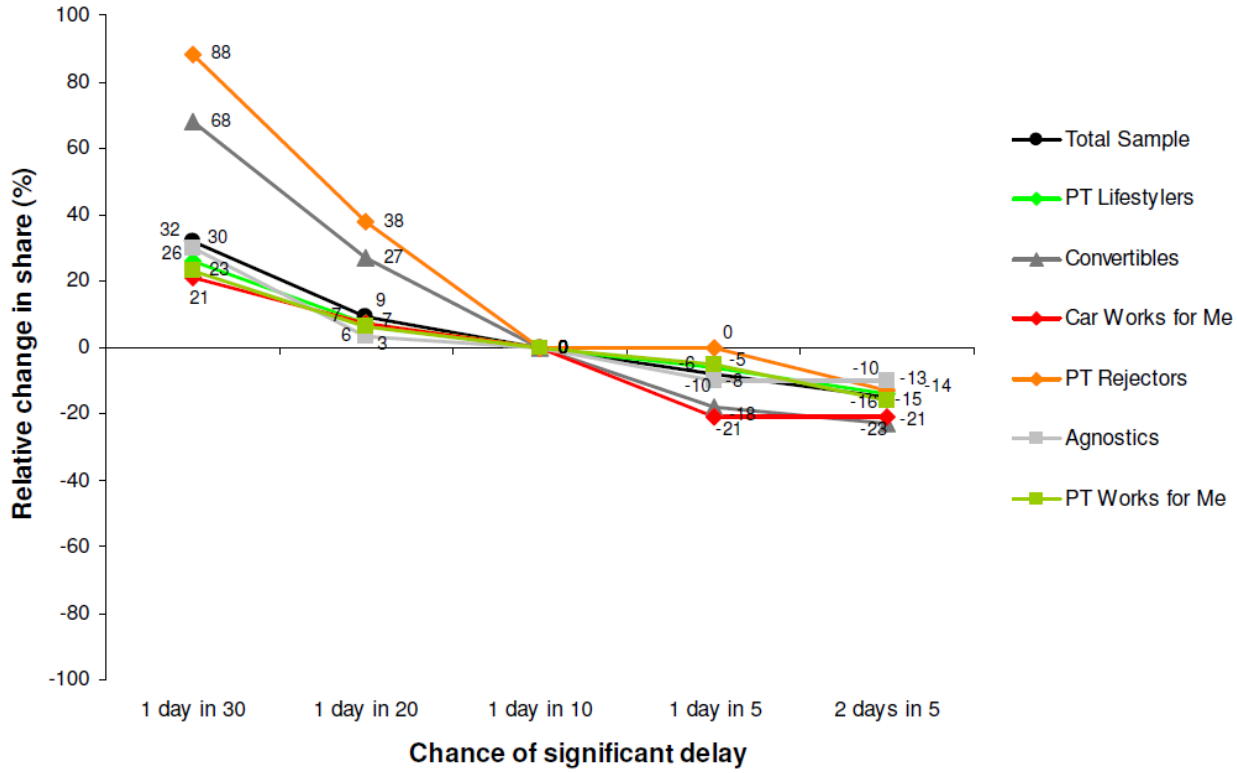
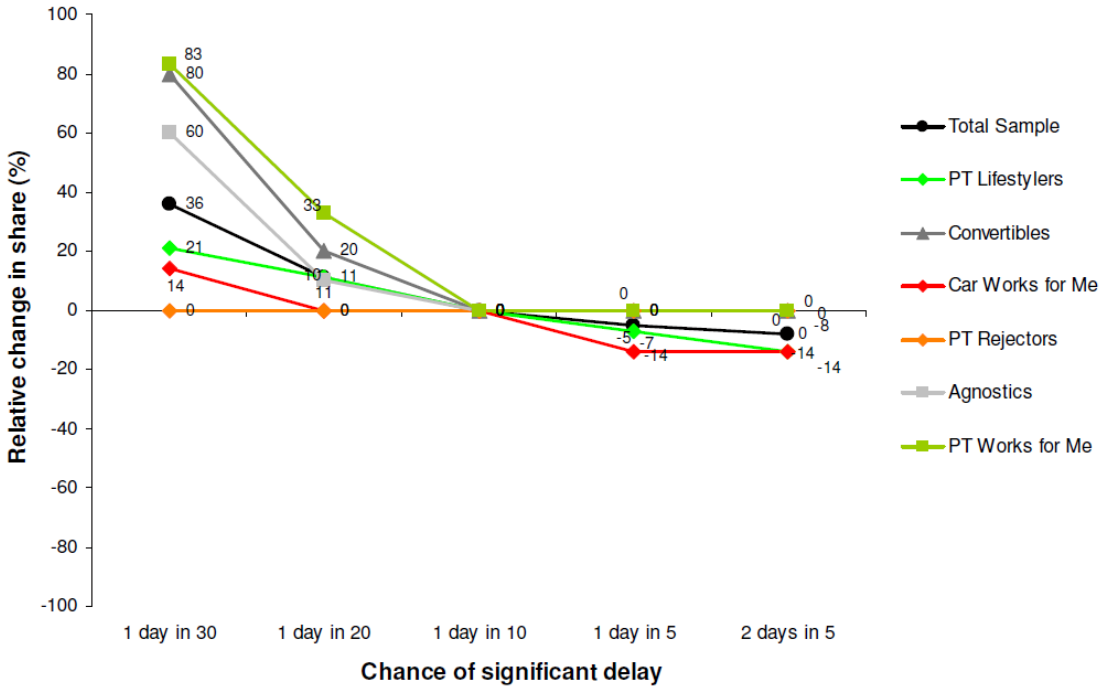


Figure 7 shows that as the reliability of train services deteriorates (to the right), there is some loss of demand but it is not substantial. As the reliability improves (to the left), there is substantial increased demand for train services. The two segments most sensitive to improved reliability on the train network are the convertibles and PT rejectors. One might expect this result for the convertibles. They express a strong alignment with public transport, with the main barrier being the service levels provided (with "reliability" obviously a key aspect). They show a similar pattern when train passenger density is improved, or when train travel times are reduced.

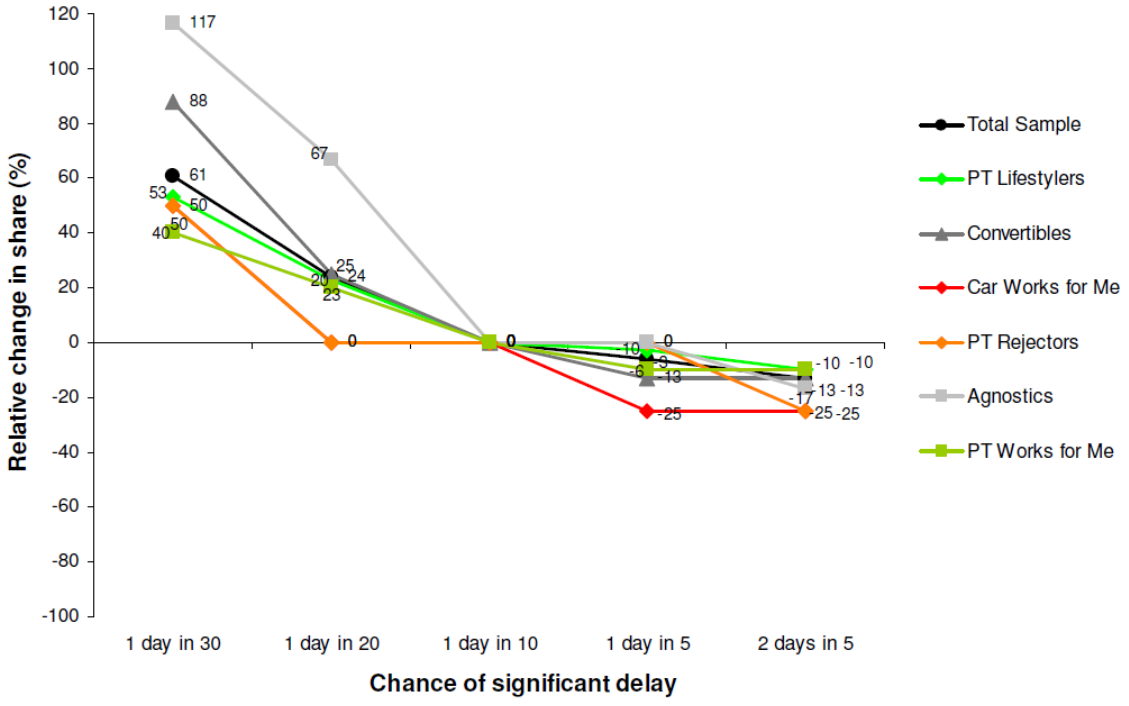
The positive response of PT rejectors to the improved conditions, however, is less expected. Having expressed a strong dislike for virtually all aspects of public transport, improving train reliability leads to significant mode shift. They show a similar pattern of results for passenger density improvements on trains as well as travel time reductions. PT rejectors are rejecting the notion of train travel, but only at currently perceived levels of service quality. Improvements would see a strong shift to train, mainly from car travel and walking & cycling. Figure 8, however, shows that improvements in bus reliability do not have the same effect for PT rejectors. Seemingly, PT rejectors will waiver in their opposition to train travel, but seem firm in opposing all things "bus". There is something about the image or "brand" of buses that removes buses from the consideration set of this segment.

Figure 8: Change in preference for bus as preferred mode as a function of changing travel reliability by segment (holding all other variables constant)



Trains and buses are clearly viewed as having very different characteristics, and different segments will be more or less responsive to service quality improvements depending on what the mode is. Figure 9 shows the same graph for tram, and shows that the agnostic segment are particularly sensitive to improvements in tram service reliability (and show a similar sensitivity to improvement in tram passenger density and travel time). Note that the convertibles segment is sensitive to improvements in all three modes.

Figure 9: Change in preference for tram as preferred mode as a function of changing travel reliability by segment (holding all other variables constant)

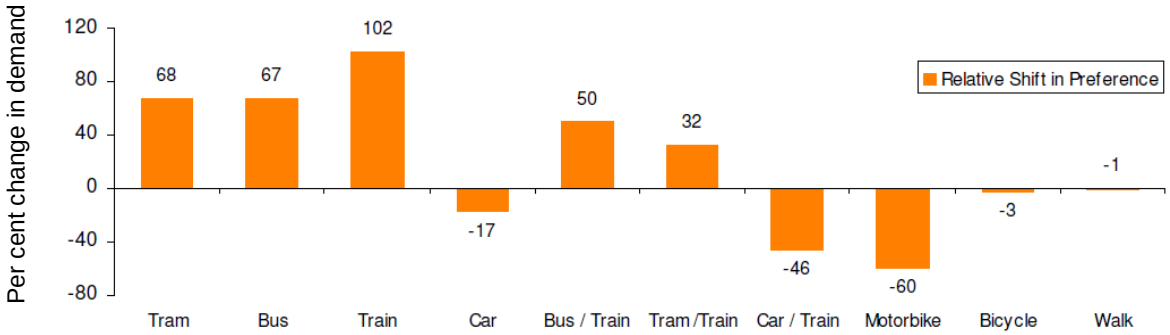


Key Finding #3: Under most scenarios, the model predicts future patronage growth will again be focused more strongly on the train network than on the tram and bus network – exactly the pattern seen in Melbourne since 2005.

The model can be used to predict the change in demand for each mode under any combination of the variables included in the survey. Figure 10 shows the predicted change in demand for each mode for travel to work / study in a scenario where:

- Tram travel and bus travel times are modestly improved;
- Petrol prices reach $1.90;
- Congestion on the roads becomes 20% worse; and
- Train crowding and reliability is improved.

Figure 10: Relative shift in preference by mode based on improved tram/bus travel times, $1.90 petrol, worse road congestion and improved train services

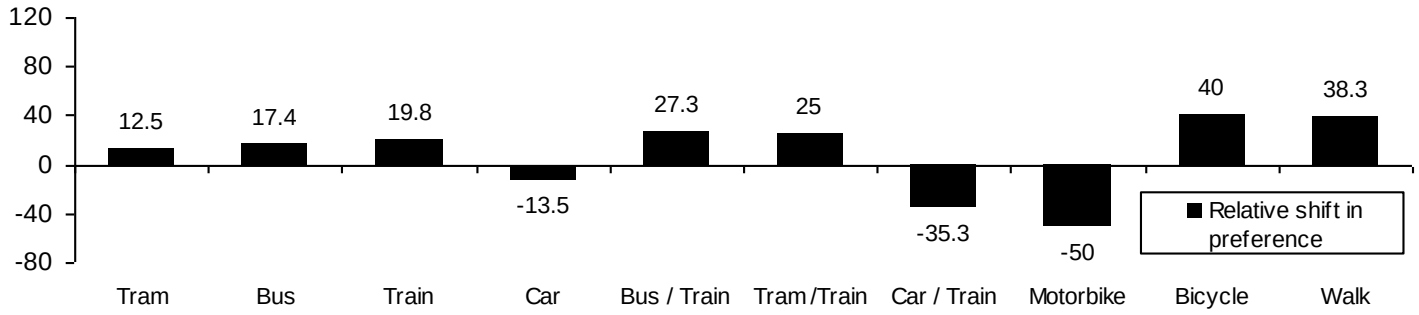


The model predicts a doubling of train patronage under these conditions, but only 67% growth on tram and bus. The 17% reduction of travel by car represents the main source of additional public transport trips. The large existing base for car travel (about two-thirds of all work / study trips were reported as currently taking place by car) means that a modest shift away from car can mean an enormous surge on other modes with lower initial mode share. There is some shift from car/train to train only (presumably as a result of higher petrol prices) but this is from a low base and does not explain much of the growth in preference for train only travel.

Key Finding #4: If the last surge in public transport could be attributed largely to rising petrol prices (leading to mode shift) in the context of a growing market (population size, CBD employment growth), the 'next surge' will occur if and only if there are significant service quality improvements on the public transport network.

Figure 10 clearly shows that under certain conditions (that are not inconceivable), the model predicts a further mode shift from private vehicle travel to public transport. Interestingly, however, is the finding that if the future leads to increased petrol prices and road congestion only, with no change to public transport travel times or travel conditions, the forecast growth is much more modest. Figure 11 shows the relative shift in preference based on $1.90 petrol and worse road congestion only (no change to the quality of public transport services). It shows that what was a doubling of train patronage in the first scenario (Figure 10) becomes only a 20% increase under the second scenario. Bus/train and tram/train have forecast demand increases that are greater than 20%, but still lower than in the first scenario. The reduction in demand for car travel is still significant (13.5%), but much more of this demand is absorbed by cycling and walking. The key finding is that there will be modest growth in public transport patronage with rising petrol prices and greater road congestion, but this will only be converted into significant patronage growth if there are simultaneously substantially better customer experiences on the public transport network.

Figure 11: Relative shift in preference by mode based on $1.90 petrol, and worse road congestion



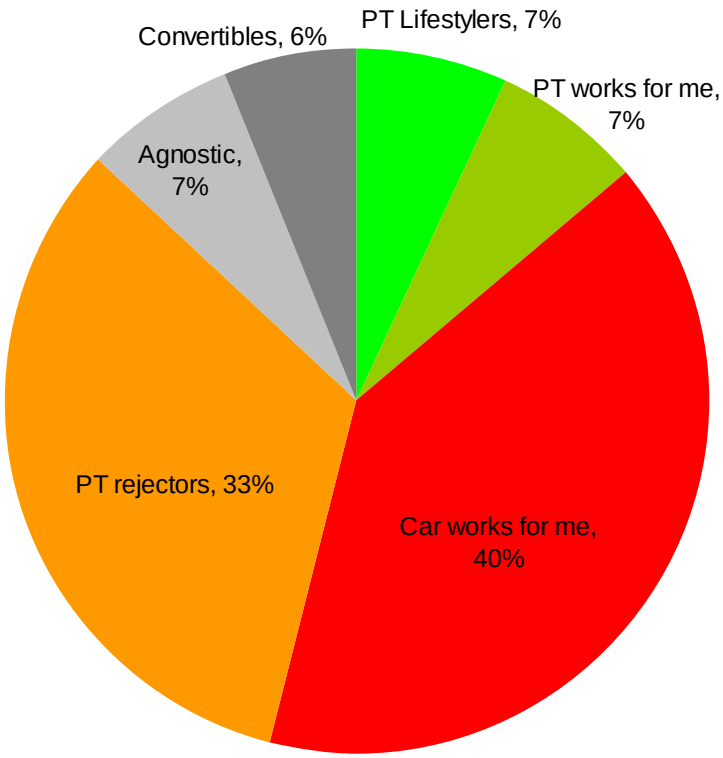
If the last surge in patronage was led by a dramatic increase in petrol prices, the next surge can only take place if there are significant improvements in the quality of services offered on the public transport network. The price elasticity for car travel associated with petrol prices found in this study was about -0.15, which is similar to some figures reported in the literature (e.g. Wallis & Schmidt, 2003), but much lower than have been previously found in Melbourne, such as a cross elasticity of -0.475 for train reported by Currie & Phung (2006). This suggests that the impact of petrol prices rising to $1.80 for the second time may not be the same as the initial rise in price to these values.

Key Finding #5: Attitudinal change has played a supporting role in the growth in public transport patronage in Melbourne since 2005.

The strategic models were unable to predict the 2005-2009 surge without a significant re-calibration of its mode allocation algorithm. In essence, it is hypothesised that this re-calibration was reflecting an increased receptiveness to public transport in the market based on attitudinal change. Without this attitudinal change, the levels of increased patronage observed in Melbourne would not have been seen.

The segmentation model developed as part of the current study can also be used to test the hypothesis that attitudinal change was critical in the growth in patronage in public transport. The model 'base case' can be re-set to reflect conditions in Melbourne in 2005, and the reduced level of demand predicted does not reflect the levels of that time. The only way that the model can accurately reflect the demand observed in 2005 is to "shrink" the size of the segments receptive to public transport and "grow" those less receptive to public transport. There are several possible solutions, but Figure 12 shows one that can explain the data. This suggests that PT lifestylers grew from 7% of the market in 2005 (to 19% in 2009), PT works for me grew from 7% in 2005 (to 17% in 2009) and the car-oriented segments had shrunk from 73% of the total market (PT rejectors 33%, Car works for me 40%) to 34% in 2009. This strongly suggests that attitudinal change has played an important role in the patronage growth story seen in Melbourne between 2005 and 2009.

Figure 12: Possible 2005 segment composition that accurately predicts 2005 demand for public transport based on survey results



6. Conclusion

The current study has successfully provided a measure of the size of the market pre-disposed to public transport attitudes based on two different sets of attitudes (environment and health & fitness). It has also attempted to understand the sensitivities of each segment to changes in the transport market to better guide future forecasting initiatives.

The results strongly point to attitudinal change having played a significant role in recent patronage growth. The only way the model can retrospectively predict the growth is to shrink the size of the public transport segments in 2005 relative to 2009. This is not inconsistent with other data sources suggesting a growth in community attitudes around the environment and health & fitness in this period.

The model has obvious limitations. The survey used to develop the model focused on work and study trips only and does not cover in any way cover other trip types (e.g. personal errands, social trips, etc.). As a cross-sectional piece of work, there is no direct indication of the change in segment size over time – inferences were made to estimate 2005 segment compositions – and no indication as to the stability of the segments. Choice modelling methodologies also tend to over rather under estimate behaviour change, particularly where significant barriers to behaviour change exist.

The significant challenge for this research is to be able to effectively convert the insights gained into improved patronage forecasting. The Department of Transport is currently looking at ways in which the quantification of attributes by segment that it is possible to extract from this segmentation model can be used as inputs into the four-step models. The perennial challenge remains, of course, by understanding the potential role of attitudes in mode shift in the same way that we understand the role of petrol prices, congestion, etc. there remains the almost impossible task of accurately forecasting long-term trends in these variables.

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