

Exploring Forced Car Ownership in Metropolitan Melbourne

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1 Introduction

“Transport poverty occurs when a household is forced to consume more travel costs than it can reasonably afford, especially costs relating to motor car ownership and usage” (Gleeson and Randolph 2002).

A number of research studies have identified the suburban fringe of Australian metropolitan areas as a focus of significant transport disadvantage (e.g. Faulkner 1978; Morris and Lane 1979; Travers Morgan 1992; Dodson et al. 2004). The lack of effective public transport services has been seen as a major problem for socially disadvantaged people living on the fringe of Australian cities (Morris 1981; Hurni 2006; Currie and Senbergs 2007). In the UK a number of research studies have suggested that car ownership is ‘forced’ upon socially disadvantaged people where no alternatives are available (Jones 1987; Banister 1994). More recent research has suggested that rising auto fuel prices and associated increases in home loan interest rates are further exacerbating disadvantage in Australia’s urban fringe (Dodson and Sipe 2006). These issues are clearly of concern to urban fringe dwellers on low income who own and operate several cars.

This paper summarises the results of a research project examining transport disadvantage in Metropolitan Melbourne. The project is part of a wider international research program funded by the Australian Research Council¹ which is currently focussing on understanding transport disadvantage in Metropolitan Melbourne.

The aim of the research is to explore the concept of ‘forced car ownership’ as it might apply to urban Melbourne. The paper explores the relationship between income, location, car ownership, accessibility and public transport supply. It also explores car related expenditure and income and the travel behaviours of low income residents who have zero cars and those who might be considered to have ‘forced’ car ownership.

Section 2 of this paper presents a summary of the research context regarding ‘forced’ car ownership. Section 3 then details the results of an analysis used to explore the concept further including how this might be defined in the Australian context. Section 4 examines travel and transport by identified households that have low income and high car ownership in Melbourne. Section 5 summarises the results of a regression analysis aimed at modelling the relationship between the share of low income families with zero cars and those with 2+ cars and how this relates to public transport supply and walk accessibility. Section 6 examines the socio-economic characteristics of low income households with high and zero car ownership. The paper concludes with a summary of the major findings plus some comments on the implications of findings for transport policy.

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2 Research Context

The term 'forced car ownership' was first used in relation to rural low income residents in the UK:

“Voluntary' car ownership means that there are adequate substitutes for gaining access to facilities, and that the car is not a necessity. Conversely, 'forced' car ownership means that there are no alternatives. In rural areas, there is clear evidence of 'forced' car ownership, since cars are owned at lower-income levels and are seen to be one of the items of household expenditure that cannot be foregone”
(Banister 1994).

The central elements of the concept are low income, need for travel, lack of alternatives to the car and hence high car ownership.

A major recent focus of social research in the UK has been the links between lack of transport and the impacts on social exclusion and well being (SEU (Social Exclusion Unit) 2003). People without access to a car, living in areas without public transport, where walking to activities is not possible, may be disadvantaged because of limitations on access to activities. Some researchers have suggested that 'forced' car ownership might represent a reversal of this link:

“in areas of low [public transport] service provision ...there may be an important element of 'forced' car ownership among poorer households who have to make major sacrifices in order to meet car-ownership and running costs;... [in this instance] there is likely to be an *inverse* relationship between car-ownership and social well-being”
(Jones 1987).

While the term 'forced' car ownership is new to Australia the concept of low income families struggling to afford access to cars, which are essential to access life opportunities, is quite common in the Australian literature:

“There is a tendency, to view the disadvantaged as those excluded from the labour market. However substantial proportions of the employed population potentially face problems of transport disadvantage, through the expenses incurred via motor vehicle ownership”
(Dodson et al. 2004)

Early research by Faulkner identified what are termed 'coping' strategies for families living on the urban fringe of Sydney with only one car available (Faulkner 1978). These included car sharing, reorganising travel habits to maximise use of the car and integrating multiple trips into single car 'tours' to ensure best use of available transport. This research did not examine the concept of zero car households or the 'forced' car ownership concept suggested by the UK research. These are the focus of this paper.

While the above literature is suggestive that the UK concept of 'forced car ownership' is valid in Australia clearly the contexts are inherently quite different. Car ownership is higher in Australia whilst urban densities are lower and travel distances higher. This certainly implies at least some differences in context. This paper aims to explore the applicability further.

3 Exploring 'Forced' Car Ownership in the Australian Context

3.1 Validity of the Term

The term 'Forced Car Ownership' is somewhat value laden. It implies that car ownership is imposed on individuals whereas this need not necessarily be the case. Indeed car ownership has grown consistently throughout the world over the last 4 decades and it is difficult to see the imposition on the wills of individuals as a major driver of this trend. It is

plausible that low income families who pay a high share of income on motor vehicles do this willingly. From a research perspective there is a need to provide a factual basis for the term 'forced car ownership' before one might adopt its use.

To avoid this problem the authors have decided to coin the term 'High Car Ownership on Low Incomes' (HCOOLI) for the target group of this paper. This is both factual and avoids use of the value laden term 'forced'. A view on the validity of the 'forced car ownership' term is addressed again in the conclusions of this paper.

Another viewpoint which relates to this concept concerns the home location decision. Much research has illustrated that low income households trade off lower housing costs for higher transport costs by deciding to locate on the urban fringe of Australian cities (Faulkner 1978; Morris and Lane 1979). In this context high car ownership could be seen as a rational decision rather than an imposition. However clearly it is worth assembling some evidence to explore how 'free' and 'rational' home location decisions are for low income groups in this context.

Another viewpoint is that use of vehicles does not necessarily mean 'paying' for them. Many employees use cars paid for by employers which might often be parked at home. Hence cars used in a household may not necessarily be paid for by low income groups. This can include cars packaged as part of salaries or specialist utility vehicles required as part of certain trades. Again the term 'forced' is hardly applicable in these cases.

Early work in this field in Australia illustrated a high and growing share of expenditures on private transport in capital cities (Morris and Lane 1979). The same work identified that low income families tend to have higher expenditures than incomes. While this is not sustainable in the long term high expenditures are consistent with 'setting up' housing costs with financing from loans, gifts, sale of assets savings on other income sources etc (Morris and Lane 1979). In this context it is plausible that high transport costs are another of the burdens which are naturally held by young people building a family. It is also plausible that these families may not always be on low incomes and that this is a transition period in life where the gap between expenditures and incomes are tight.

Clearly there are potentially conflicting views on these issues. The aim of this paper is to explore these issues further through examination of available evidence.

3.2 Defining High Car Ownership On Low Income (HCOOLI) Households

A 'special' cross tabulation of data from the 2001 census (ABS (Australian Bureau of Statistics) 2001) was requested including:

- Household income; and
- Household car ownership.

This analysis was made available at individual Census Collector District (CCD) level to enable an analysis links with public transport supply and walk accessibility.

Table 1 shows the results of this analysis summarised by region of Melbourne². This indicates that:

- Out of the 1M (valid) households in the 2001 census tabulations, some 10% had no car, 38% had one car and 52% two or more cars.

² Middle Melbourne comprised the following LGA's (Banyule, Bayside, Boroondara, Brimbank, Darebin, Glen Eira, Greater Dandenong, Hobsons Bay, Kingston, Manningham, Maribyrnong, Monash, Moonee Valley, Moreland, Stonnington (part) and Whitehorse). Outer Melbourne (Cardinia, Casey, Frankston, Hume, Knox, Mornington Peninsula, Maroondah, Melton, Nillumbik, Whittlesea, Wyndham and Yarra Ranges). Inner is the other LGA's.

- There is a strong link between car ownership and income; 34% of households earning more than \$1,000 a week owned two or more cars while only 4.8% of those earning less than \$500/week had 2 or more cars.
- There is also strong relationship between income, car ownership and location:
 - Some 13.4% of low income (<\$500/week) Inner Melbourne households have no car compared to 4.5% of Outer low income dwellings
 - Some 5.7% of Outer low income households (<\$500/week) have 2 or more cars compared to 1.9% in Inner Melbourne.

As noted the concept of 'forced' car ownership is associated with low income, high car ownership and lack of transport alternatives. There is much evidence to suggest that Outer Melbourne has considerably lower levels of public transport service compared with Inner/Middle Melbourne. An associated research paper by the authors examining public transport supply in Melbourne has found that:

"Overall the analysis has identified significant differences between the levels of service of public transport supply between Outer and Inner/Middle Melbourne. On average Outer Melbourne has only 156 services per stop per week, 75% less than inner Melbourne and 50% less than Middle Melbourne. Only 66% of Outer Melbourne CCD's are covered by public transport (32% less than Inner Melbourne and 25% less than Middle Melbourne). Overall only 10% of the spatial area of Outer Melbourne has a public transport walk catchment coverage compared to 90% of Inner Melbourne, Overall the average Outer Melbourne CCD supply score is 764 compared to 10,922 Inner and 2,695 Middle. This is illustrative of lower service levels, sparser spatial coverage and limited walk catchment overlap compared to Inner and Middle Melbourne."

(Currie and Senbergs 2007)

Reviewing the results in Outer Melbourne in Table 1:

- Some 4,403 households have more than two cars but earn an income below \$300/week including negative and nil income
- A further 16,428 have an income between \$300 and \$499 a week and run two or more cars
- Overall some 20,831 households have an income below \$500/week and run two or more cars.

A judgement regarding the income threshold to choose regarding HCOOLI households also be informed by the levels of expenditure associated with car ownership.

The NRMA (2006) define the following average weekly running costs for a new car:

- Light car average: \$133.52
- Small car average: \$164.43
- Medium car average: \$209.86
- Large car average: \$258.04.

Even allowing for inflation between 2001 and 2006, associated costs for two or more of these cars would represent a very large share of total income (at least about half) for incomes less than \$500/week (2001). Household expenditure figures on motor cars suggest actual expenditures might be below these; for 1998-99 average weekly expenditures on motor vehicles were \$127.56 and for 2003-04 they were \$133.37 (ABS (Australian Bureau of Statistics) 2006). Even so the expenditures identified represent a significant share of income for those living on less than \$500/week.

Overall a definition of HCOOLI households was set as households earning less than \$500/week (2001) with 2 or more cars and living in Outer Melbourne.

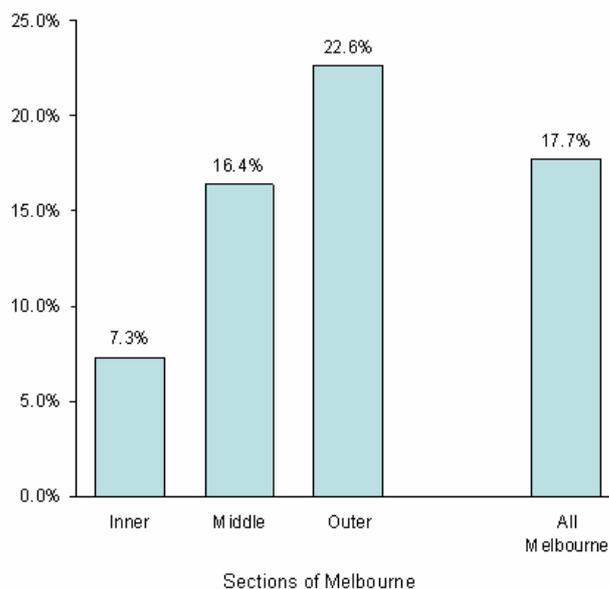
Table 1 : Household Income and Car Ownership – Metropolitan Melbourne (2001)

	No motor vehicles	1 motor vehicle	2 motor vehicles	3 or more motor vehicles	2 or more motor vehicles	Total Valid
Count of Occupied Private Dwellings by metro region by Weekly Household Income by Number of Motor Vehicles						
Inner						
Less than \$300 (incl negative/nil income)	7,656	4,262	530	192	722	12,640
\$300-\$499	4,460	5,314	810	169	979	10,753
LOW INCOME (Less than \$500)	12,116	9,576	1,340	361	1,701	23,393
\$500-\$999	5,465	12,542	3,142	534	3,676	21,683
\$1,000 or more	4,068	21,342	16,801	3,415	20,216	45,626
Total Valid	21,649	43,460	21,283	4,310	25,593	90,702
Middle						
Less than \$300 (incl negative/nil income)	29,664	34,017	4,925	1,635	6,560	70,241
\$300-\$499	17,013	55,531	17,470	2,763	20,233	92,777
LOW INCOME (Less than \$500)	46,677	89,548	22,395	4,398	26,793	163,018
\$500-\$999	11,958	77,566	55,641	11,889	67,530	157,054
\$1,000 or more	4,115	58,686	133,374	57,919	191,293	254,094
Total Valid	62,750	225,800	211,410	74,206	285,616	574,166
Outer						
Less than \$300 (incl negative/nil income)	10,210	20,041	3,487	916	4,403	34,654
\$300-\$499	6,147	34,897	14,057	2,371	16,428	57,472
LOW INCOME (Less than \$500)	16,357	54,938	17,544	3,287	20,831	92,126
\$500-\$999	3,570	45,294	52,317	12,200	64,517	113,381
\$1,000 or more	1,007	20,456	90,766	48,370	139,136	160,599
Total Valid	20,934	120,688	160,627	63,857	224,484	366,106
Total						
Less than \$300 (incl negative/nil income)	47,530	58,320	8,942	2,743	11,685	117,535
\$300-\$499	27,620	95,742	32,337	5,303	37,640	161,002
LOW INCOME (Less than \$500)	75,150	154,062	41,279	8,046	49,325	278,537
\$500-\$999	20,993	135,402	111,100	24,623	135,723	292,118
\$1,000 or more	9,190	100,484	240,941	109,704	350,645	460,319
Total Valid	105,333	389,948	393,320	142,373	535,693	1,030,974
% of occupied dwellings in that region						
Inner						
Less than \$300 (incl negative/nil income)	8.4%	4.7%	0.6%	0.2%	0.8%	
\$300-\$499	4.9%	5.9%	0.9%	0.2%	1.1%	
LOW INCOME (Less than \$500)	13.4%	10.6%	1.5%	0.4%	1.9%	
\$500-\$999	6.0%	13.8%	3.5%	0.6%	4.1%	
\$1,000 or more	4.5%	23.5%	18.5%	3.8%	22.3%	
Total	23.9%	47.9%	23.5%	4.8%	28.2%	
Middle						
Less than \$300 (incl negative/nil income)	5.2%	5.9%	0.9%	0.3%	1.1%	
\$300-\$499	3.0%	9.7%	3.0%	0.5%	3.5%	
LOW INCOME (Less than \$500)	8.1%	15.6%	3.9%	0.8%	4.7%	
\$500-\$999	2.1%	13.5%	9.7%	2.1%	11.8%	
\$1,000 or more	0.7%	10.2%	23.2%	10.1%	33.3%	
Total	10.9%	39.3%	36.8%	12.9%	49.7%	
Outer						
Less than \$300 (incl negative/nil income)	2.8%	5.5%	1.0%	0.3%	1.2%	
\$300-\$499	1.7%	9.5%	3.8%	0.6%	4.5%	
LOW INCOME (Less than \$500)	4.5%	15.0%	4.8%	0.9%	5.7%	
\$500-\$999	1.0%	12.4%	14.3%	3.3%	17.6%	
\$1,000 or more	0.3%	5.6%	24.8%	13.2%	38.0%	
Total	5.7%	33.0%	43.9%	17.4%	61.3%	
Total						
Less than \$300 (incl negative/nil income)	4.6%	5.7%	0.9%	0.3%	1.1%	
\$300-\$499	2.7%	9.3%	3.1%	0.5%	3.7%	
LOW INCOME (Less than \$500)	7.3%	14.9%	4.0%	0.8%	4.8%	
\$500-\$999	2.0%	13.1%	10.8%	2.4%	13.2%	
\$1,000 or more	0.9%	9.7%	23.4%	10.6%	34.0%	
Total	10.2%	37.8%	38.2%	13.8%	52.0%	
% of low income dwellings in that region						
INNER						
Low Income (Less than \$500)	51.8%	40.9%	5.7%	1.5%	7.3%	
MIDDLE						
Low Income (Less than \$500)	28.6%	54.9%	13.7%	2.7%	16.4%	
OUTER						
Low Income (Less than \$500)	17.8%	59.6%	19.0%	3.6%	22.6%	
TOTAL						
Low Income (Less than \$500)	27.0%	55.3%	14.8%	2.9%	17.7%	

3.3 Distribution of HCOOLI Households

Figure 1 shows the relative share of low income households (<\$500/week) operating more than 2 cars. Some 22.6% of the low income households in Outer Melbourne operate 2+ cars a week despite incomes of less than \$500/week.

Figure 1 : Low Income Households (<\$500/week) with 2+ Cars



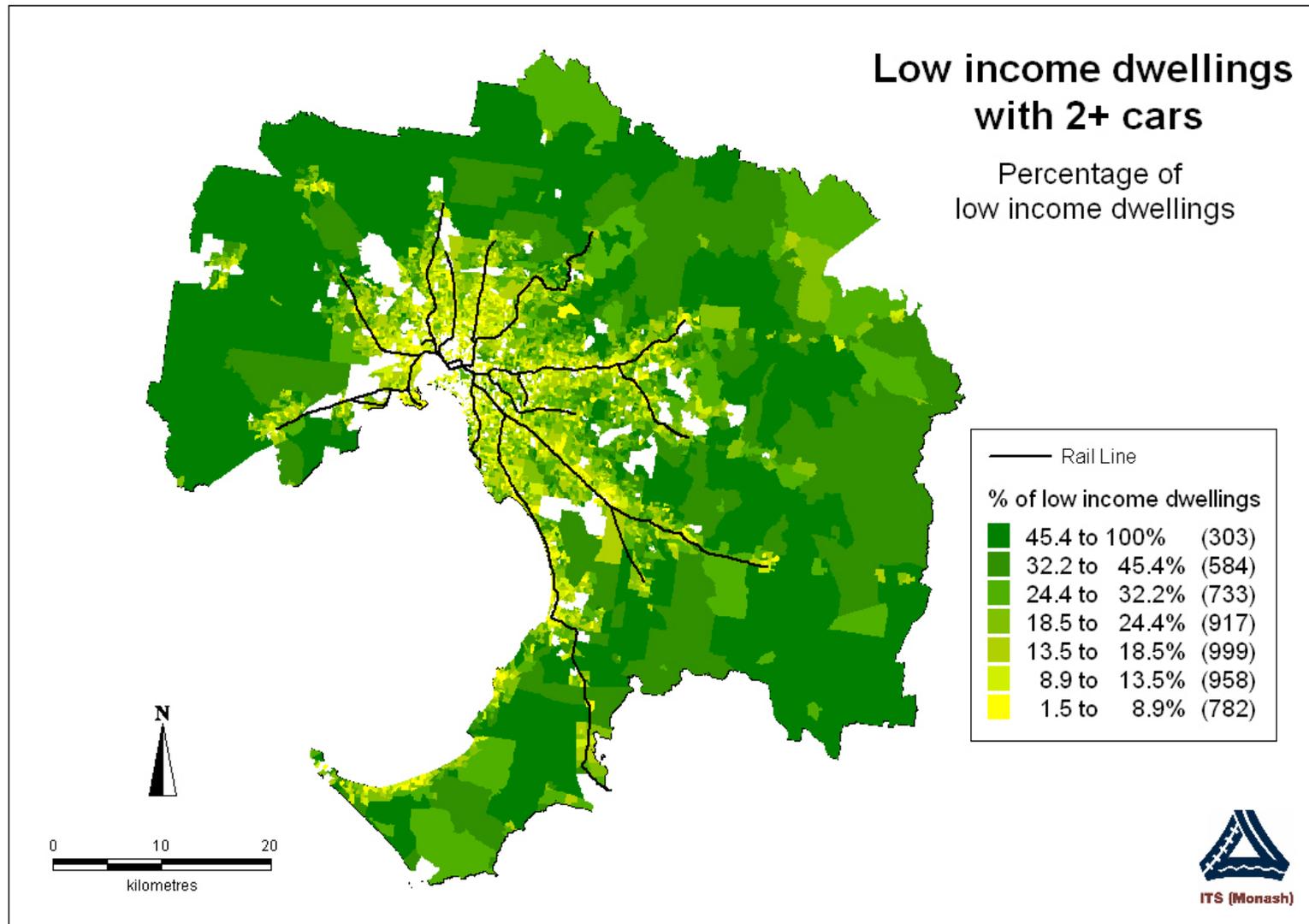
Source: ABS 2001 Census

Figure 2 shows the relative concentration across Melbourne of households earning less than \$500/week and running 2+ cars (by CCD). This shows a clear trend towards higher percentages of households in fringe urban areas of Melbourne. The proximity of Melbourne railways is suggestive that there are lower shares near public transport. Such a view was also suggested in recent research into household vulnerability to fuel price and interest rate increases (Dodson and Sipe 2006). These themes are tested further in Section 5.

3.4 Distribution of HCOOLI and Zero Car Ownership

An analysis of Table 1 data suggests that in Outer Melbourne there are 20,831 households on low income (<\$500/week) with 2+ cars and 16,357 with no cars. This suggests there are more low income residents with HCOOLI than zero car ownership in Outer Melbourne.

Figure 2 : Share of Low Income Households (<\$500/week) With 2+ Cars



4 Travel, Transport and HCOOLI Households

4.1 Transport and HCOOLI Households

An analysis of households in the Victorian Activity Travel Survey (VATS, Transport Research Centre 1996) was undertaken to isolate households in Outer Melbourne with incomes below \$500/week who have 2+ cars. The following features of their motor vehicles were established relative to other areas and income groups:

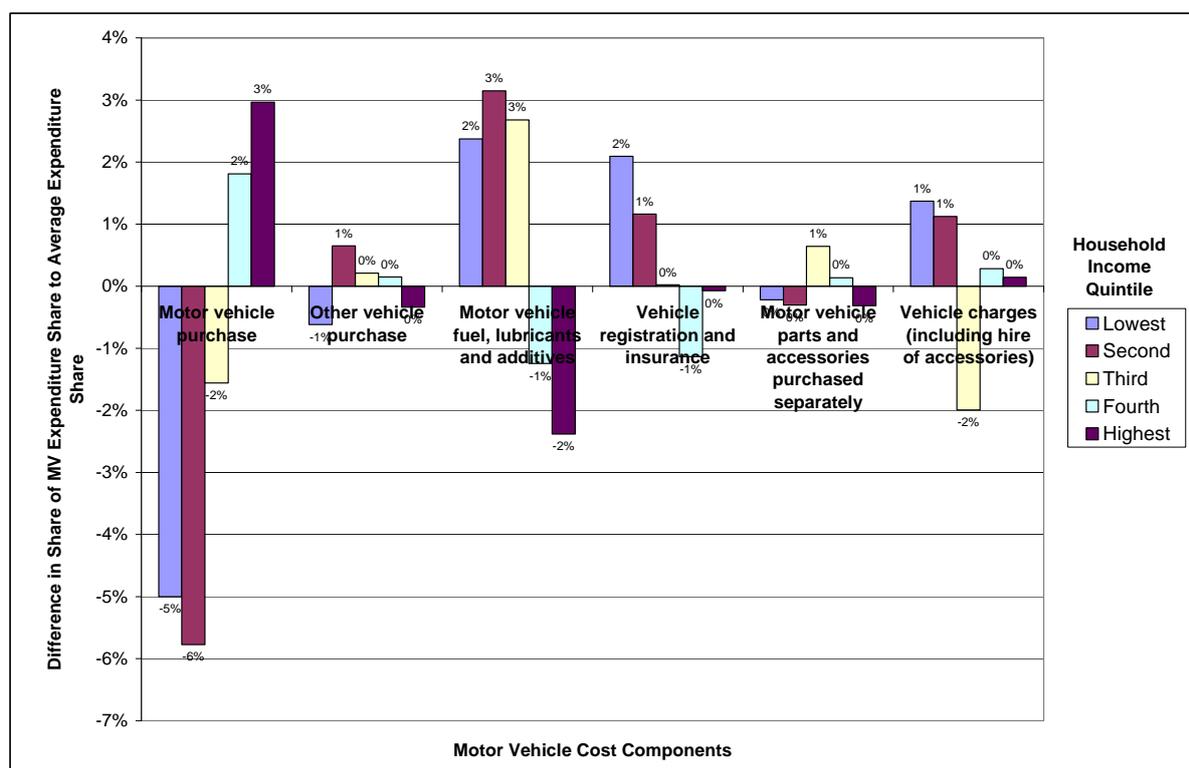
- The average age of cars owned was higher than those with higher income in Outer Melbourne. HCOOLI households had an average vehicle age of 11.5 years which compared to 10.7 for middle income earners and 9.4 years for high income earners.
- The average age of cars owned by HCOOLI households in Outer Melbourne was slightly higher (11.5 years) than that of those on low income (<\$500/week) with 2+ cars in Middle Melbourne (11.3 years).
- There is evidence that HCOOLI households run smaller cars than others living in Outer Melbourne. The average number of cylinders per car was 4.74 for HCOOLI Outer Households compared to 4.83 for Middle income household dwellers and 4.89 for high income Outer dwellers.
- Although FCO households had fewer cylinders per car than other Outer income groups, these cars were larger than all income groups in Inner and Middle suburbs. FCO households had 4.74 cylinders per car compared to high income dwellers in Middle Melbourne who had 4.73 cylinders per car. The implication is that FCO households run smaller cars than anyone else in Outer Melbourne but larger (and hence more expensive) cars than householders living in Inner and Middle Melbourne.

4.2 Car Expenditure and HCOOLI Households

Figure 3 illustrates the results of an analysis of relative household expenditure on motor vehicles by income quintile. This analysis covers all of Australia from the 2003/4 ABS household expenditure survey (ABS (Australian Bureau of Statistics) 2006) (No data of this type is available for Melbourne alone). This indicates that:

- Low income households spend substantially less on motor vehicle purchase than other income groups. This finding is consistent with the above Melbourne results on motor vehicle age and vehicle size.
- Low income households have slightly lower average expenditure on motor vehicle parts/accessories.
- Low income households have substantially higher expenditure on fuel and lubricants and other vehicle charges. These are less discretionary items of expenditure associated with use of vehicles and possible also reflect this groups lower access to company cars (where these costs may be paid for by an employer)
- Expenditure on motor vehicle registration and insurance is relatively higher for low income groups. This could be related to higher insurance premiums for younger people and also for spatial locations with higher car theft and damage. It could also reflect the fixed nature of these charges relative to total expenditure items (resulting in a high representation relative to income)

Figure 3: Share of Motor Vehicle Expenditure by Component and Income Quintile – Australia 2003/4



Source: (ABS (Australian Bureau of Statistics) 2006)

4.3 Travel and HCOOLI/ Zero Car Ownership Households

The Victorian Activity Travel survey was analysed to assess the trip frequency, distance and travel time for households with various car ownership levels and income.

The **trip frequency per day** analysis established that:

- Low income households make less trips than equivalent middle and higher income households in any particular car ownership or location group
- Having a household car and having more than one car increasingly acts to increase the number of trips made in all parts of Melbourne and for all income groups
- In general the number of trips made increases from Inner to Outer Melbourne. It is possibly significant that this is not true for zero car households which make progressively fewer trips per day in Outer Melbourne than Inner and Middle. Zero car households also make less trips in Middle Melbourne than in Inner Melbourne. This is true of all the income groups with zero car households.
- HCOOLI households make less trips per day (12.2) than middle (14.2) and higher income households (15.7) with 2+ cars. They make 12.9% less trips than the average Outer area households with 2+ cars. However compared to low income households (<\$500/week) in Middle Melbourne HCOOLI households make 5.2% more trips and compared to low income households in Inner Melbourne they make 4.7% less trips per day.

The **trip distance** analysis established that:

- Travel distance per trip generally increases with the number of cars owned per household regardless of income group
- Travel distance per trip increases from Inner to Middle and Middle to Outer Melbourne regardless of income group

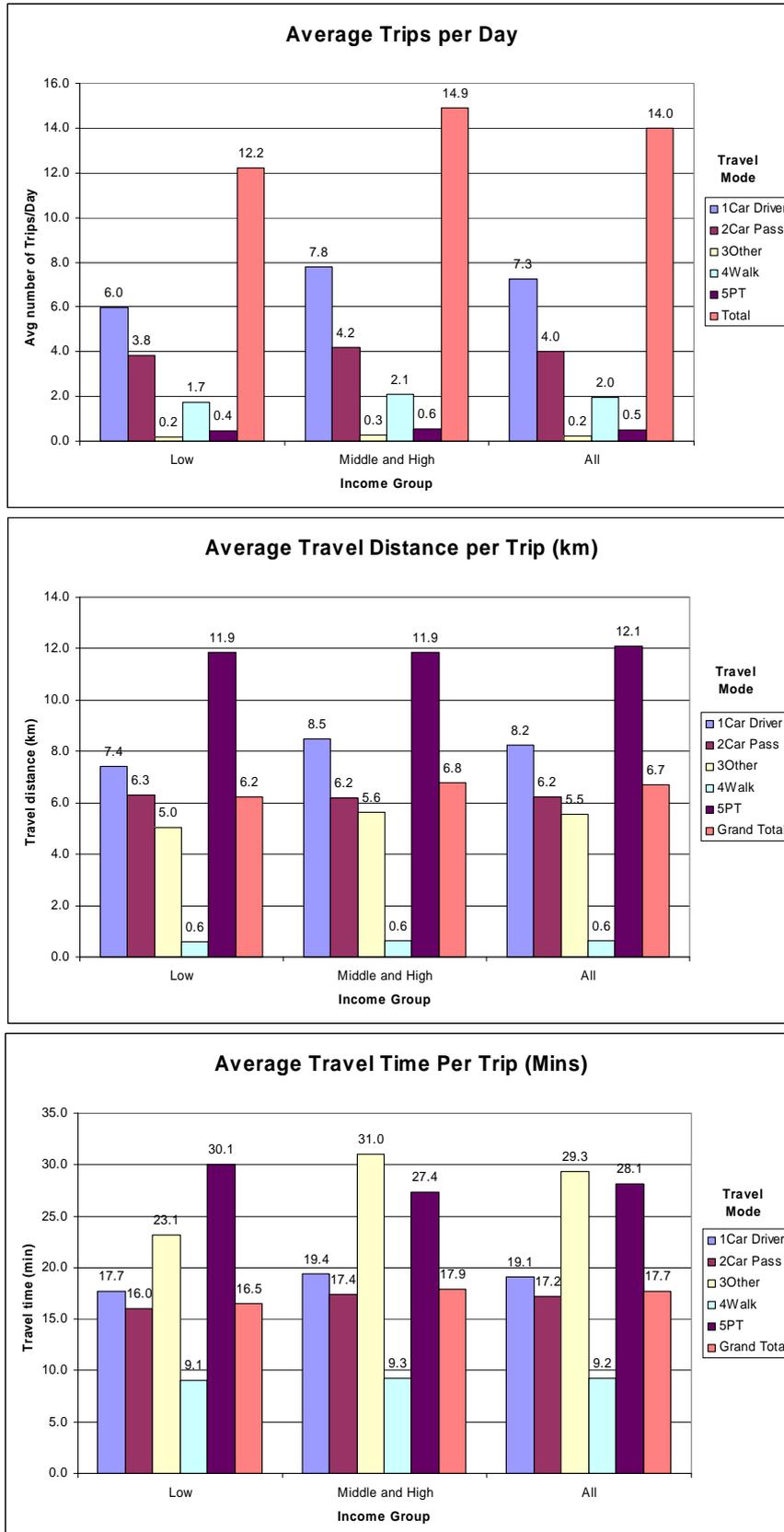
- In general higher income increases travel distance per trip in each circumstance. This does not hold for Inner area residents with zero and 1 car where there is little real difference in travel distance by income
- Travel distance increases substantially with income for Outer area residents with zero cars.
- HCOOLI households travel slightly less than high income households in the same circumstances (about 7% below the average for other households with 2+ cars). However they travel considerably further +38% than lower income householders in Middle Melbourne and also almost double the distance; 94% further than low income householders in Inner Melbourne.

These findings suggest that HCOOLI households make less trips (12.9% less), travel shorter distances (-7%) and for slightly shorter times (-6.8%) than average 2+ car households in Outer Melbourne. This relative propensity to travel less might be illustrative of financial pressures and a desire to reduce the costs of travel compared to other income groups in similar circumstances. It could also reflect more localised activity patterns which are generally less well serviced by public transport. These statistics relate well to the 'coping' behaviours suggested by Faulkner (Faulkner 1978). However the HCOOLI groups travel considerably more than Middle Melbourne low income residents; trips (+5.2%), distance per trip (+38%) suggesting a total relative daily travel quantum difference of +45% compared to middle suburbs. This is suggestive of a substantially higher travel financial cost compared to Inner/Middle Melbourne low income households.

Figure 4 illustrates the travel mode, trip distance and time for Outer Area residents owning 2+ cars per household by income group.

- In terms of trips made per day:
 - HCOOLI households are highly car dependent (80% of trips by car). This is a similar share to higher income households.
 - Public transport share is a very small share of travel (3.3%) for low income households compared to 4% for higher income households
 - Walking is a significant share of travel for low income households (13.9%) and is comparable to high income households (14%)
 - In general mode trip share is similar regardless of income with one exception:
 - The ratio of car passenger trips to car driver trips is 63% for low income households
 - This ratio is 53% for middle and high income households (against an average ratio of car passengers to drivers of 55%)
 - Overall low income households have a ratio of car passengers to drivers which is 15% larger than average for 2+ car households in Outer Melbourne.
- A rather different picture emerges when travel distance is considered. In general car driver trips are much longer than car passenger trips. However for low income households the relative length of a car passenger trip to a car driver trip is 85%. For middle and higher income households it is 73%. And on average it is 76%. The implication is that not only are there a higher share of trips involving lifts (a 15% higher ratio noted above) but also the distances lifts are given for are longer (the ratio of car passenger trip distance to car driver trip distance is 12% higher for HCOOLI households compared to the average).

Figure 4 : Travel Mode Average Trips/Day, Trip Distance and Time for 2+car Households by Household Income Group - Outer Melbourne



Source: ITS analysis of VATS 1996-1999

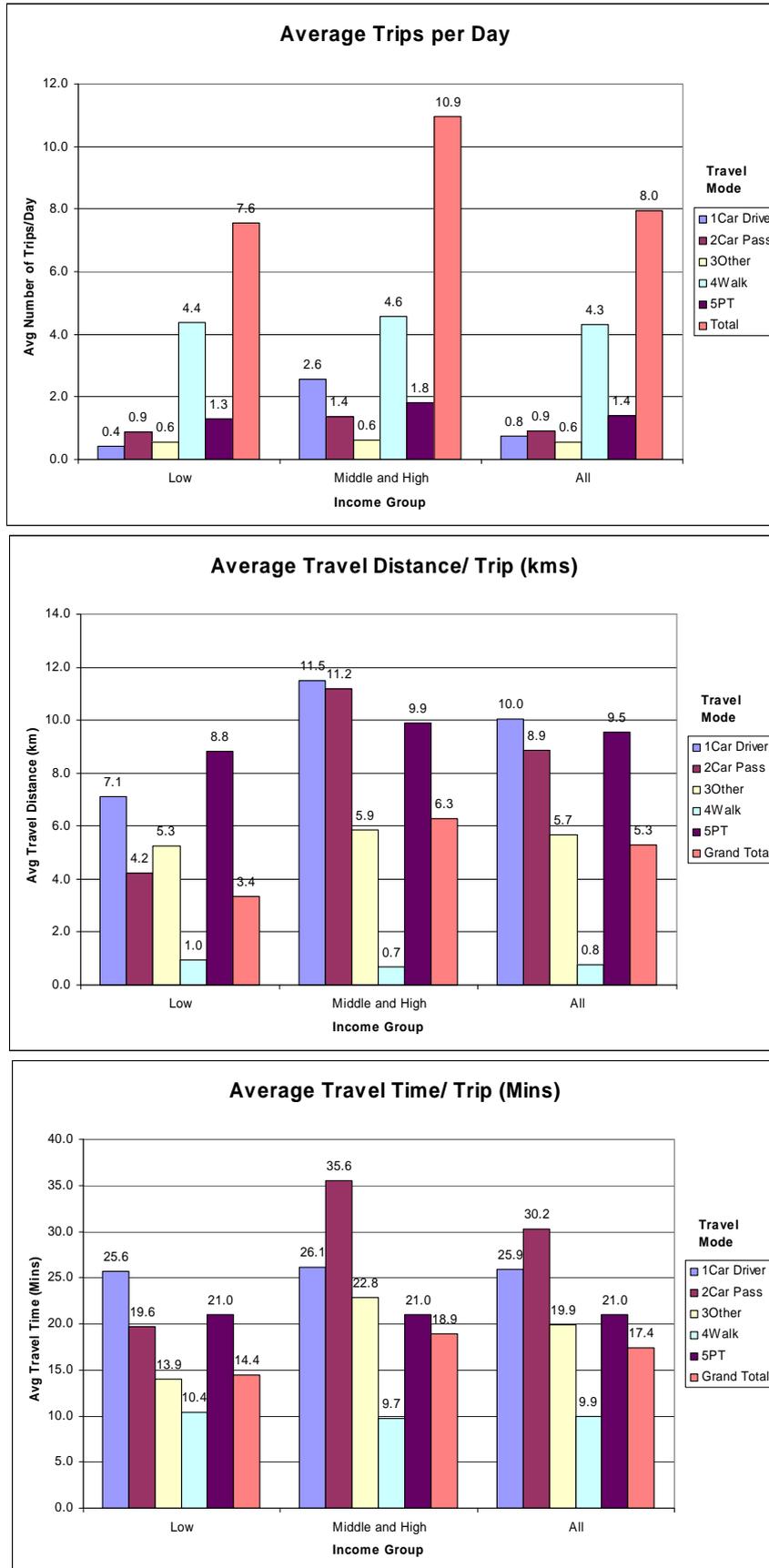
- If average trip distance and the daily number of trips is combined (average trip distance per day) then:
 - Vkms per day are:
 - Low Income Car Driver = 44.4
 - Low Income Car Passenger = 23.94
 - Ratio car pax/driver =0.54%
 - Average Car Driver = 59.86
 - Average Car Passenger = 26.04
 - Ratio car pax/driver =0.44%
 - Overall the relative difference between low income and average car pax/driver ratios is that there is a 23% greater amount of car sharing for lower income families
- The other main stand out finding in relation to the distance analysis is the very long travel distances involved in public transport trips made. These trips are on average 92% longer than average of all mode trips.
- The travel time analysis adds little to the exploration of the issue. Other trips seem to be quite long in terms of time (but not distance). Also public transport trips appear to be long in terms of time (as well as distance).

The main contribution of this analysis to the HCOOLI exploration is that it elaborates on how HCOOLI households are 'coping' with low income and the high costs of car travel. In particular evidence suggests car dependence for these groups but with a considerably higher share of car sharing. There is a 23% higher ratio of car passenger to car driver travel in FCO households compared with other high car ownership households in Outer Melbourne. This implies that these households are attempting to extract the maximum value from these cars.

Figure 5 shows a comparable analysis for Outer Melbourne households with zero car ownership by income group. This indicates that:

- In terms of the trip rate analysis:
 - Walking dominates travel for zero car households in Outer Melbourne. It represents 58% of trips made by low income households and 54% of trips by all zero car households
 - Public transport use is 17% of all trips by low income zero car households. It is about the same share for all income groups.
 - Car use (driving and sharing) is also 17% of trips for low income zero car Outer area households. However it is a 21% share of travel for all income groups together.
 - It is interesting that car use is a significant share of travel for households without a car. Getting lifts is particularly important for low income groups (a 12% share of their trips).
- As may be expected the trip distance analysis shows that walk trips are of a significantly shorter length than motorised travel. However at 1.0kms in average length, walk trips for low income households are surprisingly longer (61%) than the Metropolitan average (610 metres). Low income households also have walk trips that are longer than higher income households and the average (800m).
- Again public transport travel distances are longer. Public transport, car driving and lifts are the major long distance travel modes.
- The travel time analysis confirms long motor vehicle travel distances for middle and high income groups, particularly car passenger trips. With the associated public transport long travel times (and distances) the implications are that these might be longer distance commuter or shopping trips to destinations in Middle and Inner Melbourne.

Figure 4 : Travel Mode Average Trips/Day, Trip Distance and Time for Zero Car Households by Household Income Group - Outer Melbourne



Source: ITS analysis of VATS 1996-1999

4.4 Assessment

Two major findings are of interest for further exploration in these results:

- HCOOLI households demonstrate car dependence with little public transport use. The implication is that these households may lie further away from available public transport and also some distance from walk accessible activities.
- In contrast low income households without a car in Outer Melbourne make most of their trips by walking. This means they must reside within walking distance to activity centres. In addition a high share of their trips is made by public transport. This suggests they live near activity centres and near to available public transport.

5 Regression Analysis of the Drivers of HCOOLI /Zero Car Ownership

To explore the questions raised above a series of multiple regression models were developed to test how the dependent variable, the share of low income (<\$500/week) households owning 2+ cars, varied with regard to the following explanatory variables:

- The relative level of public transport supply
- Distance to nearest railway station (kms)
- Distance to nearest defined Melbourne 2030 major activity centre (kms)
- Distance to nearest local activity centre (defined as a business zone, kms).

A similar analysis was conducted to assess how the above explanatory variables related to the dependent variable, the share of low income households with no car.

The public transport supply variable adopted in this analysis used the approach defined in an associated analysis of this project (this is described in detail in Currie and Senbergs 2007). In summary the approach measures public transport supply in terms of the number of bus, tram and train vehicle trips offered per stop/station per week. It then factors these for overlapping walk catchments (which receive a combined higher service) and also areas not within walking distance of the stop/station. The output is a supply measure ranging from zero (no supply) to 100,000 with most values lying in the range 1,000 to 10,000. Seven groups of public transport supply were identified including 3 above and 3 below average plus a zero supply group. The average supply in Melbourne was around 2,900. Overall the supply analysis concluded that:

- Inner Melbourne stops/stations have an average supply score of 10,923 which is substantially higher than the average amount of services per week per CCD (2,149). This illustrates substantial overlap between walk catchments to stops/stations and hence a wide range of choice between routes, stops and services.
- In contrast Outer Melbourne has only 156 services per stop per week 75% less than Inner Melbourne and 50% less than Middle Melbourne. Only 66% of Outer Melbourne CCD's are covered by public transport (32% less than Inner Melbourne and 25% less than Middle Melbourne). Overall only 10% of the spatial area of Outer Melbourne has public transport walk catchment coverage compared to 90% of Inner Melbourne.
- Overall the average Outer Melbourne CCD supply score is 764 compared to 10,922 Inner and 2,695 Middle. This is illustrative of lower service levels, sparser spatial coverage and limited walk catchment overlap compared to Inner and Middle Melbourne.

(Currie and Senbergs 2007)

Table 2 shows the results of the regression analysis of FCO and zero car ownership for low income households.

Table 2 : Regression Model Results – Drivers of Zero Car Ownership and 2+ Car Ownership – Low Income Households in Outer Melbourne

Area	Regression Fit	Coefficient	P Value
% Low Income (<\$500/week) Households with 2+ Cars			
Outer Melbourne	Multiple R =0.392 Adjusted R ² = 0.152 Intercept = 26.9%		
	Public Transport Supply	-0.005	0.000
	Distance to M2030 Major Activity Centre	0.192	0.047
	Distance to Rail Station	-0.304	0.000
	Distance to Local Activity Centre	2.539	0.000
Middle Melbourne	Multiple R =0.480 Adjusted R ² = 0.231 Intercept = 12.6%		
	Public Transport Supply	-0.001	0.000
	Distance to M2030 Major Activity Centre	0.565	0.000
	Distance to Rail Station	3.459	0.000
	Distance to Local Activity Centre	1.549	0.008
Inner Melbourne	Multiple R =0.161 Adjusted R ² = 0.026 Intercept = 8.185%		
	Public Transport Supply	0.000	0.000
	Distance to M2030 Major Activity Centre	-0.287	0.720
	Distance to Rail Station	0.319	0.540
	Distance to Local Activity Centre	1.024	0.489
Total Melbourne	Multiple R =0.429 Adjusted R ² = 0.184 Intercept = 17.3%		
	Public Transport Supply	-0.001	0.000
	Distance to M2030 Major Activity Centre	0.447	0.000
	Distance to Rail Station	0.002	0.955
	Distance to Local Activity Centre	3.428	0.000
% Low Income (<\$500/week) Households with Zero Cars			
Outer Melbourne	Multiple R =0.416 Adjusted R ² = 0.173 Intercept = 10.5%		
	Public Transport Supply	0.005	0.000
	Distance to M2030 Major Activity Centre	-0.073	0.286
	Distance to Rail Station	0.107	0.004
	Distance to Local Activity Centre	-1.078	0.000
Middle Melbourne	Multiple R =0.601 Adjusted R ² = 0.361 Intercept = 27.6%		
	Public Transport Supply	0.002	0.000
	Distance to M2030 Major Activity Centre	-1.591	0.000
	Distance to Rail Station	-3.237	0.004
	Distance to Local Activity Centre	-2.436	0.000
Inner Melbourne	Multiple R =0.389 Adjusted R ² = 0.158 Intercept = 47.9%		
	Public Transport Supply	0.000	0.000
	Distance to M2030 Major Activity Centre	-3.668	0.012
	Distance to Rail Station	-2.141	0.025
	Distance to Local Activity Centre	-12.393	0.000
Total Melbourne	Multiple R =0.556 Adjusted R ² = 0.309 Intercept = 21.8%		
	Public Transport Supply	0.001	0.000
	Distance to M2030 Major Activity Centre	-0.478	0.000
	Distance to Rail Station	-0.191	0.000
	Distance to Local Activity Centre	-2.351	0.000

Low Income Households with 2+ Cars

The regression results in Table 2 relative to low income households with 2+ cars suggest a relative weak overall fit (adjusted $R^2 = 0.18$). Distance to rail stations and Distance to Melbourne 2030 Activity centres show P-Value tests which suggest these variables are a poor explanation of the share of HCOOLI households. In general public transport supply and the distance to local activity centres are significant. Public transport supply has a negative coefficient suggesting that the share of HCOOLI households declines as public transport supply increases. Distance to local activity centre has a positive coefficient, suggesting that the share of HCOOLI increases the further away a CCD is from a local activity centre.

On reflection these relationships seem logical. There are only a few Melbourne 2030 major activity centres hence they are quite remote from many CCDs particularly those in Outer areas. Hence this was not a significant variable. A similar conclusion applies to railway stations. The P-Test and associated results for this variable provided illogical answers.

Figure 5 shows how public transport supply and walk distance to local activity centres may relate to HCOOLI as suggested in the regression modelling.

These relationships suggest that the share of HCOOLI households in Outer Melbourne is particularly sensitive to the level of Public Transport Supply compared to Inner and Middle Melbourne. A reasonably small increase in public transport supply, from say zero to a supply index value of 1,000, can reduce HCOOLI from 27% of households to 22%. This would reduce the number of Outer households with HCOOLI by over 1,000.

HCOOLI is not so sensitive to walk distance when Outer Melbourne is compared with Inner and Middle. However HCOOLI is a higher share in Outer areas in all cases.

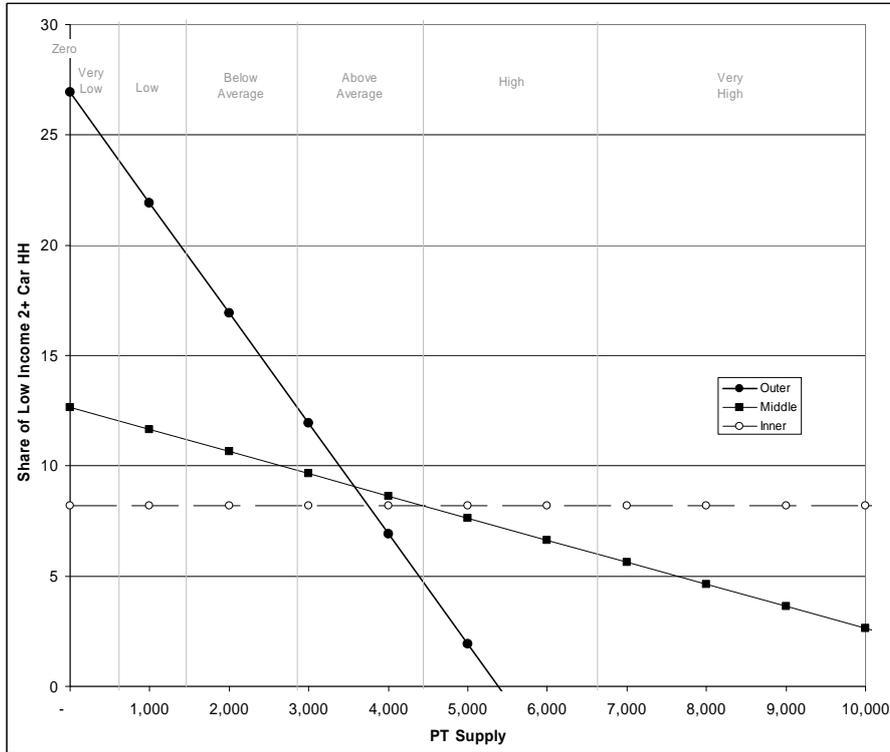
Low Income Households with Zero Cars

The regression results in Table 2 relative to low income households with no cars also suggest a relative weak overall fit but again public transport supply and distance to local activity centres are significant variables. Distance to rail stations and Distance to Melbourne 2030 Activity centres again show P-Value tests which suggest these variables are a poor explanation of the share of zero car households. In general public transport supply and the distance to local activity centres are significant. In this case Public transport supply has a positive coefficient suggesting that the share of zero car households increases as public transport supply increases. Distance to local activity centres has a negative coefficient, suggesting that the share of zero car households decreases the further away a CCD is from a local activity centre.

Again these values seem sensible. Figure 6 shows the suggested relationships between zero car ownership and public transport supply/distance to local activity centres.

Figure 5 : Modelled Relationship between the share of Low Income Households With 2+ Cars and Public Transport Supply/Distance to a Local Activity Centre

Public Transport Supply



Distance to Activity Centre

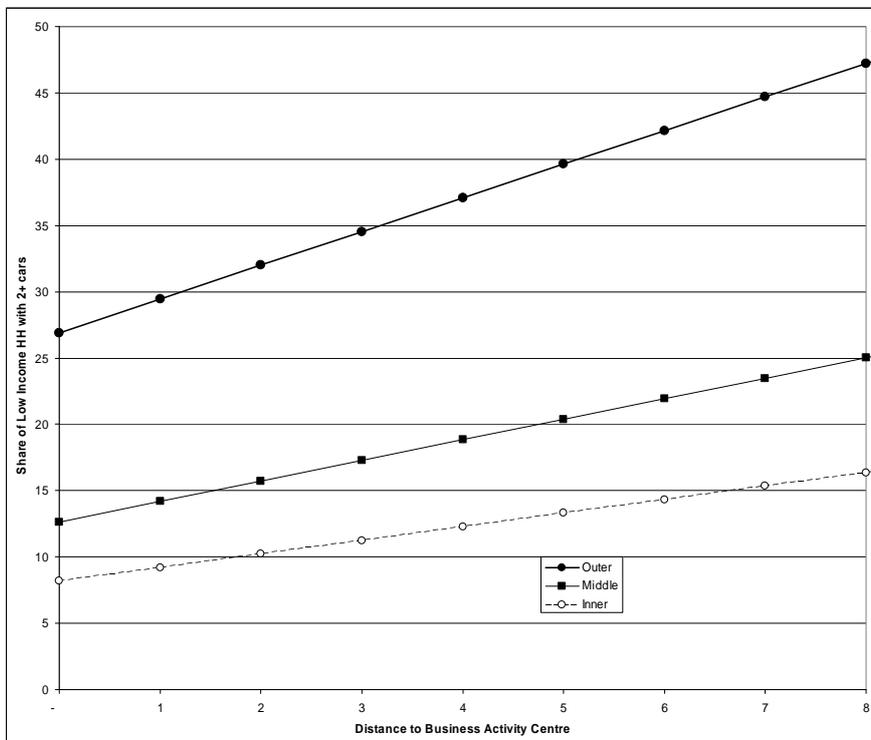
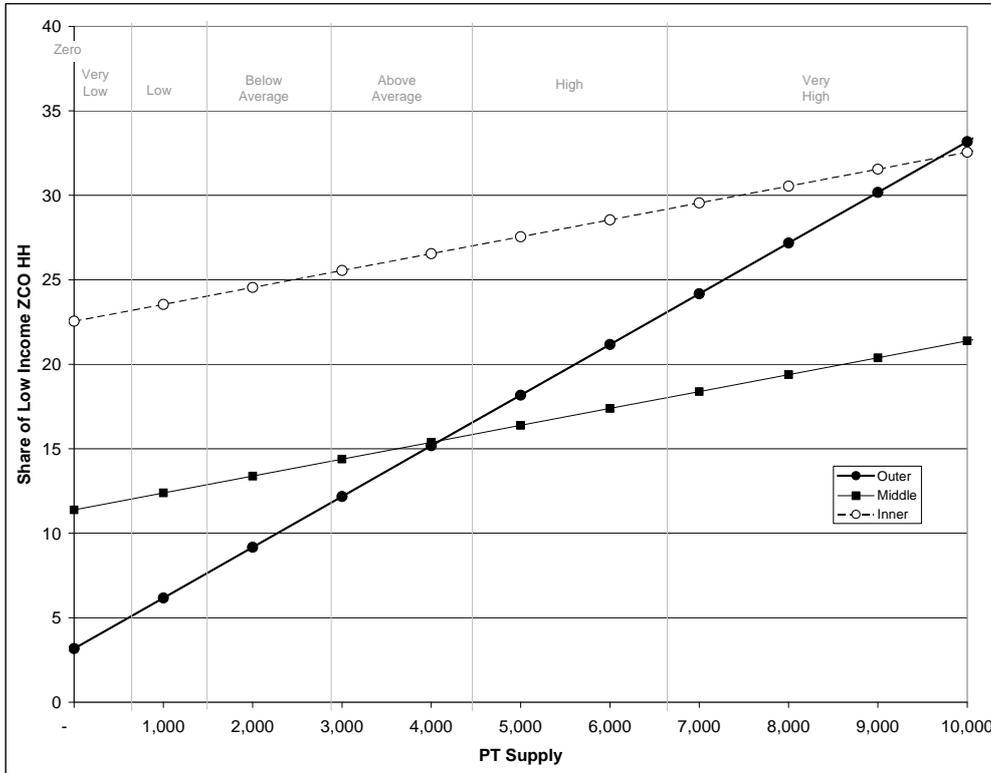
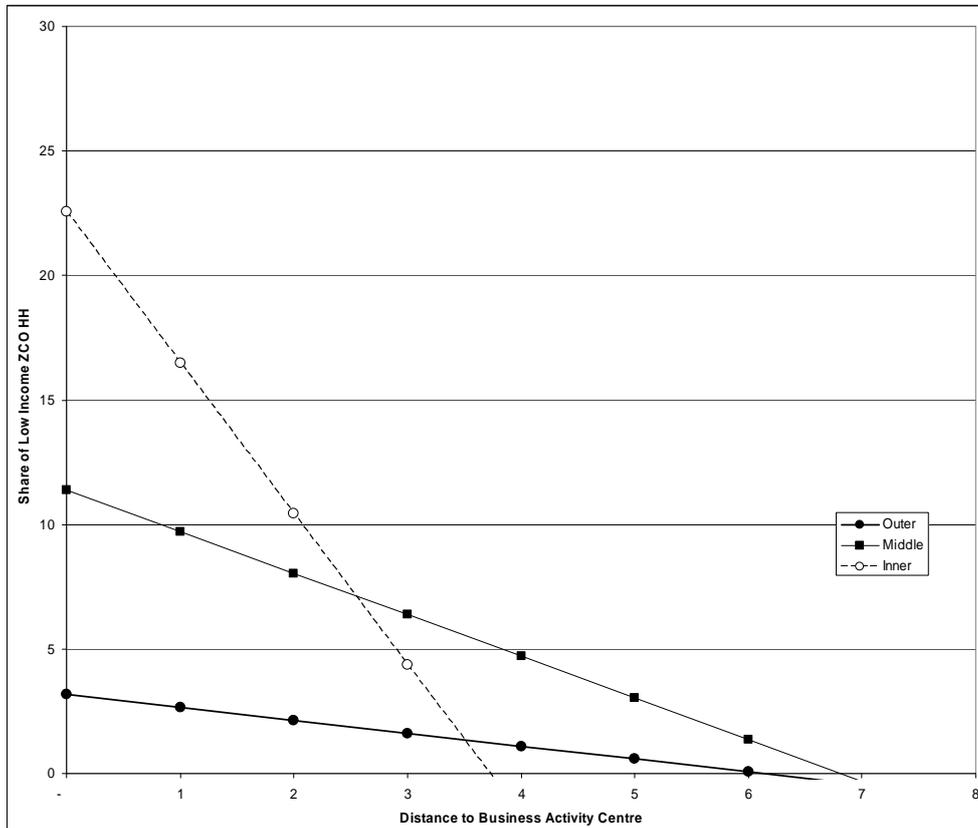


Figure 6 : Modelled Relationship between the share of Low Income Households With Zero Cars and Public Transport Supply/Distance to a Local Activity Centre

Public Transport Supply



Distance to Activity Centre



This indicates that Outer Melbourne is again more sensitive to changes in public transport supply than Inner and Middle Melbourne regarding the share of low income households without cars. However Inner Melbourne in particular has a higher share of zero car ownership overall.

The Inner Melbourne share of zero car ownership is more sensitive to distance to local activity centres than Middle and Outer Melbourne. Again shares are generally always higher in Inner Melbourne. A follow up check also showed that 99% of all CCD's with over 20% share of low income households without a car were within 1.5kms of a local activity centre.

Assessment

Overall these findings provide some interesting insights into how HCOOLI and zero car ownership relate to walk accessibility and public transport. Although the regression has a low overall fit, the statistical relationships between public transport supply and walk accessibility are significant. The relationship suggested by the model in Figures 5 and 6 present a useful basis upon which the benefits of public transport provision and walk accessibility might be benchmarked.

6 Socio-Economic Characteristics of HCOOLI and Zero Car Ownership Households

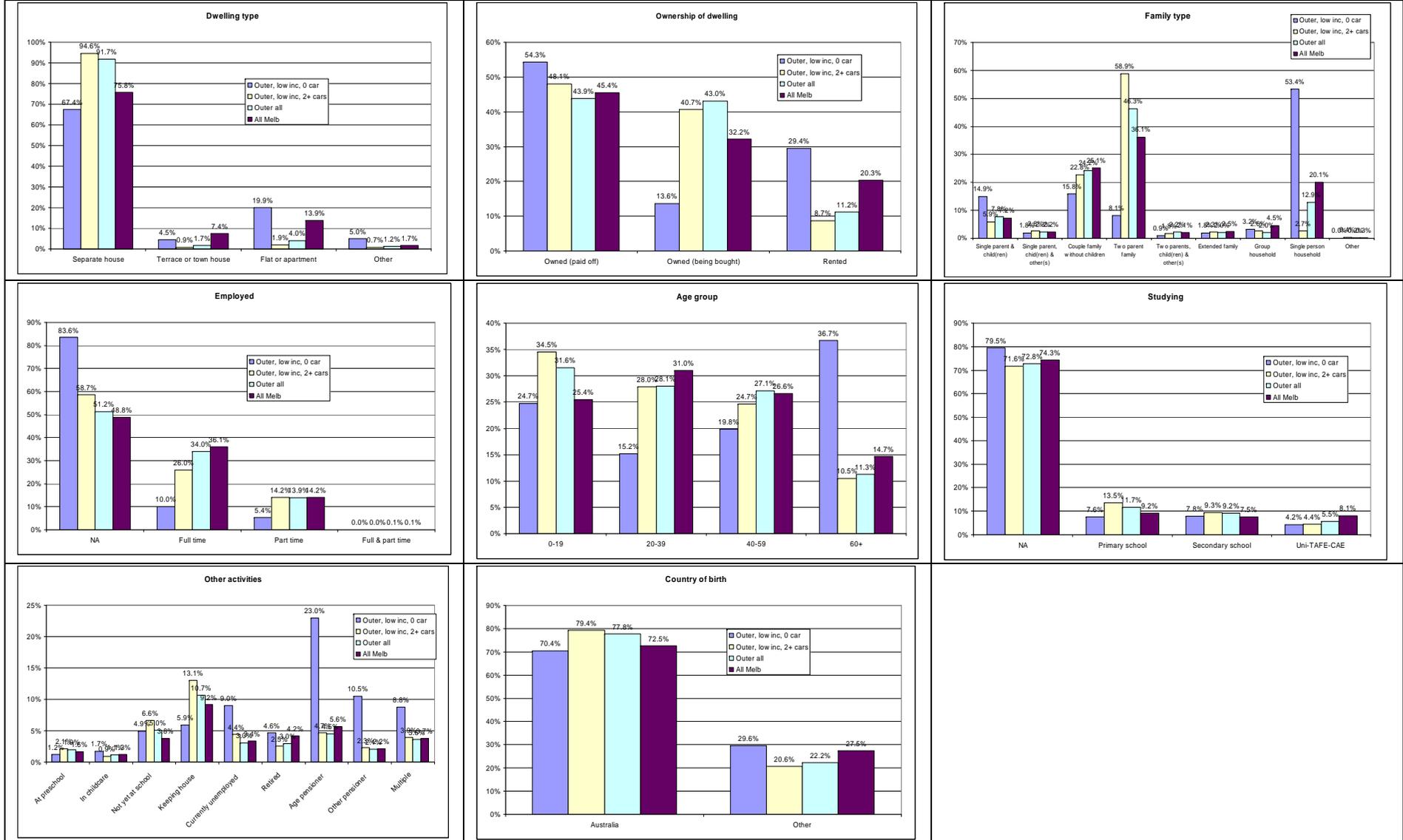
Figure 7 shows a range of analysis of household and socio-economic characteristics of HCOOLI households and those households with zero car ownership and low income in Outer Melbourne. These are compared with the average household in Outer Melbourne and the average for all Melbourne. Analysis is sourced from tabulations of households in the Victorian Activity Travel survey with these characteristics.

This indicates that comparing HCOOLI householders to average Melbourne householders, they have:

- A significantly higher share of two parent families (58.9%)
- A higher share of household members aged below 19 years of age (34.5%) and a lower share of 60+ household members.
- A higher share of household members that are not yet at school (6.6%) and at pre-school (2.1%)
- A higher share of household members who are 'keeping house' (13.1%)
- A higher share of separate accommodation (94.6%)
- A slightly higher share of households that are owned (with a mortgage paid off, 48.1%)
- A higher share of households with mortgages (40.7%) and a significantly lower share of rented accommodation (8.7%)
- A slightly higher share of persons born in Australia (79.4%)
- A lower share of full time employment (26%) and an average share of part time employment (14.2%).

Overall this data is suggestive that while there are a wide range of socio-economic groups which comprise HCOOLI households in general these can be typified as young families with children with a high share of home keepers. While some of these groups have paid off their houses a much higher share than average have mortgages to be paid off. There are clear correlations between these findings and the evidence of young families setting up homes with high household expenditures identified in previous research (Morris and Lane 1979).

Figure 7 : Household and Socio-Economic Characteristics – HCOOLI and Zero Car Ownership Household Members in Outer Melbourne



Source: Victorian Activity Travel Survey

Figure 7 indicates that comparing low income householders without a car in outer Melbourne with the Melbourne average :

- A significantly higher share (53.4%) i.e. over half, are single person households
- A significant share (36.7%) are aged over 60
- Significantly lower shares are employed full time (10%) or part time (5.4%)
- A significantly higher share are age pensioners (23%) or pensioners (10.5%) or retired (4.6% or unemployed (9%)
- A higher share are in single parent households (14.9%)
- A higher share live in a flat (19.9%). This is significantly higher compared to other dwellings in Outer Melbourne (4%).
- A significantly higher share are in rented accommodation (29.4%) but a majority live in dwellings which are paid off (54.3%).

Overall these results are suggestive of a range of types of social characteristics. The strongest typology suggests older Australians living in a single person household with a high share of rented accommodation on a pension. The data is also suggestive of a sub group of unemployed young mothers with children living in rented flats.

7 Conclusions and Discussion

This paper has explored the concept of 'forced car ownership' as it might apply to urban Melbourne. Discussion has found the concept to be 'value laden' and evidence is required to prove or disprove the degree of 'force' which is purported to apply in relationship to car ownership issues. On this basis analysis has focused on High Car Ownership On Low Income (HCOOLI) Households.

Overall some 20,831 households were identified in Outer Melbourne which may be considered to have HCOOLI including:

- low relative public transport service levels
- an income below \$500/week ; who also
- run two or more cars.

These households were found to own smaller and older cars and to spend a higher share of motor vehicle expenditure on registration and insurance and less on vehicle purchase. Analysis found that HCOOLI households make less trips (12.9% less), travel shorter distances (-7%) and slightly shorter travel time (-6.8%) than average 2+ car households in Outer Melbourne. This relative propensity to less travel might be illustrative of financial pressures and a desire to reduce the costs of travel compared to other income groups in similar circumstances. It could also be illustrative of greater efficiencies in travel exhibited by HCOOLI households. However the HCOOLI groups travel considerably more than Middle Melbourne low income residents; trips (+5.2%), distance per trip (+38%) suggesting a total relative daily travel quantum difference of +45% compared to Middle suburbs. This is suggestive of a substantially higher travel financial cost compared to Inner/Middle Melbourne low income households.

HCOOLI households are highly car dependent and make very few trips by public transport. There is a 23% higher ratio of car passenger to car driver trips in HCOOLI households compared with other higher car ownership households in Outer Melbourne. These habits are suggestive of a relatively high cost of car ownership and travel by car compared to others in Melbourne. It is also suggestive of the adoption of 'coping' strategies to better utilise available resources within limited budgets. It might also be illustrative of a desire to maximise usage of transport resources which are relatively expensive to procure.

A similar travel analysis of low income households with no car has highlighted that walking dominates travel. This indicates that, in general, fringe dwellers without a car must live near enough to activities to be able to walk.

Statistical analysis of the shares of low income households with 2+ and zero cars show a weak though significant relationship to public transport supply and walk accessibility. These findings suggest a link between the quality of public transport provision and the financial impacts of car ownership on low income families. The findings suggest a plausible link between quality of transit provision and high car ownership on low incomes. In addition these findings are suggestive that if low income families can be located within walking distance to activity centres then car ownership appears to be lower. Walk accessibility and public transport provision become more feasible options in these cases.

Analysis has also shown that some quite clear generalisations can be made about HCOOLI and zero car ownership low income families in Outer Melbourne. HCOOLI households can be typified as young families with children with a high share of home keepers. While some of these groups have paid off their houses a much higher share than average have mortgages to be paid off. The strongest typology for no car ownership low income households suggests older Australians living in a single person household with a high share of rented accommodation on a pension. The data is also suggestive of a sub group of unemployed young mothers with children living in rented flats.

The analysis in this paper has painted a new and original picture of transport disadvantage in fringe urban Australia. HCOOLI affects a numerically larger number of fringe urban households in Melbourne than zero car ownership. Hence transport disadvantage on the fringe does not necessarily mean lack of transport. In addition much previous social research has focussed on those without cars and the problems these people have in using a sparse and low frequency public transport system. This research suggests that most car-less low income fringe dwellers live near to activities they can walk to. They tend to be older retired Australians or single parent families who appear to have made logical home location decisions based on access to activities and transport. The activity centres near which they reside are both walkable and tend to have higher quality public transport than suburbs away from activity centres. Hence the image of the isolated urban fringe dweller is likely to represent the few and not the majority.

A major implication of these findings is the possible support the results provide for the 'social transit' agenda. This is a new and growing emphasis on public transport policy which encourages investment in Australian urban fringe transit to address social disadvantage related to lack of transport alternatives. In Melbourne this has recently seen an investment of over \$1.2B over 10 years in new fringe and middle urban bus services (DOI (Department of Infrastructure) 2006). The particularly sensitive nature of the suggested relationship between public transport supply and low income families with 2+ and zero cars in Outer Melbourne suggests that even modest investments in supply could be acting to reduce the financial pressures on low income families. The results could also support strategies to increase the urban densities of low income families living around activity centres particularly those associated with public transport nodes.

While these points are plausible explanations supported by the evidence presented they are far from conclusive. An alternative explanation might concern previously suggested decisions which low income families make to live in cheaper fringe low income accommodation. In part this suggests they accept higher transport costs as a trade off for lower housing costs. In practice both explanations are plausible and only evidence can provide some resolution. This requires further primary research.

Further primary research will also be an important input to resolving the question regarding the degree to which high car ownership is 'forced' on low income families on the urban

fringe. Many explanations of HCOOLI are plausible but without evidence a degree of 'forcing' is as plausible as other explanations.

A concern which the research can more conclusively illustrate is the relatively high transport costs being paid by young families on low incomes on the urban fringe. Links between high transport costs and a high share of mortgages for these groups have been made. These present clear correlations with recent research linking increasing home loan interest rates and world fuel prices as a driver of poverty in fringe urban Australia (Dodson and Sipe 2006). While it is still plausible that high expenditures and low income are a natural part of the early family life cycle in fringe urban Australia, the vulnerability of these groups to increasing transport costs and interest rates is a valid concern for social policy. Improved public transport must at least provide some element of choice to families in these positions.

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