

Relationship between income and commuter use of public transport in Australia

Afzal Hossain and Leanne Johnson

Bureau of Infrastructure, Transport and Regional Economics (BITRE)
Department of Infrastructure, Regional Development and Cities
GPO Box 501, Canberra ACT 2601, Australia

Email for correspondence: afzal.hossain@infrastructure.gov.au

Abstract

This paper is part of a broader study examining the key question: Do public transport users tend to be high- or low-income earners? To answer part of this key question, this paper addresses two questions relating to income and transport use by commuters:

- (1) What is the nature of the relationship between income and public transport use for commuting trips (and how does it differ across public transport modes: Bus, Rail, Tram/Light rail and others)?
- (2) How does the relationship between commuter public transport use and income vary by location?

The ABS *Census of Population and Housing* for 2016 was the main source of data. The results are mostly based on place of residence and presented at national level as well as several geographical scales, such as total states/territories, capital cities, state balances, major cities (with populations over 85 000) and where in the city commuters live and work.

The proportion of train users increased with average weekly personal income, and both low income and high income people had relatively high use of bus, while middle income earners were more likely to be private vehicle users (compared to low or high income individuals). Irrespective of transport modes and cities, the average weekly personal income for commuters who travel to work within CBDs was higher than for those who made their journey to work to the rest of city. In addition, estimated average weekly income of commuters in the capital cities was higher compared to those in the state balances, but train users in capital cities had lower average weekly personal income than those in the state balances.

In summary, the preliminary results presented in this paper showed that the proportion of train users increased with average weekly personal income. In addition, employed people with higher incomes tended to take public transport more than those employed people with lower incomes.

1. Introduction

There is a common perception that low-income people take public transit to work, while higher income people drive vehicles. In other words, the high-income population is mostly car dependent, while lower income people are captive of public transport (Florez 1999). Not surprisingly, higher household incomes are associated with increased amounts of travel by household members and the modes used change as income increases.

In Australia, there has been an increasing trend in people commuting from regional or satellite cities to capital cities. In the 2017-18 Budget, the Australian Government has committed \$20

billion for rail infrastructure in recognition that investment in public transport and freight networks is necessary for the future. This infrastructure investment will be a critical part of easing congestion and boosting productivity in our cities and regions. To achieve this goal, the Government announced a number of major rail initiatives, including the ‘Urban Rail Plans’. In addition, the objective of the ‘Faster Rail’ initiative is to improve commuter rail services, particularly by improving rail connections that deliver faster, frequent, reliable and comfortable journeys. The Faster Rail Initiative also provides an opportunity to understand the role of regions in managing national need for improved housing access, choice and affordability. Further, the Department of Infrastructure, Regional Development and Cities (DoIRDC) is undertaking an in-depth investigation into the current and future needs of our urban rail networks in Sydney, Melbourne, Brisbane, Adelaide and Perth, and rail links to surrounding regions. This investigation will result in the development of major rail plans for these five cities and their surrounding regions.

This paper presents Australian data, which addresses several key questions relating to income and transport use, particularly rail use.

The remainder of this paper is organised as follows. In Section 2, we present the objectives of this study, while main data source is given in Section 3. Section 4 presents a short literature review on the relationship between income distribution and various aspects of transport use and provides data on transport mode shares for the journey-to-work in Australia by income category for 2016. Section 5 identifies how personal income influences the use of the different transport modes by journey-to-work commuters at various geographic levels, while transport mode share and income for the five major capital cities and the rest of Australia is presented in Section 6. Finally, some conclusions and implications for transport policy and planning in relation to new rail infrastructure in cities and regional Australia are put forward.

2. Objectives

To explore the relationship between transport use and income, the study has implications of the findings for tackled the following key research questions:

1. What is the nature of the relationship between income and public transport use for commuting trips (and how does it differ across public transport modes: Bus, Rail, Tram/Light rail and others)?
2. How does the relationship between commuter public transport use and income vary by location (i.e. by states/territories, capital cities, state balances, major cities, and by where people live and work in the three large capital cities)?

3. Data sources

The key data source is the ABS *Census of Population and Housing* data for 2016.

Note that this paper is based on preliminary results of a BITRE Information Sheet (*Relationship between transport use and income in Australia*, BITRE 2018, forthcoming). In this Information Sheet, BITRE will draw on other sources, particularly State government travel surveys (e.g. NSW *Household Travel Survey* or HTS and *Victorian Integrated Survey of Travel and Activity* or VISTA), which will be used for selected cities (i.e. Sydney and Melbourne) to extend the analysis beyond commuting trips and look at the proportion of travel by public transport.

4. Nature of the relationship between income and public transport use in Australia

A substantial literature is available on the relationship between income distribution and various aspects of transport use, such as types of transport modes, number of trips, average trip length, average trip duration as well as number of private vehicles and geographic location, in overseas countries (Flórez 1999, South African Department of Transport 2005, Best and Lanzendorf 2005, American Public Transportation Association 2007, Van Ham and Hooimeijer 2009, Transport for London 2011, McQuaid and Chen 2012), but there are limited studies conducted in Australia (Flood and Barbato 2005, DIT 2013). In addition, transport use and income also vary by location (Zegras and Srinivasan (2007), in particular the income levels of commuters who ride transit to work vary greatly by location (Versel 2013).

In a previous study, based on ABS 2011 Census data, DIT (2013) showed that average incomes appeared to influence the type of transport used for journeys to work, while those who used public transport for their journey to work tended to have higher average weekly individual incomes than those who used other transport modes. Based on ABS 2016 Census data, the current study shows the relationship between weekly personal income and various transport mode uses for the journey-to-work (Table I).

Overall, more than three-quarters (78.4 per cent) of employed persons used private vehicles (car driver, car passenger and motorbike/scooter driver and rider) as the transport mode of journey-to-work in Australia in 2016, while 13.7 per cent used public transport. Of this 13.7 per cent public transport share, 8.4 per cent of employed people used train as their main transport to work, 4.1 per cent used bus and 1.2 per cent used other public transport (tram, ferry and taxi). Further, 5.2 per cent of employed persons either walked or rode a bicycle (active travel) and 2.7 per cent used other modes (truck, other and not stated).

Table 1 Transport mode shares for the journey-to-work by income category, Australia, 2016

Weekly personal income category	Train	Bus	Other public transport ^a	Total public transport ^b	Private vehicles ^c	Active travel ^d	Other ^e	All transport modes
Share of all transport modes (per cent)								
\$0-\$149	5.7	6.5	0.9	13.1	72.6	9.9	4.4	100.0
\$150-\$299	7.3	5.8	1.2	14.3	74.4	7.9	3.4	100.0
\$300-\$399	7.6	4.9	1.3	13.7	75.5	7.2	3.6	100.0
\$400-\$499	7.0	4.4	1.2	12.6	77.8	6.4	3.3	100.0
\$500-\$649	6.1	3.5	1.1	10.7	80.8	5.6	2.9	100.0
\$650-\$799	6.3	3.0	0.9	10.3	82.3	4.8	2.6	100.0
\$800-\$999	7.1	2.8	0.9	10.8	82.4	4.3	2.6	100.0
\$1000-\$1249	8.2	3.0	1.0	12.2	81.1	4.1	2.6	100.0
\$1250-\$1499	9.1	3.4	1.1	13.6	79.6	4.3	2.5	100.0
\$1500-\$1749	9.7	3.8	1.2	14.6	78.3	4.6	2.4	100.0
\$1750-\$1999	10.2	4.4	1.2	15.8	77.0	4.9	2.3	100.0
\$2000-\$2999	12.7	6.1	1.6	20.4	71.7	5.5	2.4	100.0
\$3000 or more	12.2	7.3	2.7	22.2	68.7	6.3	2.8	100.0
All income groups	8.4	4.1	1.2	13.7	78.4	5.2	2.7	100.0

Note: Negative income, not stated and not applicable categories were excluded from total income. Also, table excludes people who are not employed, work from home and who did not go to work on census day.

^a Other public transport includes tram, ferry and taxi.

^b Total public transport includes train, bus, tram, ferry and taxi.

^c Private vehicles include car as driver and passenger, and motorbike/scooter.

^d Active Travel includes Bicycle and Walking.

^e Other transport includes truck, other and not stated.

Source: BITRE analysis of ABS *Census of Population and Housing* for 2016 place of usual residence data (TableBuilder).

The other key results shown in Table 1 are summarised below:

1. In general, the proportion of employed persons who used train to travel to work increased with income. The train mode share was highest for employed persons when weekly personal income was \$2000-\$2999 (12.7 per cent), closely followed by the highest weekly income category (\$3000 or more) (12.2 per cent). The train mode share was 5.7 per cent for the lowest income category (\$0-\$149).
2. The bus mode share was at its highest for low income and high income people and was lower for middle income earners who commuted to work.
3. The 'other public transport' mode share is at its highest (2.7 per cent) for the highest income category (\$3000 or more). This high proportion of high income earners is probably due to the ferry and taxi users who belong to the highest income bracket.
4. The private vehicle mode share was highest for middle income earners, with an average weekly income of \$500-\$999. On the other hand, the private vehicle mode share was lowest for low and high income earners.
5. Lower income commuters were relatively more likely to be active travellers (walking and cycling) or use other transport modes (truck or other).

Similar patterns were also observed in overseas studies. For example, the American Public Transportation Association (2007) found lower rail mode share for low income earners compared to high income earners. In addition, this study also found that low income households were more likely to use bus than those with higher household incomes. In a study in the UK, using the London Travel Demand Survey data, Transport for London (2011) found that commuters in lower income groups made more bus trips, and higher income groups made more car, rail and Underground trips.

5. Relationship between income and transport use by location

The main focus of this section is to identify how personal income influences the use of the different transport modes by journey-to-work commuters at various geographic levels (States/Territories, capital cities, state balances and major cities¹). It also presents more disintegrated mode use data for the three large capital cities (Greater Sydney, Greater Melbourne and Greater Brisbane). In addition, the relationships between income and transport mode for commuters to work by city sector of residence and city sector of work are also presented. Note that data are presented only for 'employed persons' (not for 'all persons aged 15 years and more').

In this section, income and transport use is tackled from two different angles, but both are related. These are:

1. The relationship between average income and the main transport mode used by commuters to get to work?
2. How transport mode shares varies across income categories ?

¹ Major cities with populations over 85,000 people of residence, which consist of a total of 21 cities including 8 capital cities (i.e. Greater Sydney, Greater Melbourne, Greater Brisbane, Greater Adelaide, Greater Perth, Greater Hobart, Greater Darwin and Canberra) and 13 non-capital cities (i.e. Albury – Wodonga, Newcastle – Maitland, Wollongong, Ballarat, Bendigo, Geelong, Cairns, Gold Coast - Tweed Heads, Mackay, Sunshine Coast, Toowoomba, Townsville and Launceston) (Commonwealth of Australia 2017, p.7).

5.1. Estimated average weekly personal income and transport mode for commuters to work

5.1.1. States/Territories, capital cities and state balances

Figure 1 shows estimated average personal weekly income for commuters who used the different transport modes for the journey to work by capital cities (aggregated), state balance and total Australia, while data for individual capital cities, state balances and states/territories is presented in Table 2.

Figure Estimated weekly average personal income for users of various transport modes for the journey to work in total capital cities, rest of states and Australia, 2016



Notes:

1. The procedure for estimating average weekly personal income is based on method used by BITRE (refer BITRE 2014).
 2. Negative income, not stated and not applicable categories were excluded from total income. Also, table excludes people who are not employed, work from home and who did not go to work on census day.

^a Other public transport includes bus, tram, ferry and taxi.

^b Total public transport includes train, bus, tram, ferry and taxi.

^c Private vehicles include car as driver and passenger, and motorbike/scooter.

^d Active travel includes bicycle and walking.

^e Other transport includes truck, other and not stated.

^f Australian Capital Territory is same as Canberra and was included in the Capital cities total.

Source: BITRE analysis of ABS *Census of Population and Housing* for 2016 place of usual residence data (TableBuilder).

According to ABS Census data for 2016, the estimated average weekly personal income² for employed persons was \$1293 in Australia (Figure 1 and Table 2). There was income differences across mode use categories. For example, estimated average weekly income was higher for employed public transport users (\$1503) than for users of private vehicles (\$1261), active travel (\$1265) or other modes (\$1224). However, there was no difference between train and other public transport (which included bus, tram, ferry and taxi) (\$1504 versus \$1502).

² The procedure for estimating average weekly personal income is based on method used by BITRE (refer BITRE 2014). BITRE estimated average weekly income based on the categorical income responses in the census. The average value was set as the midpoint of the income range for all categories, apart from the top income category, where the average was set at 1.5 x lower band of top income category, i.e. should be set at \$4500, based on results from the ABS' *Survey of Income and Housing* 2009–10 (which show that \$4500 is a conservative midpoint for the top income category).

Estimated weekly average income was higher for public transport users compared to private vehicle users or active travellers in both capital cities and state balances.

Table 2 Estimated weekly average personal income for users of various transport modes for the journey to work in individual capital cities and rest of states, 2016

Geographic areas	Train	Other Public transport ^a	Total Public transport ^b	Private vehicles ^c	Active travel ^d	Other transport ^e	All modes (all employed persons)
Estimated average weekly personal income (\$)							
Greater Sydney	1,513	1,697	1,568	1,370	1,391	1,191	1,419
Rest of New South Wales	1,536	1,079	1,281	1,160	1,016	1,057	1,152
New South Wales	1,513	1,652	1,556	1,289	1,279	1,139	1,334
Greater Melbourne	1,504	1,287	1,444	1,273	1,373	1,128	1,306
Rest of Victoria	1,723	1,003	1,436	1,059	979	1,023	1,089
Victoria	1,512	1,270	1,443	1,227	1,281	1,098	1,259
Greater Brisbane	1,432	1,364	1,397	1,272	1,338	1,229	1,291
Rest of Queensland	1,570	1,468	1,490	1,167	1,014	1,185	1,170
Queensland	1,444	1,391	1,414	1,218	1,166	1,203	1,232
Greater Adelaide	1,185	1,142	1,153	1,194	1,255	1,129	1,190
Rest of South Australia	1,289	1,610	1,565	1,053	969	1,073	1,056
South Australia	1,188	1,161	1,168	1,164	1,169	1,112	1,163
Greater Perth	1,563	1,710	1,624	1,368	1,518	1,665	1,414
Rest of Western Australia	1,775	2,638	2,615	1,346	1,153	1,709	1,428
Western Australia	1,563	1,918	1,734	1,363	1,395	1,687	1,417
Greater Hobart	np	983	992	1,186	1,262	1,096	1,177
Rest of Tasmania	np	998	1,004	1,044	978	1,027	1,039
Tasmania	np	980	990	1,107	1,134	1,063	1,103
Greater Darwin	np	2,248	2,239	1,496	1,359	1,567	1,556
Rest of Northern Territory	np	1,625	1,637	1,358	1,022	1,100	1,276
Northern Territory	np	2,162	2,158	1,459	1,153	1,376	1,472
Australian Capital Territory ^f	np	1,413	1,421	1,595	1,602	1,299	1,576
Australia	1,504	1,502	1,503	1,261	1,265	1,224	1,293

Notes:

1. The procedure for estimating average weekly personal income is based on method used by BITRE (refer BITRE 2014).
 2. np - denotes not published, due to small sample size (<100).
 3. Negative income, not stated and not applicable categories were excluded from total income. Also, table excludes people who are not employed, work from home and who did not go to work on census day.
- ^a Other public transport includes bus, tram, ferry and taxi.
^b Total public transport includes train, bus, tram, ferry and taxi.
^c Private vehicles include car as driver and passenger, and motorbike/scooter.
^d Active travel includes bicycle and walking.
^e Other transport includes truck, other and not stated.
^f Australian Capital Territory is same as Canberra and was included in the Capital cities total.

Source: BITRE analysis of ABS *Census of Population and Housing* for 2016 place of usual residence data (TableBuilder).

Table 2 also shows that the patterns of higher incomes for public transport (train uses) is repeated for capital cities and state balances (as a whole), and also for most individual cities and state balances, but not for ACT, Tasmania or Adelaide. However, the observed pattern is driven by the most populous states of NSW, Victoria, Queensland and WA (and particularly by four large capital cities) where average income for public transport users is significant. Overall, for capital city employed persons, the average weekly personal income was \$1352, around 17 per cent higher than the average weekly income of those who worked outside the capital cities (\$1159).

In 2016, people in both total capital cities and in total non-capital cities (state balances) who used public transport (either train or other public transport) for their journey-to-work tend to have higher average weekly personal income than those who used private vehicles (Table 2).

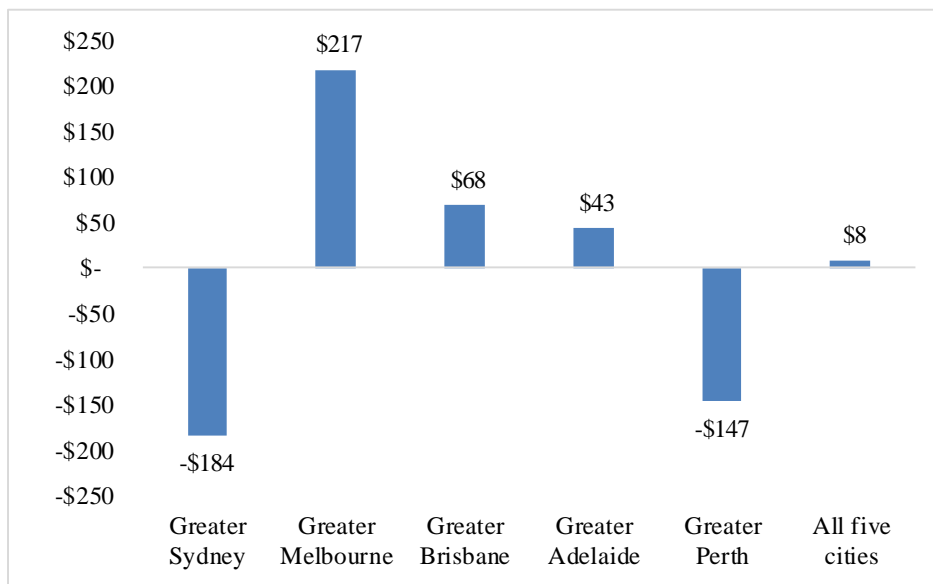
However, the difference is less pronounced for commuters in capital cities than in the state balances. The difference between public transport and private vehicle users for capital city commuters and state balances were \$184 and \$429, respectively. In other words, average incomes were 14 per cent higher for public transport users than users of private vehicles in the capital cities and 37 per cent higher in the state balances.

Table 2 also reveals that train users who travelled to work in capital cities had lower average weekly personal income than train users in the state balances or rest of Australia (\$1501 versus \$1611, or 7 per cent lower). This pattern is also evident for other public transport users. The average weekly personal income for overall public transport users was \$1498 in capital cities, while the average income for overall public transport was \$1582 in the rest of Australia, suggesting a five per cent lower rate in capital cities than in the state balances (where many of the train users in the rest of Australia would be using the train to travel to a place of work in the nearest capital city). On the other hand, private vehicle users and active travellers (walking and cycling) in capital cities have higher average weekly income than in the state balances (14 per cent for private vehicle users and 36 per cent for active travellers).

For states/territories, the average weekly personal income for all employed persons (all modes) varied substantially, from \$1103 (Tasmania) to \$1472 (Northern Territory). This is largely due to the average income of employed persons in capital cities. For the eight capital cities, the average weekly income of all employed persons was highest in Canberra (\$1576) and Darwin (\$1556) and lowest in Greater Hobart (\$1147). The average weekly income of all employed persons was relatively high in the Rest of Western Australia (\$1428) and was lowest in the Rest of Tasmania (\$1039).

Figure 2 shows the total income difference premium for train users over other public transport users in five large capital cities. Train users have lower incomes in Sydney (\$184) and in Perth (\$147). In the other three cities, train users had higher incomes \$217 (Melbourne), \$68 (Brisbane) and \$43 (Adelaide).

Figure 2 Total premium (\$) for train users over other public transport users, five large capital cities, 2016



Source: BITRE analysis of ABS *Census of Population and Housing* for 2016 place of usual residence data (TableBuilder).

Table 3 shows the breakdown of ‘Other public transport’ into bus, ferry, tram and taxi, private vehicle into car as driver, car as passenger and motorbike/scooter, and active travel as walking and bicycle for Sydney, Melbourne and Brisbane. In Sydney, ferry users had higher income

compared to users who used other public transport modes (bus, tram and taxi). However, bus users had relatively low personal incomes. Private vehicle users as driver had much higher personal income than those who used private vehicle as passenger in all three cities. Similarly, bicycle riders had significantly higher personal incomes than those who walked to work in all three cities.

Table 3 Estimated weekly average personal income for users of bus, ferry, tram and taxi (i.e. other public transport), car as driver, car as passenger and motorbike/scooter (i.e. private vehicles) and walking and bicycle (i.e. active travel) for the journey to work in Greater Sydney, Greater Melbourne and Greater Brisbane, 2016

Transport modes	Greater Sydney	Greater Melbourne	Greater Brisbane
Estimated average weekly personal income (\$)			
Other public transport			
Bus	1609	988	1329
Ferry	2777	1302	1700
Tram	1837	1434	1727
Taxi	2014	1561	1632
Total Private vehicles			
Private vehicles (Driver)	1397	1301	1299
Private Vehicles (Passenger)	936	811	899
Motorcycle	1766	1584	1480
Active Travel			
Walking	1298	1219	1180
Bicycle	1907	1699	1746
All transport modes	1419	1306	1291

Source: BITRE analysis of ABS *Census of Population and Housing* for 2016 place of usual residence data (TableBuilder).

5.1.2. Non-capital major cities

This section provides estimated average weekly income for users of various transport modes for the journey to work in major cities (for details of major cities, see Footnote 1). Note that the results for the eight capital cities are already provided in Table 2. Therefore, the results for non-capital major cities are presented.

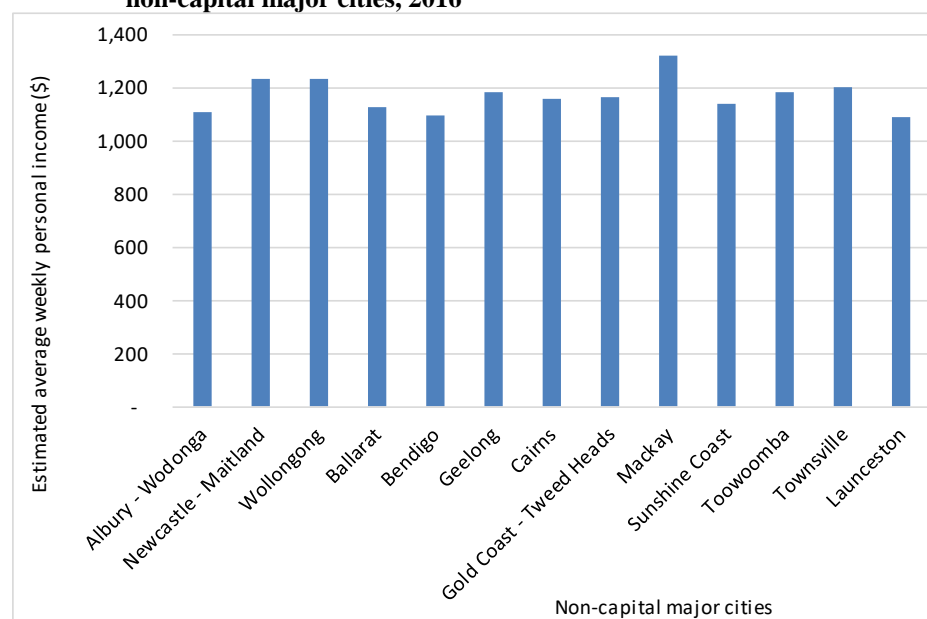
Figure 3 shows the estimated average weekly income for users of all transport modes for the journey to work in non-capital major cities, while Table 4 presents estimated average weekly income for users of individual transport modes.

The estimated average weekly income for all transport modes was higher for Mackay commuters (\$1317), followed by Newcastle-Maitland (\$1233) and lowest for Launceston commuters (1,086) (Figure 3).

The key results in Table 4 are summarised below:

- Among the non-capital major cities which had a sample size of more than 100 train users, average weekly personal income for train users varied between \$1392 (Newcastle-Maitland) and \$1862 (Ballarat). Train users in Geelong and Sunshine Coast also had relatively high average weekly personal income (\$1791 and \$1800, respectively).
- Average weekly personal income for public transport users was higher than that of all other transport mode users, except for Albury–Wodonga, Newcastle–Maitland, Cairns and Launceston).
- The average weekly personal income of train users was consistently higher than that of all employed persons in each of the non-capital major cities with a significant number of train users.

Figure 3 Estimated average weekly income for users of all transport modes for the journey to work in all non-capital major cities, 2016



Notes: Only non-capital major cities with populations over 85,000 people of residence are presented. Data for eight capital cities are not included here as they were included in Table 2.

Source: BITRE analysis of ABS *Census of Population and Housing* for 2016 place of usual residence data (TableBuilder).

Table 4 Estimated average weekly income for users of various transport modes for the journey to work in all non-capital major cities, 2016

Major cities - Non-Capitals	Train	Other public transport ^a	Total Public transport ^b	Private vehicles ^c	Active travel ^d	Other transport ^e	All transport modes
Albury - Wodonga	np	886	897	1,112	1,017	1,081	1,104
Newcastle - Maitland	1,392	1,060	1,171	1,241	1,184	1,106	1,233
Wollongong	1,575	899	1,376	1,226	1,066	1,122	1,229
Ballarat	1,862	721	1,408	1,113	1,111	1,016	1,123
Bendigo	1,491	835	1,065	1,091	1,143	1,010	1,092
Geelong	1,791	972	1,531	1,157	1,115	1,078	1,179
Cairns	np	1,105	1,116	1,159	1,087	1,351	1,159
Gold Coast - Tweed Head	1,540	1,000	1,219	1,165	961	1,196	1,160
Mackay	np	1,903	1,896	1,306	1,122	1,284	1,317
Sunshine Coast	1,800	1,242	1,382	1,134	1,030	1,260	1,141
Toowoomba	np	1,188	1,225	1,187	1,074	1,126	1,181
Townsville	np	1,415	1,416	1,197	1,187	1,271	1,202
Launceston	np	869	889	1,092	1,111	1,030	1,086

Note: Only non-capital major cities with populations over 85,000 people of residence are presented. Data for eight capital cities are not included here as they were included in Table 2.

np – Not presented as based on sample of less than 100, which is not considered meaningful.

^a Other public transport includes bus, tram, ferry and taxi.

^b Total public transport includes train, bus, tram, ferry and taxi.

^c Private vehicles include car as driver and passenger, and motorbike/scooter.

^d Active travel includes bicycle and walking.

^e Other transport includes truck, other and not stated.

Source: BITRE analysis of ABS *Census of Population and Housing* for 2016 place of usual residence data (TableBuilder).

5.2. City sector of residence

This section looks at the average weekly personal income of residents who use train, other public transport (combined bus, tram, ferry and taxi) and private vehicles (include car as driver and passenger as well as motorcyclists) by city sector for the five major cities (Sydney, Melbourne, Brisbane, Adelaide and Perth) for 2016. Note that the definition of Inner, Middle and Outer sectors of these five cities are visually shown in Map 1 (see Appendix 1).

Generally, estimated average weekly personal income of resident for the five major capital cities (aggregated) was higher for train users compared to other public transport modes (combined), private vehicles and all transport modes of the middle and outer sectors, but not the inner sector (Table 5). Overall, inner sector residents have much higher average incomes than middle sector residents, who in turn have higher income than outer sector residents. This pattern is repeated across all five cities.

Table 5 Estimated average weekly personal income for users of various transport modes by sectorial place of residence, five major capital cities, 2016

City and transport modes	Inner	Middle	Outer	Total
Estimated average weekly personal income (\$)				
Greater Sydney				
Train	1,747	1,425	1,472	1,514
Other Public Transport	1,797	1,677	1,556	1,698
Private vehicles	1,872	1,388	1,254	1,370
All transport modes	1,791	1,401	1,286	1,419
Greater Melbourne				
Train	1,512	1,573	1,380	1,504
Other Public Transport	1,528	1,219	798	1,286
Private vehicles	1,819	1,388	1,126	1,273
All transport modes	1,649	1,404	1,139	1,306
Greater Brisbane				
Train	1,376	1,484	1,396	1,435
Other Public Transport	1,491	1,322	1,295	1,367
Private vehicles	1,706	1,346	1,130	1,272
All transport modes	1,615	1,354	1,145	1,292
Greater Adelaide				
Train	1,236	1,273	1,079	1,176
Other Public Transport	1,179	1,113	1,159	1,141
Private vehicles	1,471	1,223	1,083	1,194
All transport modes	1,422	1,212	1,085	1,190
Greater Perth				
Train	1,603	1,559	1,558	1,565
Other Public Transport	1,852	1,514	1,809	1,717
Private vehicles	1,797	1,413	1,260	1,368
All transport modes	1,785	1,438	1,312	1,414
All five cities				
Train	1,656	1,493	1,441	1,502
Other Public Transport	1,656	1,378	1,418	1,493
Private vehicles	1,773	1,364	1,185	1,307
All transport modes	1,704	1,379	1,213	1,346

Notes:

1. Other public transport includes bus, tram, ferry and taxi.
2. Private vehicles include car (both as driver and passenger) and motorbike/scooter.
3. All transport modes include train, bus, tram, ferry and taxi, private vehicles, active travel (bicycle and walking), other mode and not stated.
4. Total includes Inner, Middle and Outer sectors. Map 1 in Appendix 1 shows the definition of Inner, Middle and Outer sectors of all five cities.

Source: BITRE analysis of ABS *Census of Population and Housing* for 2016 place of usual residence data (TableBuilder).

The average weekly income for train users was \$1502, while the average weekly incomes for other public transport users, private vehicle users and all transport mode users were \$1493, \$1307 and \$1346, respectively. However, there are some variations in average weekly personal income of train users by sectors for individual capital cities. Exceptions include: Sydney middle and outer sectors, Adelaide outer sector and Perth outer sector, where average weekly personal income for train users was lower than those who used other public transport, but higher than those who used private vehicles. Table 5 also shows that the average income pattern for inner sector residents differs to the general pattern for middle and outer sector residents, possibly related to increase of active travel (i.e. walking or bicycle).

5.3. City sector of work

The earning profile based on where people work is very different from the place of residence profile. The analysis in this section focuses on those who attended work and provided information on their mode of travel for the five major capital cities. The estimated average weekly income by place of work for each city was separated between the Central Business District (CBD)³ and the rest of city.

Table 6 shows the average weekly personal income of commuters using the various transport modes for the journey to work in CBD and rest of city in five major capital cities in 2016.

Table 6 Estimated average weekly personal income for users of various transport modes place of work, CBD and rest of city, five major capital cities, 2016

City and transport modes	CBD	Rest of City	Greater Capital City
	Estimated average weekly personal income (\$)		
Greater Sydney			
Train	1,741	1,285	1,526
Other Public Transport	2,162	1,152	1,707
Private vehicles	2,267	1,335	1,389
All transport modes	1,946	1,307	1,437
Greater Melbourne			
Train	1,738	1,147	1,520
Other Public Transport	1,660	973	1,286
Private vehicles	2,102	1,234	1,285
All transport modes	1,833	1,213	1,319
Greater Brisbane			
Train	1,616	1,170	1,457
Other Public Transport	1,567	1,008	1,322
Private vehicles	2,049	1,230	1,288
All transport modes	1,775	1,214	1,302
Greater Adelaide			
Train	1,279	913	1,192
Other Public Transport	1,257	764	1,118
Private vehicles	1,614	1,144	1,202
All transport modes	1,477	1,125	1,194
Greater Perth			
Train	1,789	1,098	1,572
Other Public Transport	1,875	917	1,451
Private vehicles	2,026	1,294	1,364
All transport modes	1,946	1,277	1,390
All five cities			
Train	1,721	1,221	1,515
Other Public Transport	1,815	1,034	1,461
Private vehicles	2,040	1,264	1,320
All transport modes	1,849	1,245	1,355

Notes:

1. Rest of city includes SA2 in other inner (i.e. non-CBD), middle and outer sectors.

2. Total inner includes both CBD and rest of inner sector.

3. Great Capital City includes inner, middle and outer sectors.

^a Other public transport includes bus, tram, ferry and taxi.

^b Private vehicles include car (both as driver and passenger) and motorcycle.

^c All transport modes include train, bus, tram, ferry, taxi, private vehicles, bicycle and walking, other mode and not stated.

Source: BITRE analysis of ABS *Census of Population and Housing* for 2016 place of usual residence data (TableBuilder).

³ CBD is defined within the inner sector for each major capital city using Statistical Area 2 (SA2). This classification is based on the share of key employment industries (e.g. Information Media and Telecommunications; Financial and Insurance Services; Professional, Scientific and Technical Services; Administrative and Support Services; and Public Administration and Safety) where selected individual industry has a minimum of 10 per cent of employment and is located closely to city centre.

The SA2s belong to Sydney CBD are: Darlinghurst, Potts Point – Woollahroomooloo, Pyrmont – Ultimo, Redfern – Chippendale, Surry Hills and Sydney - Haymarket - The Rocks. Similarly, Melbourne CBD includes Docklands, East Melbourne, Melbourne and Southbank SA2s, Brisbane CBD includes Brisbane City, Fortitude Valley and Spring Hill, Adelaide CBD includes Adelaide, and Perth CBD includes Perth City.

Irrespective of transport modes and cities, the average weekly personal income for commuters who travel to work within CBD was higher than for those who made their journey to work to the rest of city. Overall (i.e. all transport modes), the difference in average weekly personal income between the CBD and the rest of city was highest in Perth (\$670) and lowest in Adelaide (\$353). These differences in average weekly personal income for Sydney and Melbourne were very similar (\$639 and \$620, respectively), while for Brisbane, the difference was greater (\$562). However, these differences varied among transport modes. Compared to CBD and rest of city place of work, there was \$456 weekly premium for Sydney CBD workers who used train as mode of transport, \$591 for Melbourne CBD workers, \$447 for Brisbane CBD workers, \$365 for Adelaide CBD workers and \$691 for Perth CBD workers.

6. Transport mode share and income

6.1. Five major capital cities and rest of Australia

The national transport mode shares of commuters in different income categories were presented earlier (see Table 1). This section provides disaggregated data for the five major capital cities and the rest of Australia.

Table 7 presents the proportion of people who travel to work using various transport modes by income categories in the five major capital cities and the rest of Australia. Generally, employed people with higher incomes tended to take public transport (i.e. train and other forms of public transport), more than those employed people with lower incomes, but the lowest income category has generally higher public transport use than the second lowest income category. In terms of individual capital cities, this pattern is mixed. For example, Sydney, Melbourne, Brisbane and Perth follow this pattern. The exception is Adelaide where there is a tendency for public transport mode share to increase with income.

The opposite trend can be seen for the use of private vehicles in all five cities, with different magnitude.

Active travel mode share was U-shaped, relatively higher for lowest and highest income categories and lowest for the middle income categories.

The other transport (i.e. truck, motorbike/scooter, other and not stated) mode share was over prominent in the lower income categories, but Perth was an exception.

Table 7 Transport mode share for the journey-to-work by income categories, five major capital cities and rest of Australia, 2016

Income category	Train	Other public transport ^a	Total public transport ^b	Private vehicle ^c	Active travel ^d	Other ^e	All transport modes
Share (per cent) of employed persons							
Greater Sydney							
\$0-\$499	16.9	8.6	25.5	62.9	8.2	3.4	100.0
\$500-\$999	16.3	6.2	22.4	69.8	5.0	2.8	100.0
\$1000-\$1499	18.5	6.4	24.9	68.3	4.3	2.6	100.0
\$1500-\$1999	20.1	7.6	27.7	65.4	4.9	2.1	100.0
\$2000-\$2999	23.8	10.6	34.4	58.5	5.6	1.5	100.0
\$3000 or more	20.0	15.0	34.9	57.2	6.3	1.5	100.0
All income groups	18.5	7.9	26.3	65.6	5.4	2.6	100.0
Greater Melbourne							
\$0-\$499	11.0	7.3	18.2	71.6	7.0	3.1	100.0
\$500-\$999	10.4	4.5	14.9	78.7	4.1	2.3	100.0
\$1000-\$1499	13.3	4.2	17.5	76.5	4.2	1.8	100.0
\$1500-\$1999	15.7	4.7	20.4	73.0	5.1	1.5	100.0
\$2000-\$2999	20.5	5.6	26.1	66.4	6.2	1.3	100.0
\$3000 or more	17.7	5.9	23.6	67.4	7.2	1.8	100.0
All income groups	13.2	5.0	18.2	74.5	5.0	2.2	100.0
Greater Brisbane							
\$0-\$499	5.4	9.3	14.7	75.5	6.7	3.1	100.0
\$500-\$999	5.5	5.6	11.1	82.5	4.0	2.4	100.0
\$1000-\$1499	7.1	6.2	13.3	80.7	3.7	2.4	100.0
\$1500-\$1999	8.2	7.5	15.7	77.7	4.4	2.2	100.0
\$2000-\$2999	10.1	9.4	19.5	72.5	5.9	2.1	100.0
\$3000 or more	7.2	9.0	16.2	74.9	6.5	2.4	100.0
All income groups	6.7	7.0	13.8	79.0	4.7	2.6	100.0
Greater Adelaide							
\$0-\$499	2.6	9.9	12.5	79.1	5.6	2.8	100.0
\$500-\$999	2.4	7.0	9.4	85.3	3.1	2.1	100.0
\$1000-\$1499	3.0	7.8	10.8	84.2	3.0	2.0	100.0
\$1500-\$1999	3.1	8.1	11.2	83.0	4.1	1.7	100.0
\$2000-\$2999	3.1	8.4	11.5	81.0	5.5	2.0	100.0
\$3000 or more	1.5	5.5	7.1	84.5	6.1	2.4	100.0
All income groups	2.7	7.8	10.6	83.3	3.9	2.3	100.0
Greater Perth							
\$0-\$499	6.2	6.4	12.6	79.3	5.2	2.9	100.0
\$500-\$999	5.9	3.7	9.6	84.9	3.0	2.4	100.0
\$1000-\$1499	7.3	3.5	10.8	83.9	2.6	2.7	100.0
\$1500-\$1999	7.7	4.7	12.4	81.0	3.1	3.5	100.0
\$2000-\$2999	9.0	8.0	17.0	74.0	4.2	4.8	100.0
\$3000 or more	9.1	10.2	19.4	69.7	5.8	5.1	100.0
All income groups	7.1	5.1	12.2	80.9	3.6	3.3	100.0
Rest of Australia							
\$0-\$499	0.6	3.5	4.1	82.6	8.8	4.5	100.0
\$500-\$999	0.6	1.8	2.3	88.8	5.8	3.0	100.0
\$1000-\$1499	0.9	1.7	2.6	89.5	4.9	3.0	100.0
\$1500-\$1999	1.2	2.8	4.0	88.0	5.1	3.0	100.0
\$2000-\$2999	1.7	5.7	7.3	84.1	5.4	3.2	100.0
\$3000 or more	2.2	8.2	10.4	79.7	5.4	4.4	100.0
All income groups	0.9	2.7	3.6	86.9	6.0	3.5	100.0

Note: Rest of Australia equals to total Australia, excluding Greater Sydney, Greater Melbourne, Greater Brisbane, Greater Adelaide and Greater Perth.

^a Other public transport includes bus, tram, ferry and taxi.

^b Total public transport includes train, bus, tram, ferry and taxi.

^c Private vehicles include car as driver and passenger, and motorbike/scooter.

^d Active travel includes bicycle and walking.

^e Other transport includes all other modes not mentioned.

Source: BITRE analysis of ABS Census of Population and Housing for 2016 place of usual residence data (TableBuilder).

7. Conclusions and policy implications

As mentioned earlier, this paper forms part of more extensive research project. However, the initial results, presented in this paper, have shown some broad relationships between the use of various transport modes and personal incomes across Australia. We should note that a limitation of our study is that the relationship between income and public transport modes cannot be established to be causal due to the nature of the data. For example, higher levels of public transport access would be expected to be linked to high rates of public transport use and may also be reflected in an area having higher fare prices and incomes.

The key results show that:

- Based on place of residence data, the proportion of train users increased with average weekly personal income. Both low income and high income people were bus riders, while a relatively high proportion of middle income earners were private vehicle users.
- The estimated average weekly income of commuters in the capital cities was higher compared to those in the state balances (\$1352 versus \$1159), but train users in capital cities had lower average weekly personal income than those in the state balances.
- The total income difference premium for train users over other public transport users in five large capital cities shows that train users have lower incomes in Sydney (\$184) and in Perth (\$147, while higher incomes in Melbourne (\$217), Brisbane (\$68) and Adelaide (\$43).
- Irrespective of transport modes and cities, the average weekly personal income for commuters who travel to work within CBDs was higher than for those who made their journey to work to the rest of city.
- Employed people with higher incomes tended to take public transport more than those employed people with lower incomes, but the lowest income category has generally higher public transport use than the second lowest income category.

These results fit with other overseas and Australian studies (American Public Transportation Association 2007, Transport for London 2011, Charting Transport 2012, Department of Infrastructure and Transport 2013). These studies showed that transport modes used by residents changed as household income increased.

Since the existing Australian literature on income and transport use is very limited, the extended study of this paper will provide a broader perspective with a particular focus on public transport (specifically rail) and will compare how the relationship varies across cities and regions. This will then provide insights into the equity implications of new rail infrastructure investment in cities and regional Australia.

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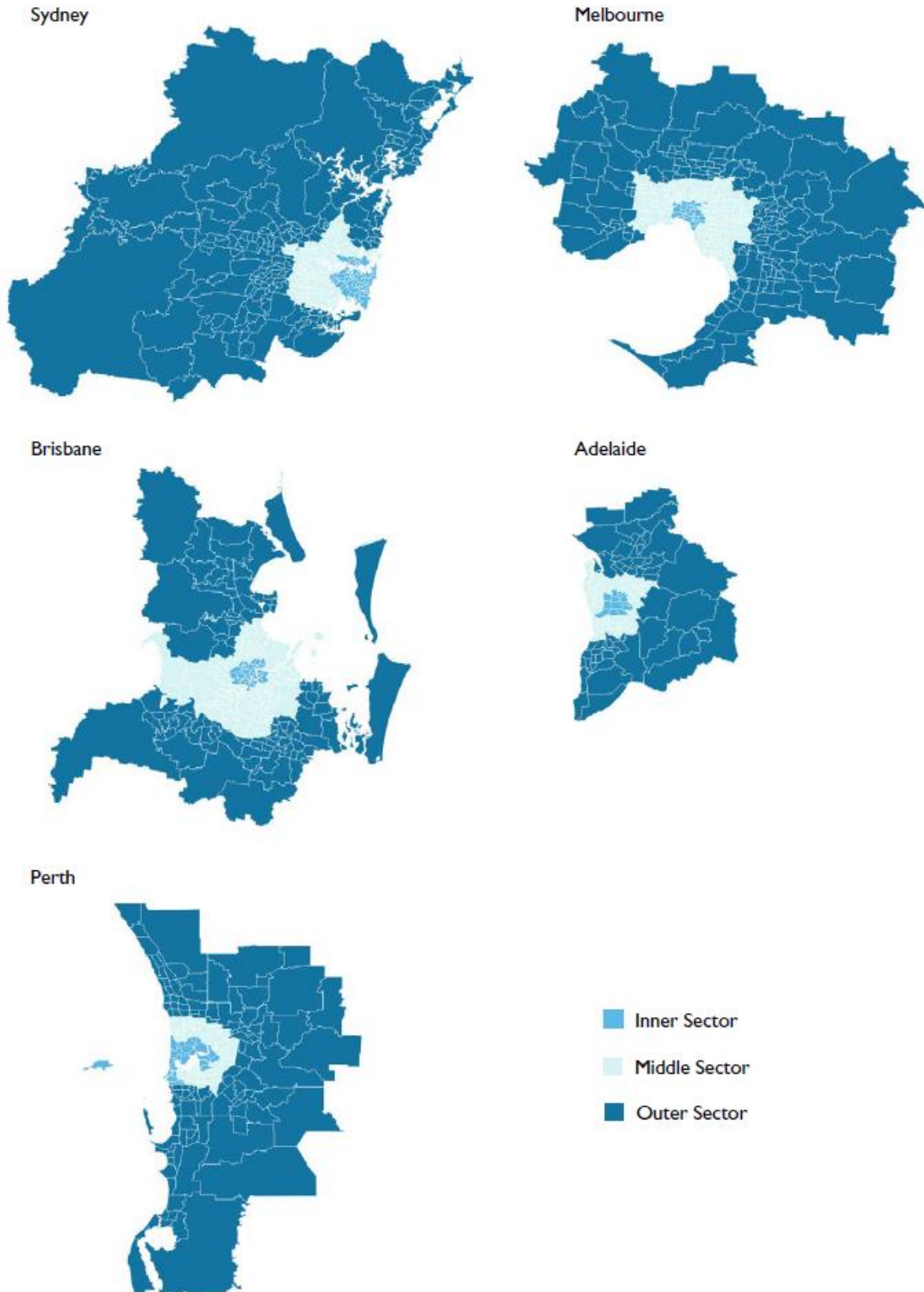
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Appendix 1

Map 1 Displaying Inner, Middle and Outer sectors of Sydney, Melbourne, Brisbane, Adelaide and Perth



Note: All five city maps are presented at a common scale. Each city has been disaggregated into an Inner, Middle and Outer sectors, based on ABS 2016 Statistical Area 2 (SA2) boundaries.
Source: BITRE analysis of ABS 2016 SA2 boundaries.