Australasian Transport Research Forum 2016 Proceedings 16 – 18 November 2016, Melbourne, Australia Publication website: <u>http://www.atrf.info</u>

A users' perspective of paid parking at a local retail precinct

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Abstract

Local retail centres are important economic areas but are overlooked in the parking pricing literature. This study looks at the impact of parking pricing from the users' perspective in a local retail centre in Melbourne Australia (Yarraville Village - 107 shops and a film theatre). The paper is part of a larger study of the parking pricing initiative which is reported in Au and Young (2016a, b). The paper presents the results of a random sampling survey of households from the suburbs around Yarraville Village. The results show impacts on the travel and shopping patterns of the patrons of the retail centre at least in the short term. Key findings include changes in visiting preference, changes in access mode (a considerable decrease in car usage trips), and a shift to shorter duration stays. Grocery and discretionary expenditures both decreased. A multinomial logistic regression model was estimated to explore demographic factors behind these behavioural changes.

1. Introduction

Although there is extensive research on the relationship between parking pricing and parking usage, the relationship between parking pricing and business activity has been a neglected area in academic research (Au & Young, 2016a). Moreover, previous studies have focussed on downtown central business districts and regional shopping centres rather than local retail centres (Au & Young, 2016b). Most studies have looked at changes to existing pricing rather than its introduction. Only a single empirical household survey study currently exists exploring the business effects of introducing parking pricing, and this was for a regional shopping centre rather than a local retail centre (van der Waerden, Borgers & Timmermans, 2009a).

Yarraville Village is a local retail centre located in the inner west of Melbourne Australia. It is a popular destination as it has the only independent picture theatre in the inner west (the Sun Theatre). The main shopping centre is also conveniently located adjacent to a train and bus station. The Village occupies a small area surrounded by a residential zone bordered by major roads. An unusual aspect of the Village is that a busy railway line cuts through the middle of the commercial area, causing heavy traffic congestion when the level crossing gates are in operation. However, this congestion (in conjunction with the narrow streets in the area) has the effect of slowing the speed of traffic to make the area pedestrian friendly. Interestingly, this contributes to the community feel of a village, which is an attraction factor for the area.

The City of Maribyrnong implemented paid parking in Yarraville Village over three months from Friday 28th August 2015 to Friday 4th December 2015 (Au & Young, 2016b). Due to widespread concerns about the effect on businesses, a moratorium was imposed by the Council to prepare a city wide destination parking management policy. The affected areas in the Village are shown in Figure 1. Ninety seven parking bays in these areas were converted to paid parking. As of August 2015 the unit cost of paid parking was AUD \$1.80/hour. Paid parking was in operation from Tuesday to Saturday from 8am to 6pm. Sunday and Monday remained free parking days. The Canterbury St car park at the east end of the Village

remained free. Paid parking affected the one and two hour bays. A full history of the paid parking system in Yarraville can be found in Au and Young (2016a, b).

The aim of this study was to quantify the short term economic impact of introducing paid parking on Yarraville Village businesses. The key research questions were:

- Were there changes in the patterns of expenditure after the implementation of paid parking?
- Were there changes in transport mode usage after paid parking?, and
- Were some demographic groups more affected by paid parking than others?

Figure 1. Yarraville Village areas affected by paid parking (97 bays). Source: Maribyrnong City Council (2015)



2. Literature review

This section briefly reviews the literature on large retail centres to identify the approaches used in large centres to rationalise parking demand. It then moves to the literature on local retail centres to understand the roles of parking and parking pricing on the viability of these centres. A full review can be found in Au and Young (2016b).

Parking pricing in central city areas is primarily aimed at income earning and rationalising the use of public and private transport. The literature is centred on off-street parking although there are a few studies of on-street parking. Considerable effort has been placed on the study of the impact of parking pricing on central business district traffic and parking (Higgins, 1992; Lennie and Smith, 1986; Bianco et al., 1997; Verhoeff et al., 1995; Hensher and King, 2001; Masden, 2006; and Hamer et al., 2011). These studies have focused on the sensitivity of parkers to activity destination, supply, pricing, and permissible access (i.e. duration of parking). Studies of parking pricing have tended to focus on isolated parking developments and looked at the elasticity of the price of parking. In a review of the parking pricing literature Hamer et al. (2011) suggests typical short-run elasticities for these situations ranges between -0.10 and -0.60, with an average of -0.30. Hensher and King (2001) utilised a

stated preference approach to broaden the understanding of central city parking pricing policy and the sensitivity of non-commuters.

Paid parking in regional retail centres is aimed at recovering the cost of providing parking and encouraging turnover of vehicles. Van der Waerden et al. (2009a, b) reported the findings of a 2001 study by the Dutch institute CROW that investigated various parking measures. With respect to travel and shopping the CROW study mainly focused on the short term. An expert panel reported on the results of eighteen cases and five regional parking studies. The panel concluded that paid parking often increases parking demand in surrounding areas where the parking charges have yet to be introduced. Parking fees have positive effects on the local economy in the long term, while in the short term there may be a decrease in the number of patrons. The move from negative to positive effects is influenced by the time elapsed and extra measures implemented to increase the attractiveness of the centre. These may be funded by the income generated from the paid parking but this is not always the case. Parking fees produce some benefits such as reduced search time, increased turnover and promotion of shorter parking stays. Van der Waerden et al. (2009b) conducted a study of the short and medium term impact of the introduction of paid parking on the Woensel Shopping complex, a regional shopping centre located in the northern part of Eindhoven (160 shops including local, national, and international operating stores). Paid parking came into effect on September 1st 2007. The parking charges were set at 0.50 Euro (1 Euro = \$US1.40 in 2007) for the first hour and 1.00 Euro for every subsequent hour, with a maximum of 3.00 Euro per day. Even though this was a regional shopping centre the charges were comparable with parking charges at the parking facilities in centre of Eindhoven, The Netherlands. An internet-based questionnaire of residents in the surrounding suburbs was used in the study. The residents were asked to describe their travel and shopping behaviour ex ante and post ante the introduction of paid parking. The car was the major mode of travel to the shopping centre three months before paid parking in June 2007: 87.3% for weekly purchases and 73.5% for non-weekly purchases. The short term impacts three months after paid parking in November 2007 were that residents' travel and shopping behaviour including expenditure patterns changed considerably. Car travel reduced to 66.7% for weekly purchases and 47.9% for non-weekly purchases. The change in expenditures for weekly purchases was related to changes in visit frequency, visit duration, travel mode, gender, and car availability. For non-weekly purchases, expenditure changes were related to changes in frequency, duration, and day of visit. Van der Waerden et al. (2009b) showed that several aspects of travel and shopping behaviour changed shortly after paid parking was introduced. These did not change back in a positive way in the medium term after the paid parking implementation. In particular, some aspects showed an improvement (e.g., increasing weekly and non-weekly expenditure, weekly visit frequency, and non-weekly visit duration) but this improvement was not significantly different from the initial negative short term effects. One aspect that showed a continuous decrease was car use for weekly purchases.

The previous sections have looked at parking pricing in central city and regional shopping centres. Another level of shopping occurs at local retail precincts and strip shopping centres. Paid parking in strip shopping centres and village environments is aimed at income generation and to facilitate other public good developments. There little research into paid parking and its impact on local business activity. There is however considerable reporting in newspapers and concern from local trader groups about the impact of paid parking on the profitability of their businesses. The relationship between on-street and off street parking was investigated by Pallarez (2014). His study analysed metered parking demand in downtown El Paso, Texas. The study takes into account meter prices, economic conditions, and the price for substitute good parking garages and parking lots. Per capita personal income and a real exchange rate index are both included in the analysis. Results obtained for downtown El Paso are similar to many of those reported in other studies. An increase in the price of the parking meter leads to a decrease in parking meter purchases, while an

increase in parking garage prices will raise parking meter sales. Another key finding in this study is that metered parking spaces are normal goods and parking meter purchases increase as per capita income increases. Furthermore, when the peso depreciates relative to the dollar, Mexican consumers lose purchasing power and therefore parking meter purchases decrease. Reimers (2013) explored the impact of policies to deter car usage on the viability of malls and strip shopping centres. His study measured the importance shoppers assign to car convenience, their perceptions of shopping malls and shopping strips in relation to it, and then compares these areas in their actual provision of car parking. To achieve these objectives, the study utilised a consumer household survey and a retail audit. The results of the study indicate that consumers regard car convenience as an important determinant of where they choose to shop, and perceive malls as a superior source of it. Moreover, with the sole exception of being able to park close to desired stores, malls offer car-borne shoppers more convenient access and parking. The findings suggest that any strategy designed to deter car usage should be designed to impact equally on both mall shopping and strip shopping, or risk tipping the balance even further in favour of the mall.

In summary, parking policy (related to location, duration, price and supply) has been seen as a second best pricing approach to traffic control. However, because of their relative ease of implementation, parking supply and pricing policies have been the first preference of transport planners in their attempt to control traffic mode use in particular areas. This may change with the increasing availability of pricing measures to control traffic flow.

3. Methodology

A simple random sampling household survey of Melbourne's inner west was used to capture changes in visitor parking and shopping behaviours in Yarraville Village. Figure 2 shows the geographical sampling frame for the study. The street boundaries were Skyline Drive in Edgewater to the north, Ashley Street in Braybrook to the west, Esplanade in Williamstown to the south and the Maribyrnong River to the east. The survey collected information on whether people changed their parking and shopping behaviour during paid parking. The survey included before and after paid parking questions on shopping behaviour (amount spent, type of shopping, shops visited), visit days/times, visit frequency, visit duration, travel mode, parking location, awareness of paid parking in Yarraville Village, and experienced parking issues. Demographics were also collected and included five year age group, gender, family status, total household income, education level, residential suburb, and the number of cars owned. The revealed preferences portion of the survey collected information on whether people changed their parking and shopping behaviour during paid parking. The data items collected included before and after paid parking questions on: shopping behaviour (areas visited, amount spent, type of shopping, shops visited), visit days/times, visit frequency, visit duration, travel mode, parking location, awareness of paid parking in Yarraville Village, and parking issues experienced. Demographics were also collected and included: five year age group, gender, family status, total household income, education level, residential suburb, and the number of cars owned. There were four open text response questions in the survey. Patrons were asked about their views on parking management policy and traffic congestion in Yarraville. They were also provided an opportunity to express their subjective views on what they thought were attraction factors for visiting Yarraville and what discouraged them from visiting. These open text responses were categorised into common themes. Copies of the questionnaire can be found in Au and Young (2016b).

Figure 2. Geographical sampling frame for the random household survey. The large square in the middle is the location of Yarraville Village. The smaller square to the west is Yarraville Square, a competing shopping centre hosting Coles, a national supermarket retailer. Map source: Google (2016)



3.1. Sample size and response rate

Invitation letters to participate in the study were letterboxed to 10,300 randomly selected households in the geographical sampling area. Simple random sampling was used, and all adults living in a household were asked to respond. The survey was undertaken between Saturday 28th November 2015 and Thursday 31st March 2016. The deployment started three months after the introduction of paid parking and one week before the moratorium on paid parking. There were 980 respondents to the survey. It was unknown how many adults were living in each household. The response rate would have been 9.5% of households assuming one response from each household.

3.2. Demographics

Table 1 shows the demographics for gender, age, family status and education while Table 2 shows the income, car availability and residential suburb of the respondents. In summary there were more female respondents than males, the age mode was 40-44 years, and most respondents were highly educated. Most had children, had cars and over 60% of the sample came from outside Yarraville.

4. Parking

Awareness of paid parking. Nearly all the respondents (960 out of 980 or 98%) were aware of paid parking in Yarraville Village.

Influence of paid parking to shop elsewhere. There were 643 (65.6%) out of 980 respondents who said they were influenced by the Yarraville Village paid parking to shop elsewhere. The confidence interval of this result is $\pm 3.91\%$ given the requirement of a 99% confidence level. That is, there is a 99% certainty that the true population proportion influenced by paid parking to shop elsewhere falls within the range of 61.69% to 69.51%.

Variable			Frequency	%	Valid %	Cumulative %
Gender	Valid					
		Male	399	40.7%	41.2%	41.2%
		Female	570	58.2%	58.8%	100%
		Total	969		100%	
	Missing		11	1.1%		
	Total		980	100%		
Age	Valid					
		15-19	6	0.6%	0.6%	0.6%
		20-24	14	1.4%	1.4%	2.1%
		25-29	46	4.7%	4.7%	6.8%
		30-34	98	10.0%	10.1%	16.8%
		35-39	152	15.5%	15.6%	32.4%
		40-44	172	17.6%	17.6%	50.1%
		45-49	152	15.5%	15.6%	65.6%
		50-54	131	13.4%	13.4%	79.1%
		55-59	89	9.1%	9.1%	88.2%
		60-64	61	6.2%	6.3%	94.5%
		65-70	39	4.0%	4.0%	98.5%
		71-74	11	1.1%	1.1%	99.6%
		75+	4	0.4%	0.4%	100.0%
		Total	975		100%	
	Missing		5	0.5%		
	Total		980	100%		
Variable			Frequency	%	Valid %	Cumulative %
Family status	Valid					
		Couple - with children	461	47.0%	49.1%	49.1%
		Couple - no children	275	28.1%	29.3%	78.5%
		Single - with children	152	15.5%	16.2%	94.7%
		Single - no children	50	5.1%	5.3%	100%
		Total	938		100%	
	Missing		42	4.3%		
	Total		980	100%		
Variable			Frequency	%	Valid %	Cumulative %
Education	Valid					
		Year 11 or below	29	3.0%	3.1%	3.1%
		Year 12	50	5.1%	5.4%	8.6%
		Certificate III or IV	47	4.8%	5.1%	13.7%
		Graduate Diploma or	145	14 00/	15 70/	20.4%
		Graduate Certificate	145	14.8%	15.7%	29.4%
		Bachelor degree	325	33.2%	35.2%	64.6%
		Postgraduate Degree	326	33.3%	35.4%	100%
		Total	922		100%	
	Missing		58	5.9%		
	Total		980	100%		

Table 1. Demographics on gender, age, family status and education levels

Reported parking problems. Table 3 shows the experience of parking issues. There were 40.2% of respondents who stated they sometimes had problems finding a park in Yarraville before paid parking. This was followed by 27.4% reporting they seldom had problems finding a park, and 12.2% who never had problems finding a park. There were 12% who reported they often had a parking problem. This changed dramatically after paid parking. After paid parking, 22.3% said they never had parking problems (a 10.1% point increase), and 22.8% said they sometimes had parking problems (a 17.4% point decrease). This may be because 15.3% of the respondents indicated they stopped visiting. The percentage that continued visiting but stopped driving rose from 4.1% to 11.4% (a 7.3% point increase). The number of patrons who always experienced parking problems stayed roughly the same at around 3.3 to 3.4%.

Variable			Frequency	%	Valid %	Cumulative %
Income	Valid					
		< \$15,000	8	0.8%	1.0%	1.0%
		\$15,000 to < \$25,000	10	1.0%	1.3%	2.3%
		\$25,000 to < \$35,000	16	1.6%	2.0%	4.3%
		\$35,000 to < \$50,000	28	2.9%	3.5%	7.8%
		\$50,000 to < \$75,000	58	5.9%	7.3%	15.0%
		\$75,000 to < \$100,000	119	12.1%	14.9%	29.9%
		\$100,000 to < \$150,00	233	23.8%	29.2%	59.1%
		\$150,000 to < \$200,000	185	18.9%	23.2%	82.2%
		\$200,000+	142	14.5%	17.8%	100%
		Total	799		100%	
	Missing		181	18.5%		
	Total		980	100%		
Variable			Frequency	%	Valid %	Cumulative %
Number of cars	Valid					
		0	18		1.8%	1.8%
		1	454		46.3%	48.2%
		2	448		45.7%	93.9%
		3 or more	60		6.1%	100%
		Total	986		100%	
Variable			Frequency	%	Valid %	Cumulative %
Suburb	Valid					
		Yarraville	376	38.4%	38.4%	38.4%
		Seddon	131	13.4%	13.4%	51.8%
		Kingsville	90	9.2%	9.2%	61.0%
		Newport	90	9.2%	9.2%	70.2%
		Footscray	83	8.5%	8.5%	78.7%
		West Footscray	83	8.5%	8.5%	87.1%
		Williamstown	73	7.4%	7.5%	94.6%
		Spotswood	21	2.1%	2.1%	96.7%
		South Kingsville	13	1.3%	1.3%	98.1%
		Williamstown North	10	1.0%	1.0%	99.1%
		Other	9	0.9%	0.9%	100.0%
		Total	979		100%	
	Missing		1	0.1%		
	Total		980	100.0%		

Table 2. Demographics on income, car availability and residential suburb

Table 3. Number and percentages of respondents experiencing park problems before and after paid parking

	before		after	
Parking problems	Respondents	%	Respondents	%
never visited	7	0.7%	150	15.3%
never	120	12.2%	219	22.3%
seldom	269	27.4%	159	16.2%
sometimes	394	40.2%	223	22.8%
often	118	12.0%	84	8.6%
always	32	3.3%	33	3.4%
visited, but didn't drive in	40	4.1%	112	11.4%
Total	980	100%	980	100%

Time to find a park. There were a large number of respondents dropping the car mode, and others who stop visiting after paid parking. However, most of the remaining driving respondents still found parks within 5 minutes of entering the Yarraville Village area (See Table 4). Quantified data of parking usage is provided in Au and Young (2016a).

Table 4. Time to find a park before and after paid parking

	before		after	
Time to find a park	Respondents	%	Respondents	%
never visited	7	0.7%	146	14.9%
less than 5 minutes	547	55.8%	430	43.9%
5 minutes to less than 10 minutes	311	31.7%	201	20.5%
10 minutes to less than 15 minutes	50	5.1%	60	6.1%
15 minutes to less than 20 minutes	19	1.9%	17	1.7%
20 minutes or more	5	0.5%	10	1.0%
visited, but didn't drive in	41	4.2%	116	11.8%
Total	980	100%	980	100%

Distance parked. Before paid parking 804 or 82% of respondents parked within a 5 minute walk away. After paid parking, 142 or 14.5% never visited, 99 or 10.1% visited but did not drive in, and 426 or 43.5% parked within a 5 minute walk away. The percentage of respondents parking 5 to 10 minutes walk away increased after paid parking from 11.2% to 25.1% (a 13.9% point increase). In other words, respondents were either avoiding Yarraville Village, visiting via car and parking further away to avoid the paid parking, or were visiting using modes other than the car (See Table 5).

Table 5. Parking distance (in walking minutes) before and after paid parking

	before		after	
Parking distance (in walking minutes)	Respondents	%	Respondents	%
never visited	7	0.7%	142	14.5%
less than 5 minutes walk away	804	82.0%	426	43.5%
5 minutes to less than 10 minutes walk away	110	11.2%	246	25.1%
10 minutes to less than 15 minutes walk away	16	1.6%	52	5.3%
15 minutes or more walk away	1	0.1%	15	1.5%
visited, but didn't drive in	42	4.3%	99	10.1%
Total	980	100%	980	100%

Visit duration. There was a clear shift to shorter stays during paid parking. The largest decreases were in the 1-2 hour and 2-3 hour groups. The largest increase was in the 10 to less than 15 minutes group (See Table 6). The mean visit duration per visit before paid parking was 97.61 minutes (*SD*=60.05 minutes). After paid parking this fell to 53.88 minutes (*SD*=55.87 minutes), a difference of 43.74 minutes.

A paired t-test was performed to compare the before and after annual visiting duration, which takes into account visiting frequencies. The results were significant. The mean annualised duration dropped by 155.79 hours (SD= 278.06 hours) comparing before paid parking (M=233.13 hours, SD= 281.53 hours) to after paid parking (M= 77.33 hours, SD= 142.05 hours); t(979) = 17.539, p < .0001. In other words, patrons would spend an average of 155.79 hours less in Yarraville Village per year due to paid parking.

Visit frequencies. There was a clear shift to less frequent visits due to paid parking (See Table 7). Before paid parking the mode was three times a week. After paid parking the mode shifted to once a week. A paired t-test was performed to compare the before and after annual visiting frequency. The results were significant. The mean number of visits respondents made to Yarraville Village per year on average dropped by 82.74 (*SD*=150.77) visits comparing before paid parking (*M*=171.36, *SD*=170.59) to after paid parking (*M*=88.62, *SD*=133.65); *t*(979) = 17.18, *p* < .0001. In other words, patrons would spend an average of 82 less visits per year to Yarraville Village due to paid parking.

Table 6.	Visit o	duration	before	and	after	paid	parking
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	before		after	
Visit duration	Respondents	%	Respondents	%
never visited	8	0.8%	150	15.3%
less than 5 minutes	0	0.0%	22	2.2%
5 minutes to less than 10 minutes	6	0.6%	52	5.3%
10 minutes to less than 15 minutes	28	2.9%	103	10.5%
15 minutes to less than 30 minutes	89	9.1%	141	14.4%
30 minutes to less than 45 minutes	110	11.2%	100	10.2%
45 minutes to less than 1 hour	111	11.3%	99	10.1%
1 hour to less than 2 hours	289	29.5%	167	17.0%
2 hours to less than 3 hours	244	24.9%	114	11.6%
3 hours to less than 4 hours	70	7.1%	27	2.8%
4 hours or more	25	2.6%	5	0.5%
Total	980	100%	980	100%

Table 7. Visit frequencies before and after paid parking. Note that the total number of respondents does not add up to 980 as some respondents had entered invalid responses in the free text response section of the survey question

	before		after	
Visit frequency	Respondents	%	Respondents	%
never visited	5	0.5%	146	15.1%
three times a day	2	0.2%	1	0.1%
twice a day	48	4.9%	20	2.1%
once a day	70	7.2%	38	3.9%
6 times a week	55	5.6%	9	0.9%
5 times a week	81	8.3%	29	3.0%
4 times a week	99	10.1%	40	4.1%
3 times a week	153	15.7%	82	8.5%
twice a week	141	14.4%	111	11.5%
once a week	95	9.7%	182	18.9%
once a fortnight	104	10.6%	123	12.7%
once a month	67	6.9%	110	11.4%
once every 2 months	27	2.8%	42	4.4%
once every 3 months	18	1.8%	30	3.1%
once every 6 months	12	1.2%	2	0.2%
Total	977	100%	965	100%

Visit days and times. Both before and after paid parking the most popular days and times for visiting were still Saturday and Sunday mornings and afternoons. This was followed in popularity by Friday evenings (See Figure 3). Drops in visitation after paid parking were present across all days, including the non-paid parking days of Sunday and Monday. There are a number of possible explanations for this. It could indicate problems with the communication of the paid parking policy as patrons might believe the policy is active all the time and across the entire Village and not just for certain bays. Another hypothesis is the mere mention of paid parking in an area is sufficient to cause people to consider visiting other areas, due to the effort required to plan life around the specific details of the policy and the belief of heightened patrolled by inspectors. People might find the details of the parking policy too hard to digest, the infringements too risky, and start to visit other shopping areas where there is subsidised parking and less time pressure.



Figure 3. Visit days and times to Yarraville Village before (white bars) and after (black bars) paid parking

5. Shopping

Paid parking impact on shopping location. To ascertain the changes in shopping location a list of shopping alternatives were presented to the respondents. These represent realistic alternative shopping places to Yarraville. The full data describing the change can be found in (Au and Young, 2016b). In the three months paid parking was operating in Yarraville Village, the most popular alternative shopping location was Highpoint Shopping Centre (the largest regional shopping centre in the inner west) which had free all day parking. This was followed by Coles at Yarraville Square which also had free all day parking. If respondents still visited Yarraville Village after paid parking the preference was to drive in but park further away, followed by walking in, and then parking in the paid parking areas. Most of the alternative shopping locations apart from Footscray also had free parking (See Table 8).

Note that in the survey the option of "Yarraville Village (drove in and parked in free parking spot)" was inadvertently left out. A small number of respondents (23) added this response into the free text box included as part of the survey question. Their responses were aggregated. It is highly likely that this figure is an undercount, and users of free parking close to the Village (e.g. short term spots and Canterbury St carpark) may have selected the "Yarraville Village (drove in but parked further away to avoid paid parking)" response option instead out of convenience. Also inadvertently left out was the option of "Yarraville Village (took the bus in)". Only one respondent added the bus response into the free text box for the survey question.

Shop types visited. After paid parking, the Sun Theatre was still the most popular destination, followed by the cafés, the supermarket and restaurants (See Figure 4). However, visitation decreased across all shop types, and a number of respondents stopped visiting altogether.

Change in net number of shop types visited. Figure 5 shows there were 210 (21.43%) patrons who visited the same number of shop types after paid parking. This number was

composed of 173 (17.65%) that had no shop type difference, i.e. they visited exactly the same shop types before and after paid parking. The remaining 37 (3.78%) experienced a change in shop type, even though the net change was zero. One example might be dropping bakery visits and taking up restaurant visits. Another would be dropping banking and the bookshop but taking up cafe and supermarket visits.

Shopping location	Choices	%
Highpoint	692	11.8%
Yarraville Square (Coles at Williamstown Rd)	619	10.5%
Seddon	579	9.8%
Footscray	530	9.0%
Altona Gate	519	8.8%
Yarraville Village (drove in but parked further away to avoid paid parking)	484	8.2%
Williamstown	431	7.3%
Yarraville Village (walked all the way in)	353	6.0%
shopped online	332	5.6%
West Footscray	237	4.0%
Newport	176	3.0%
Docklands	148	2.5%
Yarraville Village (drove in and paid for parking)	142	2.4%
Altona	130	2.2%
Spotswood	115	2.0%
Yarraville Village (biked all the way in)	113	1.9%
Yarraville Village (took the train in)	73	1.2%
South Kingsville	64	1.1%
Melbourne CBD	55	0.9%
Other	48	0.8%
Yarraville Village (drove in and parked in free parking spot)	23	0.4%
Central West Shopping Centre, Braybrook	9	0.2%
Queen Victoria Market, North Melbourne	8	0.1%
South Melbourne Market	7	0.1%
Total	5887	100%

Table 8. Shopping locations visited in the three months of paid parking

The main pattern was there were 726 (74.08% of patrons) who had a net decrease in the number of shop types they visited. Nearly all of these involved exclusively dropping shop types and not substituting them with other shop types. Only 44 or 4.49% of patrons had a net increase in the number of shop types they visited. These results show the effects of paid parking were distributed across the entire Village and not isolated to any particular shop type.

Paid parking impact on grocery spending. The grocery spend per visit is shown in Figure 6. There was a clear shift towards smaller spends. A paired t-test was performed to compare the before and after grocery expenditure per visit for all 980 patrons. (Patrons who stopped visiting were assigned \$0 to their post paid parking grocery expenditure). The results were significant. Grocery spending per visit dropped by \$24 on average, comparing before (*M*=\$47.31, *SD*=\$39.37) and after paid parking (*M*=\$23.27, *SD*=\$26.65); *t*(979) = 20.866, *p* < .001.

Annualised figures were computed to take into account the frequency of visit. The grocery spending per annum dropped by \$6,663 on average, comparing before paid parking (M=\$9684, SD=\$14,640) to after paid parking (M=\$3022, SD=\$6471); t(979) = 15.16, p < .001.

Paid parking impact on discretionary spending. The discretionary spend per visit is shown in Figure 7. There was a clear shift towards smaller spends, similar to the pattern found for the grocery spend shift.

Figure 4. Yarraville Village shop types visited before (white bars) and after (black bars) paid parking. A number of responses have been grouped together. For instance, mentions of "pub" have been categorised under "restaurant". Mentions of "opportunity shop" have been placed under "giftware". Mentions of "jeweller" were grouped under "clothing"



A paired t-test was performed to compare the before and after discretionary expenditure per visit for all 980 patrons. The results were significant. Discretionary spending per visit dropped by \$22.57 on average, comparing before (M=\$46.29, SD=\$33.83) and after paid parking (M=\$23.71, SD=\$26.22); t(979) = 20.833, p < .001.

Note that the survey did not distinguish between visits made for different purposes, and assumed the same visit could be used to cater for both grocery and discretionary purchases. Given discretionary purchases usually occur far less frequently than grocery purchases, the annualised discretionary results can only be seen as suggestive of an upper range to the economic impact of paid parking on Yarraville Village. A paired t-test was performed to compare the before and after discretionary expenditure per annum for all 980 patrons. The results were significant. Discretionary spending per annum dropped by \$5,588 on average, comparing before paid parking (M=\$8,181, SD=\$12,601) to after paid parking (M=\$2,594, SD=\$6,743); t(979) = 15.661, p < .001. This discretionary drop of \$5,588 per year was less than the grocery drop of \$6,663 per year by \$1,075.

6. Mode changes by suburb

Across all suburbs, the majority of patrons still used the car as a transport mode to visit Yarraville Village after paid parking. The analysis was broken down by aggregated suburb as only the nearest neighbouring suburbs would have patrons walking to the Village. Suburbs within walking distance were grouped together. Suburbs south of the Westgate Bridge (a natural boundary to the south of Yarraville Village) formed another group. A third group consisted of suburbs north and west of the Village, beyond walking distance but only a few minutes driving distance away.

Figure 5. Change in number of shop types visited after paid parking. (This chart also includes patrons who stopped visiting.) Negative numbers mean fewer shop types were visited after paid parking. Zero means there was no net change in the number of shop types visited after paid parking









Figure 7. Discretionary spend per visit before (white bars) and after (black bars) paid parking

The combined Yarraville, Kingsville and Seddon suburb results are shown in Table 9. These suburbs would have households less than 2 km from the Village and would thus be within walking distance. There were 597 respondents who lived in this area. Most still visited by car after paid parking (347 or 58.1% of those living in the area). There were 106 or 17.8% of residents who dropped their car usage but continued walking (they were already walking to the Village before paid parking). There were 48 (8%) who stopped visiting Yarraville Village. For suburbs further out requiring non-walk modes of travel, larger percentages of people stopped visiting. This can be seen for suburbs south of the Westgate Bridge (Kingsville South, Spotswood, Newport, Williamstown North and Williamstown combined) in Table 10, with 51 out of 207 respondents (24.6%) who stopped visiting. For suburbs north and west of the rail line (Footscray and West Footscray combined), 37 out of 166 patrons or 22.3% stopped visiting (See Table 11).

Table 9. Mode changes after pai	d parking for Yarraville	, Kingsville and	Seddon (within	walking
distance of the Village)		-	-	-

Mode change	Respondents	%
Still visit by car mode	347	58.1%
Still visit but drop car mode and maintain walk mode	106	17.8%
Still visit but drop car mode and adopt walk mode	18	3.0%
Still visit but drop car mode and adopt train mode	2	0.3%
Still visit but drop car mode and adopt bicycle mode	2	0.3%
Drop car mode and maintain other existing modes	8	1.3%
Maintain walk only	45	7.5%
Maintain bicycle only	2	0.3%
Maintain bus only	1	0.2%
No mode change	14	2.3%
New patron	2	0.3%
Adopt car mode	2	0.3%
Stop visit	48	8.0%
Total	597	100%

Table 10. Mode changes after paid parking south of the Westgate Bridge –South Kingsville, Spotswood, Newport, Williamstown North and Williamstown

Mode change	Respondents	%
Still visit by car mode	143	69.1%
Still visit but drop car mode and maintain walk mode	1	0.5%
Still visit but drop car mode and adopt train mode	4	1.9%
Drop car mode and maintain other existing modes	4	1.9%
No mode change	2	1.0%
Maintain train only	2	1.0%
Stop visit	51	24.6%
Total	207	100%

Table 11. Mode changes after paid parking for north/west of the rail line– West Footscray and Footscray

Mode Change	Respondents	%
Still visit by car mode	117	70.5%
Still visit but drop car mode and maintain walk mode	1	0.6%
Still visit but drop car mode and adopt walk mode	1	0.6%
Still visit but drop car mode and adopt train mode	1	0.6%
Maintain walk only	3	1.8%
Maintain train only	1	0.6%
Maintain bicycle only	1	0.6%
No mode change	2	1.2%
New patron	1	0.6%
Adopt car mode	1	0.6%
Stop visit	37	22.3%
Total	166	100%

7. Predicting paid parking choices

The R mlogit package was used to estimate a multinomial logistic regression model to predict visiting and transport mode choices during paid parking (Croissant 2013; R Development Core Team, 2016). Four mutually exclusive and exhaustive choice outcomes were defined, namely "still visit by car", "walk in but drop the car", "visit via non-walk modes but drop the car" and "stop visiting". The observed frequencies of each outcome are shown in Table 12. Most of the respondents continued to visit Yarraville Village by car. However, members of this group had the option of parking in the free car parks close to the Village, or further away in residential areas, rather than use the paid parking bays. A large percentage of respondents (19.7%) chose to drop the car but still visit. A smaller percentage (14.1%) stopped visiting Yarraville Village. A very small percentage of respondents (3.1%) chose to drop the car but use a mode other than walking to visit Yarraville Village.

Table 12.	Combined	visiting	and	travel	mode	options	after	paid	parking	ł

Combined visit/mode choice option	Respondents	Percentage
Visit by car	619	63.2%
Walk in but drop car	193	19.7%
Visit by non-walk modes but drop car	30	3.1%
Stop visiting	138	14.1%
Total	980	100%

Demographic variables were explored to see if they were significant predictors of these choices. They are shown in Table 13. Note that although the survey asked about the number of cars in the household this variable was excluded in the model. If patrons had no car in the first place the options of "keep visiting by car" or "stop using the car" were not relevant. The survey also asked about household incomes but due to the large number of non-responses to this sensitive question (18.5% non-response), incomes were also excluded. The

remaining demographic variables included were similar to those explored by van der Waerden, Borgers and Timmermans (2009a).

Before these demographic variables were entered into the multinomial logistic regression model, diagnostic tests were conducted to ensure the model assumptions were met. To assess whether multicollinearity was present, linear regressions on each of the predictor variables against all other predictor variables were run to calculate variance inflation factors, which were all close to one. Based on these findings, none of the characteristics were removed as independent variables. Hausman-McFadden tests were also run to examine the independence of irrelevant alternatives assumption. These tests yielded null results, which is evidence that this assumption holds.

Table 13. Variable definitions. Four choice outcomes were defined with the baseline group being "keep visiting by car". Reference categories for the independent variables are also shown

Variable name	Description
Choice (keep visiting by car)	Baseline
Choice (keep walking in but drop car)	
Choice (keep visiting via non-walk modes but drop car)	
Choice (stop visiting)	
Family status	Children (Reference)
	No children
Age group	< 40 years (Reference)
	>= 40 years
Sex	Female (Reference)
	Male
Highest educational attainment	Year 11 or below
	Year 12
	Certificate III or IV
	Graduate Diploma or Graduate Certificate
	Bachelor degree (Reference)
	Postgraduate Degree
	South of Yarraville (Williamstown, Williamstown North, Newport,
Suburb	Spotswood, South Kingsville)
	Yarraville, Kingsville, Seddon
	Footscray, West Footscray (Reference)
	All other
Number of competing shopping centres	0-12

Only main effects were entered into the model using the forced entry method as there were no theoretical reasons to include interaction terms. All independent variables were entered into the regression equation at the same time. The statistically significant variables of the multinomial logistic regression are shown in Table 14. The model fit is significant $\chi^2 = 240.68$, *p* < .001 indicating the full model predicts significantly better than the null model (i.e., a model with no predictors).

6.1 Odds of choosing "stop visiting" over "visit by car"

Household composition, gender, residential suburb, education level, and the numbers of alternative shopping locations were significant factors influencing the choice of "stop visiting" over "visiting by car". For households without children relative to households with children, the odds increase by 1.594, 95% CI [1.055, 2.408] holding all other variables constant. For males relative to females, the odds increase by 1.826, 95% CI [1.214, 2.748]. For Yarraville/Kingsville/Seddon residents relative to Footscray/West Footscray residents, the odds decrease by 0.469, 95% CI [0.280, 0.785]. For Year 12 relative to Bachelors holders, the odds increase by 2.322, 95% CI [1.066, 5.058]. If a patron were to increase his or her number of alternative shopping centres visited by one, the odds decrease by 0.900, 95% CI [0.810, 1.000]. Each result assumes all other variables are held constant.

Table 14. Estimation results relative to still visit by car choice. The logistic coefficient for each predictor variable and the associated odds ratio (the exponent of the coefficient) are shown

							95% CI for odds ratio		
Choice ^a	Predictors	Coefficient	SE	t-value	р	Sig.	Lower	Odds Ratio	Upper
Stop visit versus visit by car									
	Intercept	-1.284	0.415	-3.097	0.002	**			
	Household without children	0.466	0.210	2.217	0.027	*	1.055	1.594	2.408
	Household with children	Reference							
	Male	0.602	0.209	2.888	0.004	**	1.214	1.826	2.748
	Female	Reference							
	Yarraville/Kingsville/Seddon resident	-0.757	0.263	-2.879	0.004	**	0.280	0.469	0.785
	Footscray/West Footscray resident	Reference							
	Year 12 completion only	0.842	0.397	2.121	0.034	*	1.066	2.322	5.058
	Bachelor degree	Reference							
	Number of alternative shopping centres	-0.106	0.054	-1.968	0.049	*	0.810	0.900	1.000
Still visit by non-walk mode but drop the car									
versus visit by car	Intercept	-4.016	0.951	-4.221	0.000	***			
	Household without children	1.674	0.514	3.255	0.001	**	1.946	5.333	14.612
	Household with children	Reference							
	South of Yarraville resident	1.441	0.691	2.085	0.037	*	1.090	4.225	16.380
	Footscray/West Footscray resident	Reference							
Still walk in but drop the car									
versus visit by car	Intercept	-2.907	0.524	-5.550	0.000	***			
	>= 40 years old	-0.419	0.198	-2.117	0.034	*	0.446	0.657	0.969
	< 40 years old	Reference							
	Yarraville/Kingsville/Seddon resident	2.406	0.433	5.558	0.000	***	4.746	11.087	25.896
	Footscray/West Footscray resident	Reference							

Significance codes: p < .05 '*', p < .01 '**', p < .001 '***

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    <sup>a.</sup> Reference category is: Still visit by car
Log-Likelihood: -756.56
    McFadden R<sup>2</sup> = .13723
    Likelihood ratio test : χ<sup>2</sup> = 240.68 (p < .001)</li>
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6.2 Odds of choosing "still visit by non-walk mode but drop car" over "visit by car"

Household composition and residential suburb were the significant factors influencing choosing to "visit by non-walk modes" over "visiting by car". For households without children relative to households with children, the odds increase by 5.333, 95% CI [1.946, 14.612] holding all other variables constant. For patrons living south of Yarraville relative to patrons living in Footscray/West Footscray, the odds increase by 4.225, 95% CI [1.090, 16.380]. Each result assumes all other variables are held constant.

6.3 Odds of choosing "still walk in but drop the car" over "visit by car"

Age group and residential suburb were significant factors influencing the choice to "drop the car and walk in" over "visiting by car". For patrons 40 years or older relative to patrons under 40 years old, the odds decrease by 0.657, 95% CI [0.446, 0.969] holding all other variables constant. For Yarraville/Kingsville/Seddon patrons relative to patrons living in Footscray/West Footscray, the odds increase by 11.087, 95% CI [4.746, 25.869] holding all other variables constant.

7. Conclusions

A key consideration for parking policy is its likely effect on economic activity. This study has shown that paid parking may have unanticipated economic consequences. It may encourage people travel to nearby business areas where there is subsidised parking, change the day they visit, the time they visit, how often they visit, how long they stay when they visit, and cause them reduce both regular and discretionary spending. Further empirical research needs to be conducted to understand the consequences of introducing paid parking policy on local shopping strips.

8. References

- Au, G. & Young, W. (2016a). The impact of the introduction of paid parking at a local retail precinct: A Case Study of the Yarraville Village Paid Parking Scheme. In *Proceedings* of the 27th ARRB Conference, Melbourne, Australia.
- Au, G. & Young, W. (2016b). A users' perspective of paid parking at a local retail precinct: Major Report. Research Report, Department of Civil Engineering, Monash University, Melbourne, Australia.
- Bianco, M. J., Dueker, K., & Strathman, J. (1997). Parking strategies to attract auto users to transit (Discussion Paper 95). The Center for Urban Studies, Portland State University, Portland, Oregon.
- Croissant, Y. (2013). mlogit: multinomial logit model. R package. Version 0.2-4. <u>http://cran.r-project.org/web/packages/mlogit/</u>.
- Hamer, P., Currie, G., & Young, W. (2011). Parking pricing policy: A review of the Melbourne congestion levy. In *Proceedings of the Australasian Transport Research Forum* (ATRF), 34th, 2011, Adelaide, South Australia, Australia, 1-16.
- Hensher, D. A., & King, J. (2001). Parking demand and responsiveness to supply, pricing and the location in the Sydney central business district. *Transportation Research*, *35*(3), 177-196.
- Higgins, T. J. (1992). Parking taxes: Effectiveness, legality and implementation, some general considerations. *Transportation*, *19*(3), 221-230.
- Lennie, O. S., & Smith, R. A. (1986). Practicalities of CBD fringe area car parking policy. In *Proceedings of the 11th, Australian Transport Research Forum, Vol. 1*, 141-165.
- Marsden, G. (2006). The evidence base for parking policies: A review. *Transport Policy*, *13*(6), 447-457.
- Pallarez, E. (2014). *El Paso parking meter demand*. Master of Science, The Faculty of Graduate School, The University of Texas, El Paso.
- R Development Core Team. (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna.
- Reimers, V. (2013). Convenience for the car-borne shopper: Are malls and shopping strips driving customers away?. *Transportation Research Part A, 49,* 35-47.
- van der Waerden, P., Borgers, A., & Timmermans, H. (2009a). Consumer response to introduction of paid parking at a regional shopping center. *Transportation Research Record: Journal of the Transportation Research Board, 2118*, 16-23.
- van der Waerden, P. & Timmermans, H. J. P. (2009b). The introduction of paid parking in shopping areas: Short term versus medium term. In *Conference Proceedings of the* 16th Recent Advances in Retailing & Services Science Conference, July 6 – July 9, 2009, Niagara Falls, Canada.
- Verhoeff, E., Nijkamp, P., & Rietveld, P. (1995). The economics of regulatory parking policies: The (IM)possibilities of parking policies in traffic regulation. *Transportation Research Part A*, 29(2), 141-156.