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Competition in Print Advertising between Paid and Free Newspapers

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Working Paper

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Abstract

This paper looks at the market for print advertising in New Zealand, which is characterized by rich variation in ownership structures of overlapping paid daily metropolitan newspapers and free weekly suburban newspapers. We first present stylized empirical facts on advertising rates and readership shares, from an original dataset. We then present a simple model whose market outcome varies with ownership structure in the same manner as our empirical observation.

JEL classification: D12; L11; L13; L41

Keywords: newspaper; print advertising; ownership structure; competition

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1 Introduction

The study of competition between newspapers has typically focussed on content, retail price, and advertising rates. The theory of two-sided markets has enriched our understanding of the relationship between these variables without substantially altering the focus.[1] Much of this literature assumes competition between newspaper titles with overlapping distribution. In this paper we investigate newspaper competition in New Zealand, a market characterised by a combination of competition and co-ownership between titles with overlapping areas of distribution. Part of the motivation for this study is the recent decision by the Commerce Commission to reject a merger application by NZME and Fairfax Media.[2] As the two largest news media companies in New Zealand, they compete in radio, online news, and print news markets. The final determination cites the likely lessening of competition in the print newspaper industry, which may lead to lower quality or higher prices.

NZME owns the largest paid daily metropolitan newspaper in New Zealand, the *NZ Herald*, based in Auckland, and five other paid daily newspapers in regional centers around the North Island. In addition, it owns 22 free suburban newspapers, all based in the North Island. Roughly half are delivered to suburban areas where one of NZME's own paid daily newspapers operates; others are served by one of Fairfax's paid daily newspapers.

Fairfax owns four paid daily newspapers in the North Island and five in the South Island. They cover the three largest population centers after Auckland: Wellington, Christchurch, and Hamilton. Fairfax also owns 52 free weekly newspapers.[3] Its titles in the South Island are mostly delivered to suburban areas around its own paid daily newspapers, except those around Dunedin (explained below). Fairfax's other free weekly newspapers, in the North Island, mostly cluster around regional centers served by one of either Fairfax's own or NZME's paid daily newspapers.

Besides these two corporate owners, there are a few independent newspaper publishers in New Zealand. Allied Press publishes the paid daily newspaper in Dunedin, and fourteen free

[1] The seminal articles in the economics of newspapers are Corden (1952), Reddaway (1963), and Rosse (1967). The seminal articles on the theory of two-sided markets are Rochet and Rochet and Tirole (2003), Rochet and Tirole (2006), and Armstrong (2006). Rysman (2009) surveys the literature on two-sided markets.

[2] `http://www.comcom.govt.nz/business-competition/mergers-and-acquisitions/authorisations/merger-authorisation-register/nzme-limited-and-fairfax-new-zealand-limited/`

[3] We exclude titles that are published less than once a week.

weekly newspapers, delivered to communities on the west coast and lower half of the South Island. Star Media publishes seven suburban free weekly newspapers, all of which are delivered to Christchurch suburbs. Wellington Suburban Newspapers Ltd. publishes three free weekly titles. Sun Media publishes two free weekly titles in Tauranga. Beacon Media Group publishes a free weekly in each of Whankatane and Opotiki. Finally, smaller independent publishers produce single titles in their local communities.

To summarize, we observe a variation in newspaper ownership structure across cities in New Zealand. There are population centers where the paid daily and free weekly newspapers belong to the same owner (Fairfax), such as Nelson and Blenheim. There is Auckland, where the paid daily newspaper belongs to one corporation (NZME) and all other eleven overlapping free suburban newspapers belong to the rival corporate publisher (Fairfax). There are population centers with competition between the two corporate publishers in free weekly newspapers, such as Whangarei, Hamilton, Hawkes Bay, and New Plymouth.[4] There are cities with competition between Fairfax and one of the independent publishers in free weekly newspapers, such as Wellington, Christchurch, Dunedin, Queenstown, and Invercargill. Finally, in Tauranga there is competition between NZME and an independent publisher in free weekly newspapers.

We begin by establishing a set of stylized empirical facts about newspaper advertising rates, most importantly that they are proportional to readership. We then examine the relationship between advertising rates, overlapping areas of distribution, and the ownership of titles. Although the results are not statistically significant, largely due to the small number of titles in New Zealand, they are consistent with free weekly newspapers choosing an area of distribution strategically. Specifically, where the paid daily and free weeklies share a common owner, there are fewer free weeklies, each with a smaller readership and lower advertising rates. We incorporate these insights in a model of competition in the newspaper advertising industry based on the classic Hotelling model.[5]

Our paper adds to the large literature on the economics of newspapers, and the smaller liter-

[4]When the New Zealand Commerce Commission declined the NZME-Fairfax merger application, they dedicated a substantial portion of their final determination to these geographic markets where the merging parties have an overlap in free weekly newspapers. The media release and final determination can be found here: `http://www.comcom.govt.nz/the-commission/media-centre/features/the-nzmefairfax-final-decision/`

[5]Hotelling competition has been used to model competition between newspapers, notably in Armstrong (2006), Kaiser and Wright (2006), and Chandra and Collard-Wexler (2009).

ature on ownership concentration in the newspaper industry. Fan (2013) offers an up-to-date list of papers on the economics of newspapers. The literature on ownership concentration includes Chaudhri (1998), Chandra and Collard-Wexler (2009), and Fan (2013). An early paper by Ferguson (1983) considers ownership across media platforms, the cross ownership of newspaper-radio and newspaper-television assets within a single market. The paper closest to ours is Chandra and Collard-Wexler (2009), which investigates the impact of mergers on newspaper cover prices and advertising rates in Canada. Our paper differs from theirs in considering markets where newspapers with overlapping areas of distribution are of a different type, rather than, for example, competing daily titles. Finally, Lacy, Coulson, and Cho (2002) examine competition between different types of newspapers, including paid dailies and free weeklies, but without considering the ownership of the newspapers, an element that is central to our study.

The rest of the paper is organized as follows. Section 2 details the variation in newspaper ownership structure across cities in New Zealand, describes the original datasets we have constructed, and establishes the key empirical facts on advertising rate and readership. Section 3 presents our model, based on the classic Hotelling linear city model, as an attempt to explain the stylized empirical facts. Section 4 concludes with caveats of our model.

2 Stylized Empirical Facts

In this section we present our analysis of advertising rates, readership, and how they vary with the local ownership structure. We do so by constructing an original dataset of newspaper titles in the following manner. We are able to collect current (effective 2017) advertising rates for all paid daily and free weekly newspapers owned by NZME and Fairfax. Advertising rate cards for titles owned by the independent publishers are not publicly available, thus, all graphs, tables, and regression analyses that follow are based on this cross-section of NZME and Fairfax rates only. Advertising rate cards differ in format and specification offerings across titles, and we take great care to arrive at rates for each title that are comparable across titles; see appendix for details.

Readership data are obtained from NZME and Fairfax's most recent media kits. Numbers cited by both companies come from Nielsen. Readership numbers for all free weekly suburban newspapers are expressed in terms of number of readers reached per week. For paid daily newspapers to be comparable with that of free weekly newspapers we use the weekly (as opposed

to daily) number of readers reached measure. We obtained audited circulation numbers from the New Zealand Audit Bureau of Circulations Inc. (`http://www.abc.org.nz/`). Circulation numbers are smaller than readership numbers, because a single newspaper copy delivered to a household is usually read by more than one person.

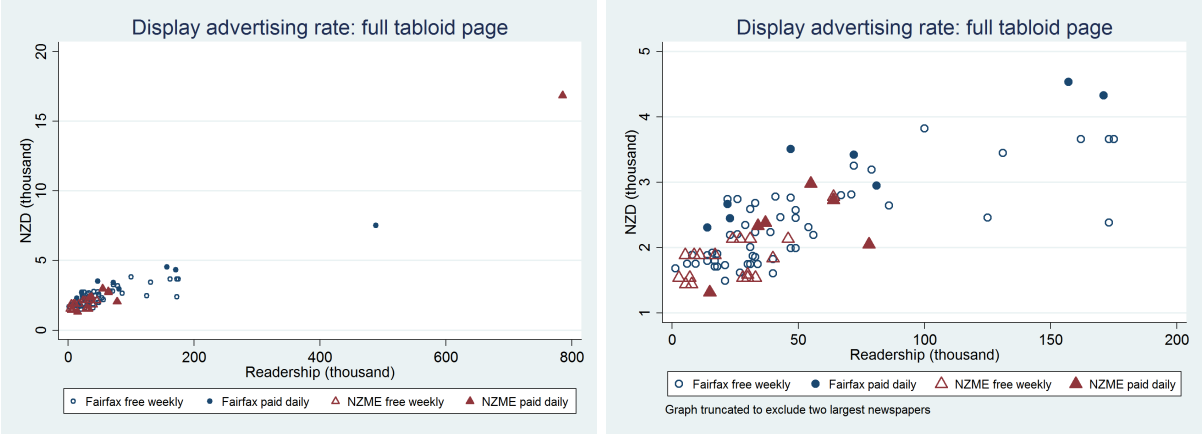


Figure 1: Display advertising rate for full tabloid page vs. readership

We collected comparable advertising rates for the following specifications. For display advertising, we collected the printed rates for full-, half-, and quarter-tabloid page areas. For classified advertising, we collected the "per column-centimeter" rate. Figure 1 is a scatter plot of full page display advertising rate against readership. The graph on the left shows all newspapers; the graph on the right truncates the two newspapers with the largest readership. We observe that advertising rates have a strong linear relationship with readership, across the full range of values, for paid and free titles of both owners. Indeed, these two variables have a correlation of 0.9475. When we regress this advertising rate on readership, we obtain a highly significant coefficient and an R^2 value of 0.8978. These results also hold true for half and quarter page display advertising rates, as well as the classified advertising rate per column-centimeter. Equivalent graphs for these rates can be found in the appendix. These advertising rates have a weaker relationship with audited circulation figures. Table 1 shows the correlation figures between the aforementioned advertising rates, and readership and audited circulation.

We use price regressions to further explore whether advertising rates are correlated with variables other than readership, such as market structure. In the regressions that follow, we focus on free weekly suburban newspapers only, for the following two reasons. First, we can largely ignore consumers' purchase behavior because these newspapers are delivered free, by

Table 1: Correlations between advertising rates and readership or circulation

Advertising rate	full page	half page	quarter page	classified per column-cm
Readership	0.9475	0.9309	0.9324	0.8884
Audited Circulation	0.6511	0.6497	0.6385	0.7435

default, to all households within the area of distribution.[6] Second, we can explore whether the NZME and Fairfax free weekly suburban newspapers, as a whole, respond to the presence of each others' paid daily newspapers and other independents when setting their advertising rates. We construct dummy variables of overlap status between each of NZME and Fairfax's free weekly newspapers with newspapers of its own or rival publisher, and with the two largest independent publishers (Star Media in Christchurch and Allied Press in bottom half of the South Island). We consult all available delivery maps and textual description of circulation areas when determining the values of these dummy variables. They take on the value of one whenever there is some degree of overlap: the larger area (of the paid daily newspaper) need not fully encompass the smaller area (of the free weekly newspaper). We acknowledge that dummy variables are crude measures of overlap; however, finer measures such as the number of households or businesses in the overlapping area are very difficult to produce. All publishers set distinct distribution areas for their portfolio of free weekly newspapers, thus free weeklies of the same owner have no overlap with each other.

Table 2 shows five sets of OLS regression results for the display advertising rate of a full tabloid page on readership and the aforementioned overlap dummy variables. Column (1) starts with just the readership variable. Columns (2) to (4) include various overlap dummy variables with paid daily newspapers; column (2) begins with broad definitions of the presence of rival and own paid dailies, while columns (3) and (4) further break down these definitions by identity of owner. Column (5) considers overlap dummy variable with other free weekly suburban newspapers. The coefficient on the readership variable is always highly significant, positive, and is stable across the five columns. The results in columns (2) to (4) are remarkably consistent: the presence

[6] We acknowledge that the free-delivery nature of weekly suburban newspapers does not eliminate its two-sided nature entirely. Theoretically, if readers have a very strong dislike for advertising, or if the quantity or quality of the newspapers' original content drop drastically, readers can discard these newspapers upon receiving them, which would result in a lower surveyed readership.

of a paid daily by a rival publisher is negatively correlated with the free weekly's advertising rate, while the presence of a paid daily by the same owner is positively correlated with the free weekly's advertising rate. Unfortunately most of the coefficients of these overlap dummy variables are not statistically significant, likely due to the small sample size. The results in column (5) matche our existing understanding of newspaper competition: the presence of a rival free weekly newspaper is negatively correlated with the free weekly's advertising rate.[7] In particular, in Christchurch Star Media seems to exert the strongest downward pressure on Fairfax's advertising rate. Equivalent regression results for other advertising rates (half tabloid page, quarter tabloid page, and classified rate per column-centimeter), largely similar to the above, can be found in the appendix. The strong linear relationship between advertising rate and readership, as well as the regression results in columns (2) to (4), are the basis and inspiration for our theoretical model in the next section.

We now turn to a brief analysis of the readership of free weekly newspapers. In our data collection we observed entry and exit of titles, often accompanied by an adjustment of circulation area of adjacent titles. Not all habited areas are served by a title, so there is still room for "greenfield" expansion (although these areas are sparsely populated). We also remark that the division of metro areas (such as Auckland and Wellington) between newspaper titles does not always follow geographic (such as an island) or administrative boundaries. Furthermore, this division is far from even. For example, in the Auckland metro area[8], the largest title has a readership of 175,000, while the smallest has 17,000. We take these empirical observations to suggest that publishers make endogenous choices about each title's distribution area (and hence readership), and that they make this decision strategically, responding to market structure and local businesses' advertising needs. Here we empirically explore the former, since we do not observe the latter.

We observe some indication of a relationship between ownership structure and readership share in our data. We define the readership share of each free weekly newspaper as a ratio of the readership of the free weekly newspaper to that of the nearest paid daily newspaper. Since, in spatial terms, the coverage of the free weekly newspaper needs not be a proper subset of the nearest paid daily newspaper, this ratio can be larger than one. We encounter this in eight

[7]The Commerce Commission's final determination on the NZME/Fairfax case dedicates much of its Section 3 on markets with overlapping free weekly newspapers.

[8]Excluding Waiheke Island, which is geographically separated.

Table 2: OLS regression result with full tabloid page display advertising rate as dependent variable

	(1)	(2)	(3)	(4)	(5)
Readership	0.0112***	0.0116***	0.0108***	0.0115***	0.0121***
	(0.00113)	(0.00117)	(0.00120)	(0.00118)	(0.00112)
Overlap rival paid daily		−0.0731			
		(0.123)			
Overlap own paid daily		0.0703			
		(0.131)			
Overlap rival NZME paid daily			−0.00789		
			(0.113)		
Overlap rival Fairfax paid daily			−0.309*		
			(0.140)		
Overlap rival Allied Press paid daily			−0.120		
			(0.166)		
Overlap own NZME paid daily				0.0619	
				(0.140)	
Overlap own Fairfax paid daily				0.140	
				(0.102)	
Overlap rival NZME/Fairfax free weekly					−0.0842
					(0.110)
Overlap rival Star Media free weekly					−0.856**
					(0.274)
Overlap rival Allied Press free weekly					−0.101
					(0.158)
constant	1.700***	1.673***	1.769***	1.612***	1.711***
	(0.0659)	(0.151)	(0.0749)	(0.100)	(0.0706)
R^2	0.588	0.599	0.618	0.599	0.643
R^2 adjusted	0.582	0.582	0.595	0.582	0.621
N	72	72	72	72	72

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

observations, where we cap the ratio at the maximum value of one. Table 3 shows the results when we regress free weekly newspapers' readership shares on ownership dummies. Although coefficients are not statistically significant (again due to the small number of observations), we observe a consistent pattern. In the presence of a rival paid daily newspaper, publishers of the free weekly newspapers are likely to divide the total readership into smaller titles. If the publisher also owns the overlapping paid daily newspaper, it is likely to divide the total readership into fewer, larger titles. We attempt to explain this with our model in the next section.

Table 3: OLS regression result with readership share as dependent variable

	(1)	(2)	(3)	(4)
Overlap rival paid daily	−0.0880			
	(0.111)			
Overlap rival NZME paid daily		−0.237		
		(0.125)		
Overlap rival Fairfax paid daily		−0.239		
		(0.165)		
Overlap own paid daily			0.199	
			(0.115)	
Overlap own NZME paid daily				0.140
				(0.166)
Overlap own Fairfax paid daily				0.217
				(0.122)
constant	0.453***	0.508***	0.279**	0.279**
	(0.0774)	(0.0708)	(0.0938)	(0.0943)
R^2	0.00943	0.0664	0.0430	0.0465
R^2 adjusted	−0.00558	0.0377	0.0285	0.0172
N	68	68	68	68

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3 Model

Our model of print advertising is inspired by the classic Hotelling linear city model. Notable papers using the Hotelling model on the newspaper industry include Armstrong (2006), Kaiser and Wright (2006), and Chandra and Collard-Wexler (2009). The incumbent paid daily metropolitan newspaper has the maximum possible readership in the city, and determines the advertising rate (normalized by readership). The publisher of the free weekly suburban newspapers matches this advertising rate, and chooses an optimal division of the city into separate titles. These titles together create discrete levels of readership. Each business has a desired readership size for its advertising. It chooses the newspaper that gives it the greatest surplus from advertising, as determined by the difference in readerships demanded and supplied, and other model parameters. We model how market outcomes—advertising rate and title division—vary with ownership structure.

We establish the model notation as follows. Consider the unit interval $i \in [0, 1]$, where a uniform distribution of businesses of mass 1 reside. Business i's location on the interval indicates its advertising need, in terms of the number of readers it hopes to reach and is willing to pay to do so. For example, at the small end of the spectrum, $i = 0$ might be a local independent barber

shop; at the large end of the spectrum, $i = 1$ might be a prominent downtown department store. As in the classic model, we assume that the location of a business on the interval is exogenously given.

Consider the case where a city has one paid daily metropolitan newspaper, and one publisher of (potentially multiple) free weekly suburban newspaper(s). These two different types of newspaper may belong to the same or competing publishers. Let $j = 0$ denote the "outside good" of not purchasing print advertising, $j = 1$ be the paid daily newspaper, and $j = 2, ...$ be the free weekly newspaper(s). We first focus on the primary difference between these two types of newspapers: readership, which also gives that newspaper's advertising reach.[9] Denote newspaper j's readership by $r_j \in [0, 1]$. We fix the incumbent paid daily newspaper's readership to meet the largest advertising need, thus $r_1 = 1$. The publisher of the free weekly newspaper(s) endogenously chooses how to divide the city's suburbs, and thus readership, between titles.[10] For simplicity, we consider the case where the publisher of free weekly newspapers divides the total readership evenly into N titles, where N is a positive integer. This publisher chooses endogenous variable N given r_1. This set-up reflects historical reality, as paid daily newspapers in New Zealand were founded much earlier than the free weeklies, and have wider geographic coverage, than the free weeklies in the same city. When N is chosen, the readerships of all free weekly newspapers are identical to $r_2 = \frac{1}{N}$.

If a business chooses to advertise with the free weekly newspaper(s), it is allowed to advertise with more than one title.[11] Here we depart from the discrete choice set-up in the classic Hotelling model. When the readership and advertising reach of each free weekly is $r_2 = \frac{1}{N}$, a business has the choice of advertising with any number of them $n = 1, ..., N$, giving this set of possible advertising readerships: $nr_2 = \frac{n}{N}, \forall n = 1, ..., N$. We henceforth refer to the free weekly newspapers in the singular, as if it is a single newspaper that offers fractional advertising reach, in contrast to the paid daily newspaper. The larger the N chosen, the larger the range of fractional advertising (or spatial divisibility) available. This element of the model is motivated

[9]Other differences include the cover or subscription prices, frequency, advertising ratio, news hole, total number of pages, topics covered, content quality, etc.

[10]This implicitly assumes a spatial nature in newspaper readership and advertising. We hope to give a flavor of spatial divisibility in our model while refraining from explicitly modeling spatial competition.

[11]It is common for publishers of free weekly newspapers to offer multi-title deals such as "5 paper buys" or "group buys".

by the empirical observations on readership share from the previous section.

Each business i makes its advertising decision based on the utility it receives from the newspaper's advertising reach. We normalize the business's reservation value of reaching readership r_j to be 1, thus the total reservation value of readership r_j is also r_j. We let the price that newspaper j charges for its advertising service to be proportional to its readership: ar_j, where $a \in (0, 1)$ is endogenously determined by the paid daily. This functional form is motivated by the empirical observation in the previous section, that advertising rates and readership are strongly linearly related across newspapers of different readerships. Finally, each business experiences a "dissatisfaction cost" (analogous to the "transportation cost" in the standard Hotelling model) $\tau > 0$ that captures the difference between the specific readership size it wants to reach and the newspaper's readership size. Thus, utility of business i purchasing advertising service with newspaper j is given by:

$$u_{ij} = r_j - ar_j - \tau|i - r_j|$$

In other words, if business i advertises with newspaper j, with $r_j > i$, the business pays for and derives positive marginal utility from reaching the readers excess of its advertising needs, while suffering from the "transportation cost" on the absolute difference between r_j and i. If instead $r_j < i$, the business does not pay for, and does not derive positive marginal utility from, the shortfall of readers it wished it could reach, and suffer from "dissatisfaction cost" in the same manner. We normalize the utility of the "outside good" to be $u_{i0} = 0$. Each business chooses to advertise with the newspaper (or the outside good) that provides the highest utility. When the two newspapers offer identical utilities, $u_{i1} = u_{i2}$, which will be the case if the business chooses to advertise with *all* free weekly titles, we break the tie by specifying that the business advertises with the paid daily newspaper. The choice between the fractional advertising levels offered by the free weekly newspaper is analogous: the business chooses the fractional level closest to its need that gives positive utility; otherwise it chooses the "outside good". This utility function has the following implications. Because the first half of the utility function $(1-a)r_j$ is increasing in r_j, a newspaper with larger readership brings a larger maximum utility. And because "transportation cost" τ is common across all newspapers, a newspaper that provides a larger maximum utility also has a larger potential demand. On the flip side, a business with a larger i is more likely to purchase advertising service (instead of the outside good) than a business with a smaller i.

We now present the newspapers' profit functions. For simplicity we assume that there is only

a single print advertising product with each type of newspaper; in reality, most newspapers offer different price points for display and classified advertising of different sizes. We assume that each newspaper incurs a constant marginal cost c_j to produce, print, and deliver copies to each unit of reader, and a fixed cost FC_j. Newspaper j receives advertising revenue ar_j from each business that purchases its service. Let $d_j(a)$ be the demand for newspaper j. In general, its profit is then given by:

$$\pi_j = (d_j(a) \cdot a - c_j)r_j - FC_j$$

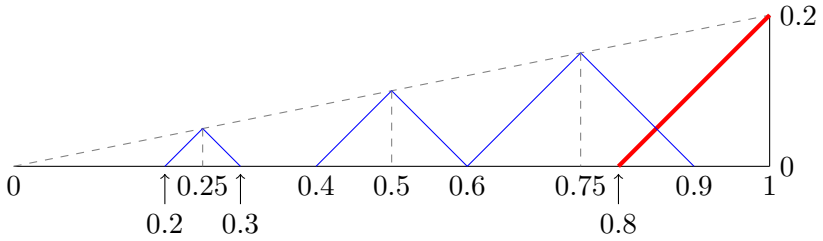
As in the classic Hotelling model, the demand for each newspaper is delineated by indifferent customers $\hat{i}_{jk}$, between paid daily and free weekly newspapers; between different fractional advertising levels of the free weekly newspapers; and between any of the above and the outside good. For a quantitative illustration, consider the set of parameter values: $N = 4, a = 0.8, \tau = 1, c_1 = c_2 = 0.05$. Figure 2 shows the uniform distribution of business advertising need in the horizontal axis, and each business i's utility from purchasing newspaper j's advertising service (if positive) in the vertical axis. The paid daily newspaper offers $r_1 = 1$, and the utility of advertising with it is represented by the red (or thick solid) line. The free weekly newspaper offers four levels of fractional advertising service: $(\frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1)$, and the utility of advertising with it is represented by the blue (or thin solid) lines. The business at $i = 1$ receives maximum utility from advertising with the paid daily newspaper, and its utility is $1 - a = 0.2$. Utility decreases with slope $\tau = 1$ for businesses further away from $i = 1$. The blue (or thin solid) lines can be understood in the same manner. We observe that the lines of the two newspapers intersect at $i = 0.85$, which is the business that is indifferent between advertising with the paid daily newspaper and the free weekly newspaper at 0.75 fractional advertising. Thus, the demand for advertising with the paid daily newspaper is the range $[0.85, 1]$, of length 0.15. The demand for advertising with the free weekly newspaper is the sum of these three ranges: $[0.2, 0.3], [0.4, 0.6]$, and $[0.6, 0.85]$, corresponding to the three fractional levels of advertising. If we abuse notation slightly, and use $j = 2n$, for $n = 1, 2, 3$, to denote these three fractional levels of advertising, the free weekly newspaper's profit given by the sum:

$$\pi_2 = \sum_{n=1}^{N-1} \pi_{2n} = \sum_{n=1}^{N-1} [(d_{2n}(a) \cdot a - c_2)r_{2n} - FC_{2n}],$$

assuming the same constant marginal cost c_2 is applied throughout.

When the two newspapers are in competition, the endogenous variables N and a are chosen in a two-stage game as follows. In the first stage, the incumbent paid daily newspaper chooses

Figure 2: Business advertising demand with sample parameter values



a. The free weekly newspaper will adopt the same advertising rate. In the second stage, the free weekly newspaper chooses N given a. The sub-game perfect equilibrium of this simple two-stage game can be solved by backward induction. When the two newspapers have a common owner, we assume that N and a are chosen simultaneously to maximize total profits $\pi_1 + \pi_2$. The choice of a depends on the demand elasticity of businesses on advertising. The choice of N rests on the marginal benefit and cost on "spatial divisibility": the finer the publisher of free weekly newspapers divides the market "spatially", the wider the range of businesses it will cater to, at the cost of the marginal cost of serving more readers, and fixed costs for each separate title. Because of the discreteness of N, we cannot solve it with first order condition. Because of the presence of indifferent consumers between two newspapers demarcating demand, demand and profit functions are not continuously differentiable at all values of a, even given N. Thus, we approximate the maximization problem by discretizing the parameter space and computing the profits at each set of parameter values. We consider $N = 2, 3, 4, 5, 6$ (we ignore $N = 1$ because $\pi_2 = 0$, from our model specification on tie-breaking), and $a \in (0, 1)$ from 0.1 to 0.9 at intervals of 0.1.[12] For simplicity, we assume all fixed costs to be zero in the computation, but it is easy to use non-trivial values. Table 4 shows the computed profits. In each cell, the profit of the paid daily newspaper π_1 is listed on the first row; the profit of the free weekly newspaper π_2 (the total profit from all fractional advertising levels) is listed on the second row; and the total $\pi_1 + \pi_2$ is listed on the third row in parentheses. Here we note a few patterns in the computed profits. Firstly, at any given a, π_2 is observed to increase, reach a maximum, then decrease in N, even within our short range of integer values. Moreover, the larger the given a, the larger the N that maximizes π_2. For example, at $a = 0.3$, $N = 3$ maximizes π_2; at $a = 0.8$, $N = 5$ maximizes π_2. This agrees with our intuition on the free weekly's marginal benefit and cost on

[12] As a robustness check, we have considered a finer discretization of a, from 0.05 to 0.95 at intervals of 0.05. This does not change the result.

the choice of N; in particular, the larger the given a, the larger the marginal benefit of N on π_2 from serving more businesses, thus the larger the N that maximizes it. Secondly, at any given a, π_1 is decreasing in N. This is because the free weekly's choice of N determines how much business it steals from the paid daily. The larger the N, the closer is $\frac{N-1}{N}$ (largest fractional readership of free weekly) to 1 (readership of paid daily), thus the larger the indifferent business $\hat{i}$, and the more business the free weekly steals from the paid daily. Lastly, at any given N, π_1 is increasing in a, while π_2 is first increasing then decreasing in a. This follows from the same reasoning above.

We now explore how market outcomes from the model differ by ownership structure. Under competition, the sub-game perfect equilibrium is $(N^*, a^*) = (4, 0.7)$. Under common ownership, total profit is maximized at $(\widehat{N}, \widehat{a}) = (2, 0.9)$. In conclusion, the simulated results from our model match the empirical observations from the last section. In a city with both a paid daily metropolitan newspaper and free weekly suburban newspapers, when the publishers are in competition, the free weekly newspapers are divided into a greater number of titles; and advertising rates (normalized by readership) are lower. The converse is true when the two types of newspaper are jointly owned.

Table 4: Simulated profits at discretized values of strategy variables

	N				
a	2	3	4	5	6
0.1	-0.00250 -0.00125 (-0.00375)	-0.0183 -0.0172 (-0.0356)	-0.0262 -0.0378 (-0.0641)	-0.0310 -0.0602 (-0.0912)	-0.0342 -0.0835 (-0.118)
0.2	0.0400 0.0200 (0.0600)	0.0100 0.0144 (0.0244)	-0.00500 -0.00125 (-0.00625)	-0.0140 -0.0208 (-0.0348)	-0.0200 -0.0422 (-0.0622)
0.3	0.0775 0.0388 (0.116)	0.0350 0.0450 (0.0800)	0.0138 0.0347 (0.0484)	0.00100 0.0182 (0.0192)	-0.00750 -0.00125 (-0.00875)
0.4	0.110 0.0550 (0.165)	0.0567 0.0744 (0.131)	0.0300 0.0700 (0.100)	0.0140 0.0568 (0.0708)	0.00333 0.0394 (0.0428)
0.5	0.138 0.0688 (0.206)	0.0750 0.103 (0.178)	0.0437 0.105 (0.148)	0.0250 0.0950 (0.120)	0.0125 0.0799 (0.0924)
0.6	0.160 0.0800 (0.240)	0.0900 0.130 (0.220)	0.0550 0.139 (0.194)	0.0340 0.133 (0.167)	0.0200 0.120 (0.140)
0.7	0.177 0.0887 (0.266)	0.102 0.144 (0.246)	0.0638 0.166 (0.229)	0.0410 0.166 (0.207)	0.0258 0.157 (0.183)
0.8	0.190 0.0950 (0.285)	0.110 0.128 (0.238)	0.0700 0.175 (0.245)	0.0460 0.188 (0.234)	0.0300 0.186 (0.216)
0.9	0.198 0.0988 (0.296)	0.115 0.100 (0.215)	0.0737 0.108 (0.182)	0.0490 0.123 (0.172)	0.0325 0.144 (0.176)

4 Conclusion

In this paper we investigate competition in the newspaper industry in New Zealand. Our main empirical findings are that: advertising rates are proportional to readership; area of distribution is another strategic variable; and that the number of free weeklies in a city depends on whether they share a publisher with the local paid daily. Our model produces market outcomes under different ownership structures that are consistent with our empirical observations.

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A Constructing comparable advertising rates

Advertising rate cards differ in format and specification offerings across titles, and we take the following measures to arrive at rates for each title that are comparable across titles.

1. When comparing display advertising rates between broadsheet and tabloid newspapers, we take the equivalent area. For example, we compare the full-page tabloid display advertising rate to the half-page broadsheet rate. (All free weekly newspapers are tabloid sized. All NZME paid daily newspapers are tabloid sized, while all Fairfax paid daily newspapers are broadsheet sized.)

2. We use the direct advertising rate, as opposed to the agent (commission-bearing) advertising rates, since the former is more widely available, and the use of agents is uncommon for free suburban newspapers.

3. For the minority of titles whose advertising rates are expressed in terms of column-centimeters, as opposed to page area (e.g., full page, half page, etc.), we multiply the column-centimeter rate by the equivalent number of columns and centimeters. For example, a full tabloid page is equivalent to 7 columns $\times$ 37cm = 259 column-centimeters.

4. For the minority of titles whose rates for display advertising do not include color, we add in the color processing rate. (Among the Fairfax free weekly suburban newspapers that we have access online, almost all pages are full-color, including both the content and display advertising.)

5. We take the "regular" rate whenever both a "regular" and "casual" rate are listed. We take the "run of paper" rate whenever that and other "premier" rates (e.g. guaranteed front pages, or first half position) or section-specific rates are listed.

6. We ignore all forms of bulk discounts, such as "multi-paper buys", "annual spend discounts", and volume discounts in terms of total column-centimeters purchased.

B Additional graphs

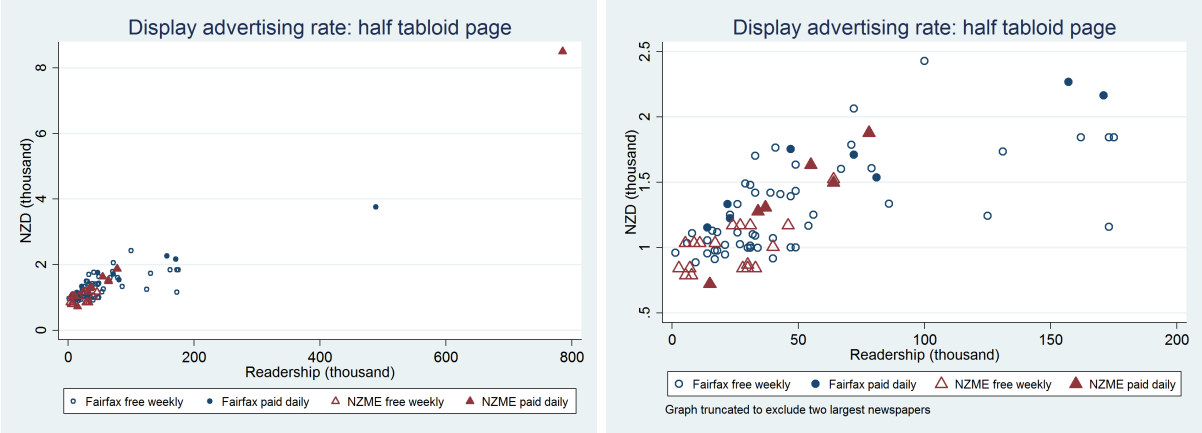

Figure 3: Display advertising rate for half tabloid page vs. readership

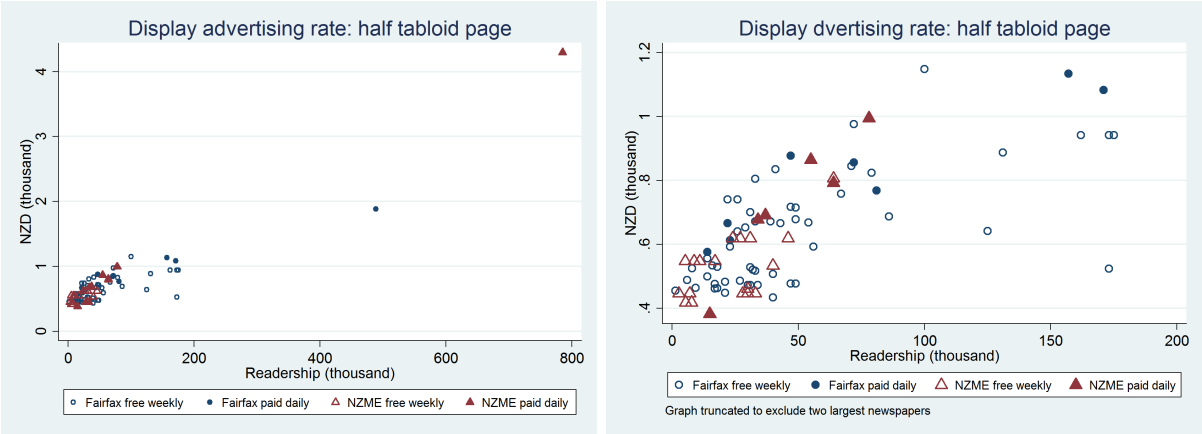

Figure 4: Display advertising rate for quarter tabloid page vs. readership

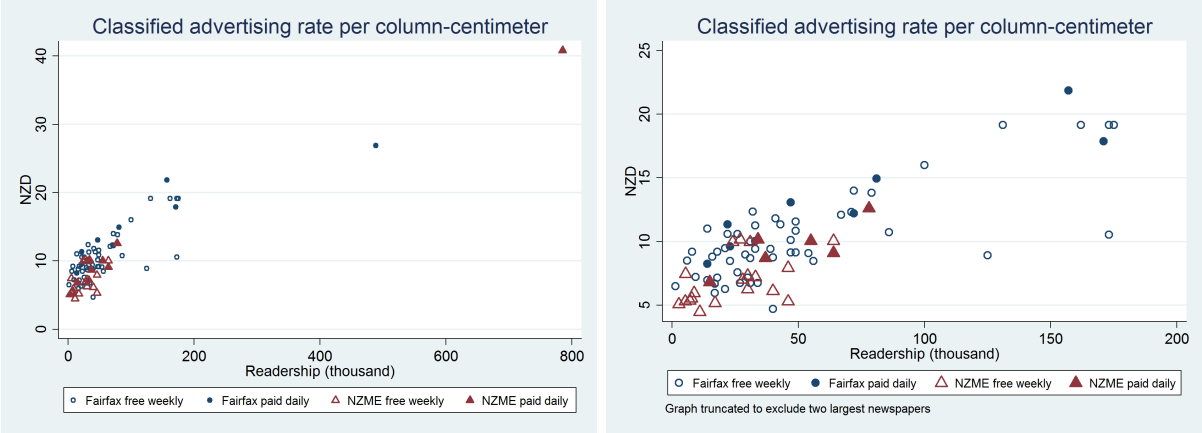

Figure 5: Classified advertising rate per column-centimeter vs. readership

C Additional regression results

Table 5: OLS regression result with half tabloid page display advertising rate as dependent variable

	(1)	(2)	(3)	(4)	(5)
Readership	0.00535***	0.00584***	0.00540***	0.00566***	0.00597***
	(0.000769)	(0.000772)	(0.000813)	(0.000771)	(0.000775)
Overlap rival paid daily		-0.0599			
		(0.0816)			
Overlap own paid daily		0.115			
		(0.0865)			
Overlap rival NZME paid daily			-0.0969		
			(0.0764)		
Overlap rival Fairfax paid daily			-0.230*		
			(0.0951)		
Overlap rival Allied Press paid daily			-0.0785		
			(0.112)		
Overlap own NZME paid daily				0.0581	
				(0.0914)	
Overlap own Fairfax paid daily				0.187**	
				(0.0667)	
Overlap rival NZME/Fairfax free weekly					-0.00319
					(0.0763)
Overlap Star Media free weekly					-0.554**
					(0.189)
Overlap Allied Press free weekly					-0.0288
					(0.109)
constant	0.985***	0.920***	1.044***	0.874***	0.977***
	(0.0450)	(0.100)	(0.0507)	(0.0657)	(0.0487)
R^2	0.409	0.460	0.461	0.474	0.476
R^2 adjusted	0.400	0.436	0.429	0.450	0.445
N	72	72	72	72	72

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: OLS regression result with quarter tabloid page display advertising rate as dependent variable

	(1)	(2)	(3)	(4)	(5)
Readership	0.00258***	0.00268***	0.00250***	0.00269***	0.00292***
	(0.000361)	(0.000376)	(0.000389)	(0.000383)	(0.000350)
Overlap rival paid daily		-0.0400			
		(0.0413)			
Overlap own paid daily		0.00351			
		(0.0444)			
Overlap rival NZME paid daily			-0.0155		
			(0.0365)		
Overlap rival Fairfax paid daily			-0.0784		
			(0.0455)		
Overlap rival Allied Press paid daily			-0.0602		
			(0.0537)		
Overlap own NZME paid daily				0.0306	
				(0.0454)	
Overlap own Fairfax paid daily				0.0345	
				(0.0333)	
Overlap rival NZME/Fairfax free weekly					0.000933
					(0.0344)
Overlap Star Media free weekly					-0.315***
					(0.0850)
Overlap Allied Press free weekly					-0.0484
					(0.0493)
constant	0.496***	0.509***	0.519***	0.470***	0.494***
	(0.0213)	(0.0523)	(0.0246)	(0.0332)	(0.0222)
R^2	0.426	0.443	0.456	0.435	0.530
R^2 adjusted	0.417	0.418	0.423	0.410	0.501
N	71	71	71	71	71

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: OLS regression result with classified advertising rate per column-centimeter as dependent variable

	(1)	(2)	(3)	(4)	(5)
Readership	0.0641***	0.0660***	0.0598***	0.0642***	0.0683***
	(0.00648)	(0.00677)	(0.00674)	(0.00667)	(0.00656)
Overlap rival paid daily		-0.553			
		(0.744)			
Overlap own paid daily		0.216			
		(0.798)			
Overlap rival NZME paid daily			0.216		
			(0.632)		
Overlap rival Fairfax paid daily			-2.147**		
			(0.788)		
Overlap rival Allied Press paid daily			-0.949		
			(0.930)		
Overlap own NZME paid daily				-0.507	
				(0.791)	
Overlap own Fairfax paid daily				0.968	
				(0.580)	
Overlap rival NZME/Fairfax free weekly					-0.424
					(0.644)
Overlap Star Media free weekly					-4.298**
					(1.592)
Overlap Allied Press free weekly					-0.815
					(0.922)
constant	6.526***	6.571***	7.009***	6.147***	6.621***
	(0.382)	(0.940)	(0.425)	(0.579)	(0.416)
R^2	0.587	0.597	0.636	0.617	0.631
R^2 adjusted	0.581	0.579	0.613	0.600	0.609
N	71	71	71	71	71

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$