Online Appendix for "Mergers in Two Sided Markets"

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March 14, 2009

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1 County Level Analysis

While it is the case that we do not have county level circulation data for a subset of Canadian dailies, as a practical matter there is no straightforward solution to this problem, since ABC simply does not collect or provide data for the 28 newspapers for which we only have aggregate circulation figures. In the county level analysis that follows, we will restrict our attention to the newspapers for which we do have county level data. For the most part, with one major exception, the 28 newspapers without county data are low circulating, small-town newspapers. The one exception is the *Globe and Mail*, at the time Canada's only national newspaper and the second largest newspaper in the country with an average daily circulation of over 300,000.¹ ABC does not collect county level circulation data for the *Globe and Mail*, but we were able to obtain circulation figures at the CMA level for this newspaper.² We analyze circulation figures specifically for the *Globe and Mail* in a supplementary note to this paper;³ our results indicate that the *Globe and Mail* was not affected by the newspaper mergers; in fact, its circulation remained quite stable across each province over the period of our study.

We argue that the remaining newspapers for which we do not have county level data will not affect our results significantly. The average weekday circulation of all daily newspapers during our study period is approximately 46,000 while the median is approximately 18,000. By contrast, 18 of the 27 omitted newspapers have a daily circulation of less than 10,000. Of the remainder, the largest are the *Kingston Whig-Standard* and the *Peterborough Examiner* with approximate daily circulations of 27,000 and 22,000 respectively. We will proceed with the county level analysis under the assumption that the omitted newspapers did not see major changes in their circulation at the county level, controlling for changes in aggregate circulation; in essence, we will take their county level circulation and market shares as given, and examine those newspapers on which we do have data. This method does allow us to say more on this subject than if we were to restrict ourselves only to the (complete) aggregate data.

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Year	Mean Group Weighted Herfindahl	Mean Own Weighted Herfindahl
1995	0.68	0.64
1996	0.69	0.63
1998	0.72	0.64
1999	0.72	0.62

Table 1: Change in Concentration of Canadian Newspapers from 1995 to 1999.

Finally, we discuss the results using Herfindahl indices generated from county level circulation data. As discussed above, we create weighted Herfindahl indices that, for each newspaper, weight the standard Herfindahl index in each county that the newspaper circulates in, by its circulation in that county, thereby assigning greater importance to counties where the paper has larger audiences. Therefore, as with a regular Herfindahl index, this measure ranges between 0 and 1, and the higher it is, the less the competitive nature of a firm's market. We use these measures to examine whether newspapers that faced a lower level of competition from rival publishers tended to see greater changes in their advertising or circulation prices. We distinguish between two types of the weighted Herfindahl index: Own Weighted Herfindahl (OWH), which calculates market shares based on the circulation of individual newspapers, and Group Weighted Herfindahl (GWH), which treats the publishing group as the unit of analysis in each county, though still weighs the Herfindahl by each individual paper's circulation. That is, for newspaper i,

$$\underbrace{OWH_i}_{\text{Own Weighted Herfindahl}} = \frac{\sum\limits_k \left[circ_{ik} * \sum\limits_j s_{jk}^2 \right]}{\sum\limits_k circ_{ik}}$$

where $circ_{ik}$ is *i*'s circulation in county *k* and s_{jk} is the market share of newspaper *j* in county *k*. Similarly, for newspaper *i*,

$$\underbrace{GWH_i}_{\text{Group Weighted Herfindahl}} = \frac{\sum\limits_k \left[circ_{ik} * \sum\limits_g s_{gk}^2 \right]}{\sum\limits_k circ_{ik}}$$

where s_{qk} is the market share of group g in county k.

As can be seen from Table 2, there is significant variation across newspapers in this index. The values of OWH and GWH range from 0.33 to 1. Table 1 shows that the average Group Weighted Herfindahl increased from 0.68 to 0.72 from 1995 to 1999. However, this increase in GWH was solely due to merger activity since OWH did not change over this period. This is due to the fact that individual papers did not experience significant changes in their market shares during this period.

We estimate different versions of the specification outlined in equation 1, which regresses log ad rate per reader of newspaper i in year t on the Herfindahl for this newspaper.

$$\underbrace{r_{it}}_{\text{Log Ad Rate Per Reader}} = \beta_h \underbrace{H_{it}}_{\text{Herfindahl}} + \underbrace{\alpha_i}_{\text{Newspaper Effect}} + \underbrace{\gamma_i t}_{\text{Newspaper Trend}} + \underbrace{\delta_t}_{\text{Year Effect}} + \epsilon_{it}$$
(1)

We add newspaper fixed effects (α_i) to control for newspaper characteristics, such as wealthier readers for *Le Devoir* than the *Journal de Montreal*, which may affect ad rates. We also introduce year effects (δ_t) to account for changes in the newspaper industry over time. Finally, we add newspaper specific time trends (γ_i) to the model to control for trends in newspaper ad rates, such as decreases in the Montreal Gazette's ad

Variable	Ι	II	III
Group Weighted Herfindahl [†]	0.434	-0.067	-0.066
	(0.137)	(0.104)	(0.123)
1996		0.088	0.038
		(0.015)	(0.010)
1998		0.193	0.042
		(0.016)	(0.010)
1999		0.201	
		(0.016)	
Newspaper Fixed Effects	Х	Х	Х
Newspaper Specific Trend			Х
Observations	292	292	292
R Squared	0.04	0.52	0.83
Estimated Parameters	1	4	76
Number of Newspapers	73	73	73

Table 2: Did More Concentrated Newspapers Raise Ad Rates? (Dependent Variable: Log Ad Rate Per 10000 readers)

[†]: Group Weighted Herfindahl is defined as the Herfindahl for a newspaper taking into account other newspapers owned by the same firm.

rates over time. Note, however, that the direction of causality cannot be inferred from our results, since the Herfindahl index and the ad rate per reader are jointly determined.

Table 2 presents estimates of the effect of increases in concentration (as measured by the Herfindahl) on advertising rates. In all specifications, we include newspaper fixed effects. Surprisingly, it seems that concentration increases advertising rates since the effect of Herfindahl on ad rates are significantly positive. However, when we control for year we find that the estimated effect of concentration on rates falls dramatically, indicating that newspaper rates are increasing over time for other reasons than changes in competition. Moreover, when we add newspaper specific time trends into the model, we find that concentration has no significant effect on ad rates. In fact, in specification III in Table 2, the 95% confidence interval on the effect of an increase in the group Herfindahl by 0.1 (well below the mean increase in group Herfindahl over the time period) would be between a 3.0% decrease and a 1.7% increase in ad rates. Thus, even for the most pessimistic estimate we would only expect prices to rise by less than 2%.

In a similar vein, we also examine if cover prices increased at newspapers in markets which became more concentrated. We use the same specification for ad rates, detailed in equation (1), replacing the dependent variable with the circulation price. Table 3 presents results of this regression. There is no evidence that concentration would increase cover prices since the coefficient on the Herfindahl is not statistically different from zero in any specification. Moreover, these estimated coefficients are also economically small, since an increase in the Group Weighted Herfindahl by 0.1 would cause between a 4.5 cent increase and a 3.9 cent decrease in the cover price if we take the 95% confidence interval from column III. Thus we cannot find evidence that increased concentration harmed newspaper readers.

These results are consistent with the model that we presented, for either the case where the switching consumer yields a profit of about zero to the firm or the case where readership of newspaper A and B does not overlap before the merger, which will induce no change in cover price and hence no change in the advertising rate. Moreover, we find that ad prices and consumer prices move in the same direction (in this case no change), which is a testable implication of the model.

Variable	Ι	II	III
Group Weighted Herfindahl [†]	-0.158	0.139	0.028
	(0.179)	(0.181)	(0.215)
1996		0.013	0.035
		(0.027)	(0.018)
1998		-0.104	-0.039
		(0.028)	(0.018)
1999		-0.085	
		(0.028)	
Newspaper Fixed Effects	Х	Х	Х
Newspaper Specific Trend			Х
Observations	289	289	289
R Squared	0.00	0.12	0.68
Estimated Parameters	1	4	75
Number of Newspapers	73	73	73

 Table 3: Did More Concentrated Newspapers Raise Cover Price? (Dependent Variable: Newspaper Cover Price)

[†]: Group Weighted Herfindahl is defined as the Herfindahl for a newspaper taking into account other newspapers owned by the same firm.

We also attempted to gauge the fraction of the population that was impacted by the ownership changes. From 1995 to 1999, 229 out of the 256 counties in our dataset experienced an ownership change for at least one of the newspapers circulating in the county. The total population of these counties was approximately 97% of the national population. However, only 58% of readers were impacted by the mergers by having their newspaper acquire new ownership. This is due to the fact that the acquired newspapers were, on average, smaller (average circulation of approximately 35,000) than those that were not acquired (average circulation of approximately 35,000). This is driven in large part by the fact that Canada's 3 largest newspapers—the *Globe and Mail, The Toronto Star*, and *Le Journal de Montreal*—did not change ownership over this period.

2 Diff and Diff

Table 4 compares characteristics of newspapers that changed hands over the four year period of consolidation 1995-1999, to those that did not. Here, the newspapers with changed ownership are considered to be in the treatment group.

It appears to be the case that neither circulation nor advertising prices at acquired newspapers experienced changes that were significantly different from those that did not change ownership. In general, average circulation prices rose slightly and average advertising rates fell slightly for both groups of newspapers. The fall in advertising prices is related to slight declines in circulation for both groups of newspapers over this period. Upon examining advertising prices per 10,000 readers (i.e. normalizing by circulation), it appears that advertising rates per reader decreased for newspapers with new ownership, and this change is significantly different from the change for unacquired newspapers, whose per reader advertising prices rose slightly over the same period. We also examined whether the two groups of newspapers had different percentage changes in circulation by looking at the difference in the logs of daily circulation, but there was no significant difference. The fact that there is no significant difference in either circulation or prices between merged and unmerged newspapers suggests that quality of the newspapers is not likely to have changed

	Unc	hanged	Ch	Changed		Diff-in-Diff	
	Owr	nership	Owr	nership			
Change in Variable	Mean	Std Dev	Mean	Std Dev	Mean	Std Err	
Circ. Price	0.13	0.09	0.11	0.10	-0.02	0.02	
Weekday Circ.	-5952	8525	-2932	4075	3020	1736	
Ad rate	-0.13	0.94	-0.43	0.67	-0.30	0.20	
Av Pages	0.50	7.07	-0.57	5.41	-1.07	1.52	
Ad rate per 10K	0.08	0.38	-0.12	0.30	-0.19	0.08	
Log Weekday Circ.	-0.10	0.06	-0.10	0.09	0.00	0.02	
N	26		75				

Table 4: Difference in Differences estimates for newspapers with changed ownership, 1995 to 1999

	Unchanged		Cha	Changed		Diff-in-Diff	
	Own	nership	Own	nership			
Change in Variable	Mean	Std Dev	Mean	Std Dev	Mean	Std Err	
Circ. Price	0.17	0.12	0.14	0.11	-0.03	0.03	
Weekday Circ.	-3257	13354	-5989	13355	-2732	2907	
Ad rate	0.26	1.44	-0.10	0.67	-0.36	0.27	
Av Pages	-2.13	12.71	0.48	5.97	2.61	2.43	
Ad rate per 10K	0.13	0.49	0.08	0.56	-0.05	0.11	
Log Weekday Circ.	-0.10	0.13	-0.19	0.29	-0.09	0.04	
N	30		71				

Table 5: Difference in Differences estimates for newspapers with changed ownership, 1995 to 2002

either.

In Table 5, we extend the time period of the study by looking at differences between newspapers with changed and unchanged ownership over the period 1995 to 2002. This allows us to examine whether the ownership changes had a delayed effect; it also allows us to examine the effect of the Canwest takeovers of 2000. The results of Table 4 continue to hold; it is not the case that newly acquired newspapers had significantly different changes in either of the two prices as compared to newspapers with unchanged ownership.⁴ However the results do indicate that the newspapers with new ownership had significantly greater percentage declines in circulation compared with newspapers that retained their ownership. It is surprising, though, that this change appears a few years following the takeovers, rather than immediately following them.

In Tables 6 and 7, we examine whether newspapers that were part of the two dominant chains in 1999 and 2002, had significantly different price changes (from their 1995 levels) than the remaining papers. The two dominant chains were Hollinger and Quebecor in 1999 (controlling 67% of the daily newspaper market) and Canwest and Quebecor in 2002 (with 53% of the market).

Once again, there are almost no significant differences in the changes for the two groups. The one variable that is significant (or marginally significant) is the per reader advertising price. However even in this case it is not clear what effect the mergers had; the Hollinger and Quebecor newspapers' per reader advertising prices experienced a greater price decline than the remaining newspapers in 1999; but the Canwest and Quebecor papers of 2002 had somewhat (though marginally significant) higher price increases than the other papers. We also examined percent changes in the variables of interest, rather than simply looking at

	Others		Hol	Hollinger/		in-Diff
			Que	ebecor		
Change in Variable	Mean	Std Dev	Mean	Std Dev	Mean	Std Err
Circ. Price	0.13	0.10	0.11	0.09	-0.03	0.02
Weekday Circ.	-5118	7949	-3141	4396	1977	1564
Ad rate	-0.27	0.92	-0.39	0.69	-0.12	0.27
Av Pages	-1.65	7.10	0.25	5.24	1.90	2.43
Ad rate per 10K	0.05	0.37	-0.12	0.31	-0.17	0.11
Log Weekday Circ.	-0.10	0.06	-0.10	0.08	0.00	0.04
N	29		72			

Table 6: Difference in Differences estimates for Hollinger and Quebecor, 1995 to 1999

	Others		Car	Canwest/		Diff-in-Diff	
			Que	ebecor			
Change in Variable	Mean	Std Dev	Mean	Std Dev	Mean	Std Err	
Circ. Price	0.15	0.10	0.14	0.13	-0.01	0.02	
Weekday Circ.	-3370	10338	-7933	16716	-4564	2956	
Ad rate	-0.03	1.03	0.07	0.88	0.10	0.19	
Av Pages	-1.10	8.86	1.18	7.38	2.28	1.63	
Ad rate per 10K	0.01	0.44	0.21	0.65	0.20	0.12	
Log Weekday Circ.	-0.14	0.16	-0.19	0.35	-0.05	0.06	
N	61		40				

Table 7: Difference in Differences estimates for Canwest and Quebecor, 1995 to 2002

the change in levels. We do not present those results here, other than the percent changes in circulation, but the results do not point to significant differences between any of the pairs of newspaper groups.

3 Matching Estimator

Table 8 shows the first stage results for the matching estimator.

	Ownership Change		Hollinger-	-Quebecor
	1995-1999	1995-2002	1995-1999	1995-2002
Circulation	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Pages	-0.02	0.02	0.02	0.02
	(0.01)	(0.02)	(0.01)	0.01
Cover Price	-4.88	-3.24	4.70	3.89
	(1.12)	(1.61)	(1.49)	(1.04)
Ad Rate	-0.01	0.32	-2.62	-0.75
	(0.07)	(0.25)	(0.57)	(0.23)
Ad Rate per 10 000	-0.69	-0.96	0.24	0.64
	(0.25)	(0.34)	(0.29)	(0.20)
British Columbia	0.84		7.33	0.09
	(0.48)		(0.93)	(0.49)
Manitoba	-0.54	-0.61	7.82	0.63
	(0.59)	(0.87)	(1.01)	(0.67)
New Brunswick	-1.00	-0.93		
	(0.60)	(0.88)		
Newfoundland	0.53	0.28		
	(0.58)	(0.94)		
Nova Scotia	0.62	1.09	6.35	0.06
	(0.38)	(0.78)	(0.91)	(0.44)
Quebec	0.47	-1.59	7.74	-0.53
	(0.44)	(0.70)	(0.97)	(0.52)
Yukon	1.53	1.48		
	(1.39)	(1.67)		
P.E.I.			7.24	
			(0.00)	
Saskatchewan			8.09	
			(0.99)	
Constant	4.38	3.67	-8.80	-3.38
	(0.96)	(1.35)	(1.17)	(0.89)
Observations	181	149	172	157
Pseudo-R2	0.20	0.40	0.37	0.16
Log Likelihood	-79.43	-28.08	-54.66	-75.72

Table 8: First Stage Propensity Score Estimates: Probits