

Online Appendix for Revisiting the Relationship between Competition and Price Discrimination

Ambarish Chandra^{a,b}

Mara Lederman^a

June 23, 2017

^a: University of Toronto, Rotman School of Management

^b: University of Toronto at Scarborough, Department of Management

1 Appendix A: Hypothesis Tests

In Table 1 we present a single regression that pools together the multiple regressions presented in Table 5. By doing so, we can test whether the relevant coefficients are significantly different from each other. Note that the coefficients in the upper panel are identical to those in Table 5. The lower panel presents p-values from tests of the hypothesis that coefficients in the middle of the distribution are equal to those at the tails. All hypotheses are rejected, at the 5% level for the 75th percentile, and at the 1% level for the others.

Table 1: Regression of Fare Ratios

	Log(Fare)
Pctile=1 × Num. Direct Rivals	-0.025*** (0.009)
Pctile=25 × Num. Direct Rivals	-0.080*** (0.013)
Pctile=50 × Num. Direct Rivals	-0.073*** (0.014)
Pctile=75 × Num. Direct Rivals	-0.069*** (0.021)
Pctile=99 × Num. Direct Rivals	-0.022 (0.015)
Constant	5.088*** (0.011)
R ²	0.910
Obs	55320
H_0 : P25=P1	0.000
H_0 : P25=P99	0.001
H_0 : P50=P1	0.001
H_0 : P50=P99	0.009
H_0 : P75=P1	0.039
H_0 : P75=P99	0.036

Top panel: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Route, month, year FEs included. Standard errors, clustered by route, in parentheses. Bottom panel: Each hypothesis displays the associated p-value.

2 Appendix B: Robustness to Dropping Certain Route-Months

In Tables 2 and 3 we re-estimate the specifications in Tables 4 and 5, excluding route-months in which the share of Y-code passengers seems implausibly high. Specifically, we exclude any route-months in which the fraction of Y-code passengers exceeds 17%, which is the maximum share of passengers accounted for by Y fares in any route-month prior to 2008, which was when we first observed these irregularities in the data. This drops a total of 3755 route-months from our sample. The results in Tables 2 and 3 are extremely similar to those in Tables 4 and 5, indicating that, while the problematic observations may introduce some measurement error into our data, they do not meaningfully affect our results.

Table 2: Regression of Cabin Level Average Fares on Competition Measures

	Coach			Business		
	(1)	(2)	(3)	(4)	(5)	(6)
Num. Direct Rivals	-0.058*** (0.013)			-0.006 (0.012)		
Duopoly		-0.075*** (0.016)			-0.035* (0.020)	
Competitive		-0.134*** (0.025)			-0.016 (0.026)	
-Ln(HHI)			-0.133*** (0.023)			-0.069*** (0.024)
Constant	5.100*** (0.016)	5.109*** (0.015)	5.105*** (0.015)	6.183*** (0.026)	6.195*** (0.027)	6.198*** (0.025)
R ²	0.897	0.898	0.899	0.945	0.945	0.946
Obs	7308	7308	7308	2574	2574	2574

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include route, month and year FEs. Standard errors, clustered by route, in parentheses.

Table 3: Regression of Coach Percentiles

	(1)	(2)	(3)	(4)	(5)
	1	25	50	75	99
Num. Direct Rivals	-0.035*** (0.008)	-0.082*** (0.012)	-0.077*** (0.013)	-0.069*** (0.017)	-0.010 (0.014)
Constant	4.321*** (0.011)	4.720*** (0.014)	4.904*** (0.025)	5.172*** (0.033)	5.932*** (0.019)
R ²	0.838	0.898	0.851	0.768	0.856
Obs	7308	7308	7308	7308	7308

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include route, month and year FEs. Standard errors, clustered by route, in parentheses.

3 Appendix C: First-stage Regressions—with and without Route FEs

Table 4 presents two kinds of first-stage regressions for use in the Instrumental Variables estimation. The first column simply replicates the results of Table 6. Recall that this was a logit regression of whether each carrier served a certain route in a given month. The right hand side interacts the identity of each of the four carriers with the exogenous variables that we believe to be good predictors of airlines' expansion strategies.

The second column of Table 4 adds route fixed-effects to the specification in the first column. Doing so improves the fit of the logit regression considerably, and also improves the prediction of the number of carriers in each route-month as discussed in the text. Note that the magnitudes of the coefficients change substantially with the addition of route fixed-effects—this is to be expected as each coefficient now represents the deviation from the (unreported) route fixed-effect for the corresponding airline with respect to each exogenous characteristic. Nevertheless, the pattern of coefficients is similar to that of Column 1. For example, within a given route, all airlines are more likely to provide service as endpoint populations grow.

Table 4: Predicted Service by Carrier: Pooled Logit Regression

	(1)		(2)	
	Pooled		Pooled with Route FEs	
served_route				
Westjet \times Origin Pop.	0.915***	(0.016)	7.549***	(0.511)
Porter \times Origin Pop.	0.018	(0.062)	5.699***	(0.520)
Canjet \times Origin Pop.	0.901***	(0.051)	8.236***	(0.551)
Jetsgo \times Origin Pop.	2.652***	(0.152)	9.242***	(0.556)
Westjet \times Dest. Pop.	0.908***	(0.016)	8.652***	(0.540)
Porter \times Dest. Pop.	0.017	(0.062)	6.719***	(0.545)
Canjet \times Dest. Pop.	0.924***	(0.051)	9.302***	(0.578)
Jetsgo \times Dest. Pop.	2.650***	(0.152)	10.354***	(0.584)
Westjet \times Route Dist.	3.519***	(0.143)	6.680***	(1.951)
Porter \times Route Dist.	-39.826***	(4.882)	38.836***	(13.052)
Canjet \times Route Dist.	4.279***	(0.747)	-49.172***	(4.620)
Jetsgo \times Route Dist.	3.239***	(0.847)	0.000	(.)
Westjet \times Min. Distance to HQ	-5.483***	(0.145)	-8.527***	(1.316)
Porter \times Min. Distance to HQ	-22.411***	(1.467)	-13.728***	(2.422)
Canjet \times Min. Distance to HQ	-32.568***	(1.830)	-45.974***	(9.527)
Jetsgo \times Min. Distance to HQ	-1.591	(1.090)	-7.164***	(1.515)
Westjet \times Age	0.013	(0.009)	0.034**	(0.014)
Porter \times Age	0.061**	(0.030)	0.097**	(0.044)
Canjet \times Age	0.006	(0.029)	-0.045	(0.048)
Jetsgo \times Age	0.053	(0.035)	0.179***	(0.056)
Westjet \times Age \times Min. Distance to HQ	0.001***	(0.000)	0.003***	(0.001)
Porter \times Age \times Min. Distance to HQ	0.025**	(0.011)	0.149***	(0.025)
Canjet \times Age \times Min. Distance to HQ	0.037***	(0.009)	0.113***	(0.024)
Jetsgo \times Age \times Min. Distance to HQ	0.114***	(0.021)	0.238***	(0.034)
Constant	-3.074***	(0.647)	-13.393***	(1.667)
Pseudo R ²	0.570		0.759	
Obs	57750		27775	

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Regressions include polynomials in distance measures, and route, month and year FEs. Standard errors in parentheses.

4 Appendix D: Additional Details on Market Structure

Table 5: Routes served, by Carrier, and Competition on AC routes

Year	Routes served by:				AC routes:			
	Westjet	CanJet	Jetsgo	Porter	Monopoly	Duopoly	Competitive	Total
2002	44	18	8	0	32	46	12	90
2003	62	18	23	0	20	46	26	92
2004	70	18	31	0	18	41	34	93
2005	66	20	27	0	20	51	26	97
2006	66	17	0	0	29	61	11	101
2007	74	0	0	10	30	68	8	106
2008	82	0	0	10	25	72	10	107
2009	88	0	0	12	20	76	12	108
2010	82	0	0	18	24	68	16	108
2011	80	0	0	18	26	70	14	110

Note: The sample period is 2002–2011 (inclusive). WestJet was in the industry throughout the sample period. Jetsgo and CanJet entered in June and July of 2002, respectively. They exited in April 2005 and September 2006, respectively. Porter entered the industry in March 2007 and remained until the end of the sample. Values in the first 4 columns refer to the maximum number of non-stop routes served by each airline in that year.

5 Appendix E: Robustness to changing cutoffs

In our original data we dropped itineraries with fares below \$50 to avoid including free or deeply discounted tickets that may arise from frequent-flyer rewards or employee discounts. Our results are not sensitive to small changes to this cutoff in either direction. As an example, Tables 6 and 7 below repeat the results of Tables 4 and 5 using a \$25 cutoff. The results are very similar.

Table 6: Regression of Cabin Level Average Fares on Competition Measures (\$25 cutoff for fares)

	Coach			Business		
	(1)	(2)	(3)	(4)	(5)	(6)
Num. Direct Rivals	-0.060*** (0.014)			-0.009 (0.013)		
Duopoly		-0.071*** (0.016)			-0.038* (0.020)	
Competitive		-0.138*** (0.029)			-0.023 (0.027)	
-Ln(HHI)			-0.118*** (0.025)			-0.062** (0.025)
Constant	5.086*** (0.016)	5.091*** (0.015)	5.084*** (0.015)	6.177*** (0.024)	6.188*** (0.025)	6.189*** (0.023)
R ²	0.899	0.900	0.899	0.947	0.947	0.947
Obs	11064	11064	11064	3144	3144	3144

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include route, month and year FEs. Standard errors, clustered by route, in parentheses.

Table 7: Regression of Coach Percentiles (\$25 cutoff for fares)

	(1)	(2)	(3)	(4)	(5)
	1	25	50	75	99
Num. Direct Rivals	-0.040*** (0.010)	-0.083*** (0.013)	-0.075*** (0.014)	-0.070*** (0.021)	-0.022 (0.015)
Constant	4.213*** (0.013)	4.718*** (0.015)	4.904*** (0.026)	5.208*** (0.030)	5.817*** (0.020)
R ²	0.806	0.880	0.850	0.771	0.831
Obs	11064	11064	11064	11064	11064

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include route, month and year FEs. Standard errors, clustered by route, in parentheses.

6 Appendix F: Air Canada fare types and fare codes

North American Fare Structure

	TANGO K, N, G, P, T, E	TANGO PLUS M, U, H, Q, V, W, S, L	LATITUDE Y, B	EXECUTIVE CLASS® LOWEST D, Z	EXECUTIVE CLASS® FLEXIBLE J, C
Changes	\$ 75 + difference in fare	\$ 50 Canada, \$ 75 Transborder + difference in fare	Difference in fare may apply	\$ 50 Canada, \$ 75 Transborder + difference in fare	Difference in fare may apply
Same Day Change Upon Check-in	\$ 150 \$ 75 on Rapidair routes	\$ 75	Complimentary	\$ 75	Complimentary
Same Day Airport Standby	n/a	Available only on Rapidair	Available	Available	Available
Refunds	Non-Refundable	Non-Refundable	Refundable	Non-Refundable	Refundable
Advance Seat Selection	\$15, \$17, \$22' (Optional)	Complimentary	Complimentary	Complimentary	Complimentary
Maple Leaf™ Lounge Access	\$ 45	\$ 35	\$ 30	Yes	Yes
Onboard Café	Prepay \$7 for \$9 value, at aircanada.com/agents .		Complimentary	Complimentary Executive Class meal	Complimentary Executive Class meal
Aeroplan® Accumulation	25 % Aeroplan Miles	100 % Air Canada Status Miles	100 % Air Canada Status Miles	150 % Air Canada Status Miles	150 % Air Canada Status Miles
Air Canada Top Tier Upgrade Certificates	n/a	As per the terms and condition on the certificates	As per the terms and condition on the certificates	n/a	n/a
Priority Service Check-in, Bags, Boarding	No	No	At airports in Canada, where available	Yes	Yes
On My Way™	\$ 25: up to 1,000 miles \$ 35: 1,000 + miles	\$ 25: up to 1,000 miles \$ 35: 1,000 + miles	\$ 25: up to 1,000 miles \$ 35: 1,000 + miles	\$ 25: up to 1,000 miles \$ 35: 1,000 + miles	\$ 25: up to 1,000 miles \$ 35: 1,000 + miles

Figure 1: Air Canada fare codes across Service Levels