Supplement to "Corporate social responsibility and consumer choice: Lessons from the milk boycott"

In Kyung Kim
Sogang University

Kyoo il Kim
Michigan State University

In these online appendices, we (i) estimate the milk demand using a larger sample; (ii) check for the pre-boycott sales and price trends of the boycotted products; (iii) measure the cost pass-through before and after the boycott for each producer; and (iv) present additional tables and figures.

Appendix A: Milk demand estimation with an extended sample

In the manuscript, we analyze the 14 best-selling brands of the three major producers whose combined revenue share reached 75 percent during the sample period. In this appendix, we examine whether our empirical findings are robust to sample selection. To do so, we increase the number of brands from 14 to 34 by adding the 20 best-selling brands of non-major firms to the sample. Table D2 in Appendix D shows that together, these 34 brands accounted for 97 percent of the white milk sales during the sample period. Since advertising information is not available for these 20 brands, we estimate milk demand without controlling for ad spending:

$$u_{ijrt} = \alpha_i p_{jrt} + \sum_{s=1}^{6} \beta_s \, 1[t \in s] \times Namyang_j + \xi_j + \xi_r + \xi_t + \Delta\xi_{jrt} + \varepsilon_{ijrt}. \tag{1}$$

We then calculate and report the average (IV and RC logit) marginal effects of each variable on the choice probability in the first two columns of Table A1. The marginal effects of the boycott, although smaller in magnitude compared to our main results in Table 10 in Appendix A.2 of the manuscript, indicate that the negative impact of the boycott on consumer utility persisted long after its outbreak. Moreover, through counterfactual analysis with the extended sample, we discovered that Namyang's revenue loss would have been over twice as large had the firm not implemented lower prices (a 6.9 percent decrease with the price reduction versus a 15.5 percent decrease without it). Overall, these results with the extended sample support our conclusion that the boycott effects were long-lasting and that price reduction served as an effective strategy to counteract the boycott movement.

Regarding the quantitative changes in the boycott effects when increasing the number of brands in the sample from 14 to 34,[1] it may arise because the newly added 20 brands are mostly local, niche, or private brands with low market shares (as shown in Table D2). Thus, they may not constitute a suitable control group for the two 'treated' Namyang brands. In other words, selecting a subset of brands similar in nature to the two boycotted brands as the control group would lead to both *quantitatively* and *qualitatively* robust empirical results.

[1] These changes do not appear to be attributable to the exclusion of advertising expenditures as a control variable in the utility model. Indeed, when we use only the 14 brands of the three major producers in estimating model (1), we obtain marginal effects (as reported in the last two columns of Table A1) that closely align with those presented in Table 10 in Appendix A.2 of the manuscript.

Table A1: Marginal effects with an extended sample

	34 brands		14 brands	
Variable	IV logit	RC logit	IV logit	RC logit
Mean utility				
Price	-0.0170	-0.0185	-0.0521	-0.0534
	(0.0009)	(0.0016)	(0.0017)	(0.0023)
Namyang×1[$t \in 1$]	-0.0030	-0.0029	-0.0092	-0.0075
	(0.0009)	(0.0009)	(0.0020)	(0.0016)
Namyang×1[$t \in 2$]	-0.0028	-0.0029	-0.0098	-0.0090
	(0.0010)	(0.0009)	(0.0020)	(0.0016)
Namyang×1[$t \in 3$]	-0.0015	-0.0019	-0.0079	-0.0081
	(0.0010)	(0.0010)	(0.0024)	(0.0017)
Namyang×1[$t \in 4$]	-0.0023	-0.0029	-0.0070	-0.0075
	(0.0011)	(0.0010)	(0.0023)	(0.0019)
Namyang×1[$t \in 5$]	-0.0037	-0.0041	-0.0100	-0.0100
	(0.0011)	(0.0010)	(0.0022)	(0.0017)
Namyang×1[$t \in 6$]	-0.0017	-0.0019	-0.0074	-0.0079
	(0.0012)	(0.0013)	(0.0024)	(0.0020)
Consumer heterogeneity				
ln(y)		0.0048		0.0155
		(0.0005)		(0.0010)
v		0.0036		0.0167
		(0.0008)		(0.0008)
Fixed effects				
Product	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes

Note: The table presents the average marginal effect (across all observations) of each variable on the choice probability. 34 brands (14 brands of the three major producers) are used in the first two columns (next two columns). Standard errors estimated using the delta method are in parentheses.

Appendix B: Pre-boycott sales and price trends

Here, we check for the pre-boycott sales and price trends of Namyang products with the following difference-in-differences model:

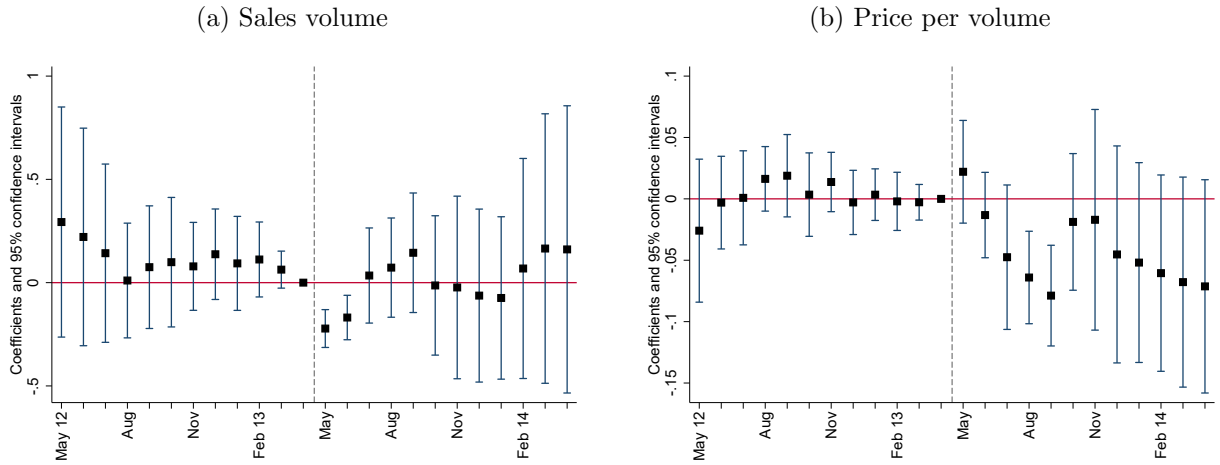
$$\ln y_{jrt} = \beta_0 + \sum_t \beta_t \; t \times Namyang_j + \xi_j + \xi_r + \xi_t + \varepsilon_{jrt}, \tag{2}$$

where we use the log sales volume and the log price as the dependent variable one by one. t is an indicator for each time except for April 2013, the last month of the pre-boycott period. The coefficient β_t captures the sales (or price) difference between Namyang and others at time t relative to the sales (or price) difference in April 2013. We conduct the analysis for a window of 12 months before and after the boycott outbreak.

We present point estimates of β_t along with the 95 percent confidence bands in Figure B1. There is no evidence that the sales and prices of the boycotted firm deviated from those of its non-boycotted rivals during the pre-boycott period. Based on these observations, we argue that changes in relative sales and prices of Namyang during the post-boycott period were caused by the boycott. The two panels of the figure also show that sales of Namyang decreased by 20.5 and 15.2

percent in May and June 2013, respectively, and then quickly recovered afterward thanks to the firm's price cut starting in July 2013.

Figure B1: Relative sales and price trends of Namyang



Note: The figure presents estimated β_t in the difference-in-differences model (2) and the 95 percent confidence bands. The log sales and the log price are used as the dependent variable in panel (a) and panel (b), respectively.

Appendix C: Cost pass-through before and after the boycott

For our counterfactual analysis in Section 5, we assume that the non-boycotted firms did not make any price adjustments to take advantage of the boycott over and above those in response to changes in other market factors. To see whether the data support this assumption, we consider the following specification:

$$\ln p_{jrt} = \alpha_p \ln rp_t + \beta_p \, T_t \times \ln rp_t + \psi_r + \psi_j + \varepsilon_{jrt}, \tag{3}$$

where subscripts j, r, and t represent product, region, and time (year-month), respectively. $\ln p$ and $\ln rp$ are the log price and the log raw milk price index, respectively, and T_t is an indicator for the post-boycott period. The model also includes region and product fixed effects, ψ_r and ψ_j.

In the model, the coefficient α_p measures the cost pass-through during the pre-boycott period, while β_p captures the change in the pass-through rate after the outbreak of the boycott. Given the spike in the raw milk price in late 2013 (as shown in the bottom left panel of Figure 2 in the manuscript and the relatively modest increase in the price of Namyang products (as shown in the top right panel of Figure 2), we anticipate that β_p would be negative for Namyang products. Regarding non-boycotted products, if the boycott did not impact their prices, then the coefficient β_p would be non-negative; non-boycotted firms would have increased their prices as much as they did prior to the boycott outbreak, or even more, considering the asymmetry of the cost pass-through (Peltzman, 2000; Tappata, 2009).

We estimate the cost pass-through model (3) separately for each of the three major milk producers as well as others as a whole.[2] Estimates reported in Table C1 are consistent with our conjectures; the cost pass-through of Namyang decreased after the outbreak of the boycott, whereas the pass-

[2] As in Appendix A, we use observations of the 34 top-selling products.

through rates of non-boycotted firms increased. This finding is consistent with our assumption of non-boycotted firms' irresponsiveness to the boycott.

Table C1: Cost pass-through before and after the boycott

Parameter	Seoul	Namyang	Maeil	Others
α_p	0.529***	0.507***	0.287***	0.543***
	(0.016)	(0.014)	(0.014)	(0.019)
β_p	0.005***	-0.002***	0.007***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Fixed effects				
Region	Yes	Yes	Yes	Yes
Product	Yes	Yes	Yes	Yes
R-squared	0.877	0.923	0.932	0.735
Observations	3,614	1,370	3,024	10,859

Note: The table presents the OLS estimation results of the cost pass-through model (3) where the log price is the dependent variable. Standard errors (clustered by market) are in parentheses. The notation *** indicates significance at 1% level, ** at 5% level, * at 10% level.

Appendix D: Additional tables and figures

Table D1: Number of households and sales record of white milk by region

Region	# of households		Sales volume		Sales revenue	
Kyunggi	3,831	(22.3%)	133,636	(25.0%)	285	(24.6%)
Seoul						
- South	1,796	(10.5%)	68,265	(12.8%)	150	(13.0%)
- North	1,709	(10.0%)	59,481	(11.1%)	128	(11.1%)
Busan	1,244	(7.3%)	41,243	(7.7%)	92	(8.0%)
Kyungnam	1,151	(6.7%)	40,245	(7.5%)	90	(7.8%)
Kyungbuk	1,005	(5.9%)	22,377	(4.2%)	49	(4.2%)
Incheon	919	(5.4%)	27,981	(5.2%)	60	(5.1%)
Taegu	868	(5.1%)	22,396	(4.2%)	48	(4.1%)
Chungnam	749	(4.4%)	16,111	(3.0%)	35	(3.0%)
Jeonnam	681	(4.0%)	15,718	(2.9%)	35	(3.0%)
Jeonbuk	660	(3.8%)	16,187	(3.0%)	35	(3.0%)
Chungbuk	559	(3.3%)	12,607	(2.4%)	27	(2.4%)
Kangwon	558	(3.3%)	13,910	(2.6%)	30	(2.6%)
Taejeon	533	(3.1%)	16,204	(3.0%)	34	(3.0%)
Gwangju	516	(3.0%)	17,172	(3.2%)	37	(3.2%)
Woolsan	374	(2.2%)	10,005	(1.9%)	22	(1.9%)

Note: The table presents the number of households in 2010 and the sales record of white milk in 2012, categorized by region. The number of households is in 1,000, while the sales volume is in 1,000 liters and sales revenue is in million US dollars. Source: 2010 Population Census and NielsenIQ.

Table D2: Product list

Product	Rev. share	Manufacturer
Seoul Milk	30.09	**Seoul Dairy Cooperative**
GT	16.40	**Namyang**
Maeil Milk	11.67	**Maeil Dairies**
Store Brand	6.34	Store Brand
Mokjang	5.83	**Seoul Dairy Cooperative**
Low Fat Milk	4.41	**Seoul Dairy Cooperative**
Busanmilk	3.84	Pusankyungnam Milk
Einstein	2.15	**Namyang**
Sowanamu	1.83	Dongwon
Good Morning Milk	1.74	Binggrae
Enfant	1.18	**Seoul Dairy Cooperative**
Fresh Milk	1.15	Lotte
Chammat Milk	1.08	Binggrae
Low Fat Milk	0.93	Lotte
365	0.83	**Seoul Dairy Cooperative**
Maeil Joeun	0.82	**Maeil Dairies**
Ppeoga Teunteun	0.80	Purmil
Sangha Mokjang	0.73	**Maeil Dairies**
Chukhyup Milk	0.61	Pusankyungnam Milk
Sohwaga Jaldoeneun	0.56	**Maeil Dairies**
Denmark	0.36	Dongwon
Zero Fat Milk	0.36	Lotte
Absolute W Milk	0.35	**Maeil Dairies**
Matitneun Milk	0.35	**Namyang**
Morning Fresh	0.34	Vilac
Denish The Healthy	0.32	Dongwon
Low Fat Milk	0.30	Pusankyungnam Milk
Fresh Plus	0.27	Vilac
Sinseonhago Matjoeun	0.26	Purmil
Low Fat Milk	0.23	Purmil
Choyuneeun Milk	0.20	Ildong Food'is
Jeongilpum	0.19	Pusankyungnam Milk
Milk Master	0.19	**Seoul Dairy Cooperative**
Daegwanryeong Gowon Milk	0.17	Samyang Food
Total	96.86	

Note: The table lists the 34 top-selling products between January 2011 and April 2014. The 14 brands in bold type are produced by the three major firms.

Table D3: Post-boycott sales and revenue gaps
in the first three and last nine months of the 12-month post-boycott period

	First three months				Last nine months			
	Sales volume		Sales revenue		Sales volume		Sales revenue	
Product	Gap	%	Gap	%	Gap	%	Gap	%
Panel A: Namyang brand								
GT	-4,300	-16.4	-12,650	-18.2	-3,083	-4.4	-19,787	-9.8
Einstein	-789	-36.1	-2,803	-34.2	24	0.6	-917	-5.3
Total	-5,089	-17.9	-15,453	-19.9	-3,059	-4.1	-20,705	-9.5
Panel B: Non-boycotted brand								
Seoul Milk	1,603	4.1	4,165	4.1	1,477	1.4	4,232	1.4
Maeil Milk	724	4.2	1,839	4.2	539	1.3	1,513	1.3
Mokjang	305	4.5	904	4.5	312	1.5	970	1.5
Low Fat Milk	226	4.0	612	4.0	198	1.1	579	1.1
365	78	4.3	198	4.3	83	1.0	204	1.1
Enfant	71	4.0	159	4.0	71	2.3	277	2.4
Maeil Joeun	60	5.3	216	5.3	31	1.3	89	1.3
Sangha Mokjang	25	4.4	77	4.4	65	3.0	330	3.0
Sohwaga Jaldoeneun	12	3.8	28	3.9	22	1.5	78	1.5
Milk Master	21	6.6	129	6.6	8	1.0	18	1.0
Absolute W Milk	16	5.3	58	5.4	10	2.5	41	2.6
Total	3,141	4.2	8,383	4.2	2,817	1.4	8,332	1.4

Note: The table presents the sales and revenue effects of the boycott for both boycotted and non-boycotted products in the first three and last nine months of the 12-month post-boycott period. Sales and revenue gaps are in 1,000 liters and million KRW, respectively.

Table D4: Sensitivity analysis: Boycott effects with Namyang's price and advertising adjustments

	100 draws of y_i and v_i		Pre-boycott price ratio			
			Apr 2013		Same month	
Product	Gap	%	Gap	%	Gap	%
			Panel A: Sales effects			
Namyang brand						
GT	-6,132	-6.5	-4,751	-5.1	-3,798	-4.1
Einstein	-883	-13.5	-723	-11.3	-1,191	-17.4
Non-boycotted brand						
Seoul Milk	3,294	2.3	2,321	1.6	2,156	1.5
Maeil Milk	1,335	2.2	981	1.6	946	1.6
Mokjang	705	2.6	479	1.7	432	1.6
Low Fat Milk	437	1.9	309	1.3	279	1.2
365	151	1.5	104	1.0	125	1.3
Enfant	177	4.3	109	2.6	104	2.5
Maeil Joeun	116	2.8	90	2.2	85	2.0
Sangha Mokjang	140	5.7	77	3.1	79	3.1
Sohwaga Jaldoeneun	56	2.7	37	1.8	32	1.6
Milk Master	18	1.6	16	1.4	12	1.0
Absolute W Milk	34	4.9	23	3.3	21	3.0
			Panel B: Revenue effects			
Namyang brand						
GT	-29,006	-10.9	-26,656	-10.1	-24,471	-9.3
Einstein	-4,197	-16.2	-3,587	-14.2	-5,031	-18.8
Non-boycotted brand						
Seoul Milk	9,006	2.2	6,270	1.5	5,824	1.4
Maeil Milk	3,563	2.2	2,597	1.6	2,484	1.5
Mokjang	2,147	2.5	1,452	1.7	1,308	1.5
Low Fat Milk	1,231	1.9	863	1.3	773	1.2
365	358	1.6	245	1.1	293	1.3
Enfant	673	4.3	409	2.6	391	2.5
Maeil Joeun	309	2.7	238	2.1	224	1.9
Sangha Mokjang	736	5.8	415	3.2	412	3.1
Sohwaga Jaldoeneun	185	2.7	123	1.8	106	1.5
Milk Master	42	1.6	36	1.4	26	1.0
Absolute W Milk	131	5.0	87	3.2	81	3.0

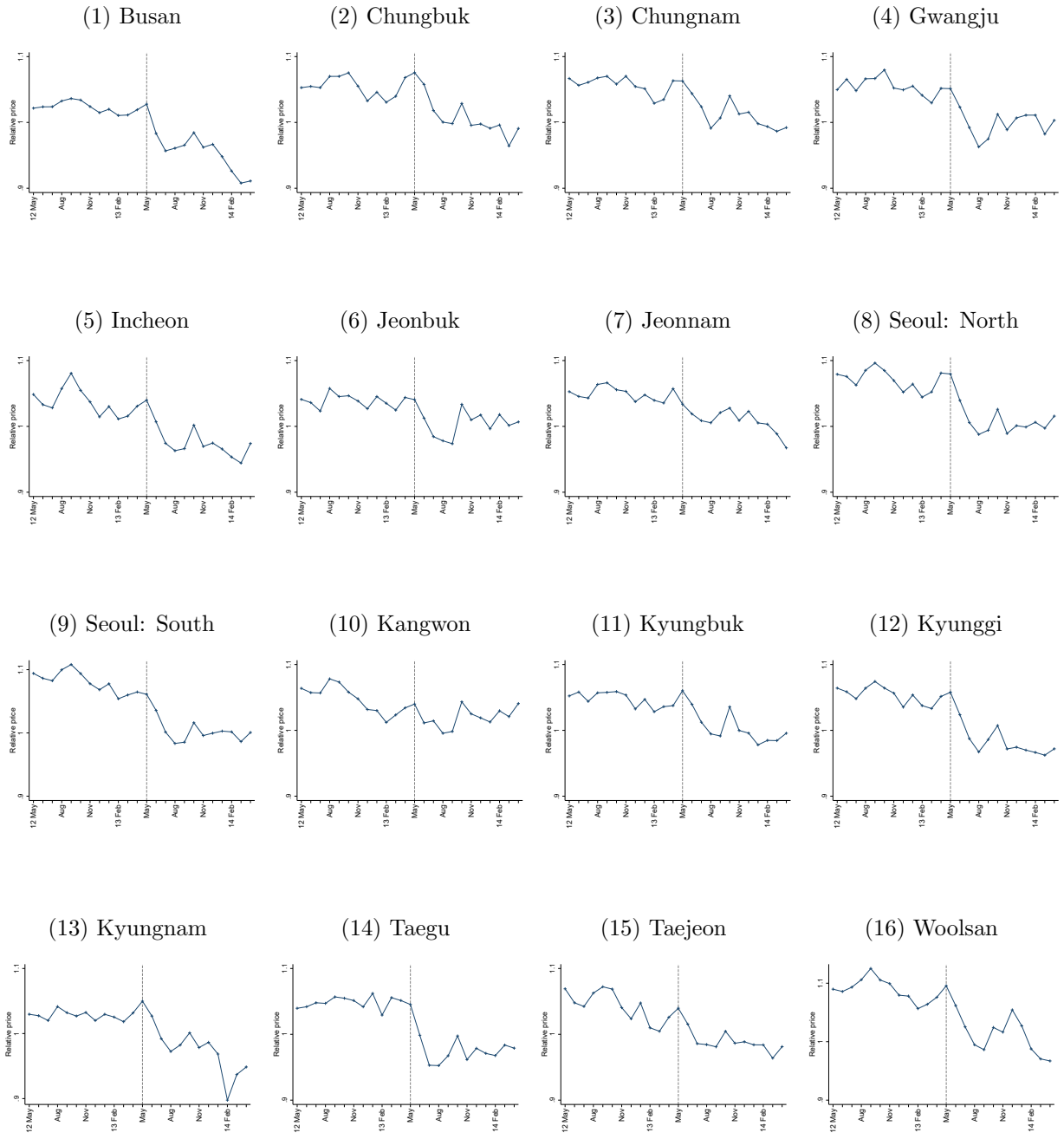
Note: The table reports gaps between actual and 'no-boycott' (counterfactual in the absence of the boycott) sales and revenues. The counterfactual sales and revenues are simulated with (i) 100 draws of y and v and (ii) counterfactual prices of boycotted brands calculated by using two alternative pre-boycott price ratios: the price ratio in April 2013, the last pre-boycott month, and the price ratio in the same month of the previous year. Sales and revenue gaps are in 1,000 liters and million KRW, respectively.

Table D5: Sensitivity analysis: Boycott effects without Namyang's price adjustment

	100 draws of y_i and v_i		Pre-boycott price ratio			
			Apr 2013		Same month	
Product	Gap	%	Gap	%	Gap	%
			Panel A: Sales effects			
Namyang brand						
GT	-26,780	-28.2	-23,868	-25.5	-23,701	-25.6
Einstein	-1,696	-26.0	-1,537	-24.1	-1,633	-23.9
Non-boycotted brand						
Seoul Milk	10,087	6.9	7,829	5.3	7,802	5.3
Maeil Milk	4,097	6.9	3,193	5.3	3,189	5.3
Mokjang	1,988	7.2	1,529	5.5	1,521	5.5
Low Fat Milk	1,560	6.8	1,216	5.3	1,211	5.2
365	631	6.4	492	5.0	498	5.0
Enfant	352	8.5	266	6.3	265	6.3
Maeil Joeun	278	6.7	222	5.3	221	5.3
Sangha Mokjang	224	9.2	176	7.0	176	7.0
Sohwaga Jaldoeneun	151	7.4	117	5.7	116	5.6
Milk Master	66	5.8	53	4.7	52	4.6
Absolute W Milk	59	8.5	46	6.5	46	6.5
			Panel B: Revenue effects			
Namyang brand						
GT	-75,564	-28.3	-67,603	-25.5	-67,220	-25.6
Einstein	-6,754	-26.1	-6,112	-24.2	-6,411	-24.0
Non-boycotted brand						
Seoul Milk	28,243	6.9	21,853	5.3	21,782	5.3
Maeil Milk	11,044	6.9	8,579	5.3	8,563	5.3
Mokjang	6,134	7.3	4,710	5.5	4,685	5.5
Low Fat Milk	4,486	6.8	3,486	5.2	3,472	5.2
365	1,481	6.4	1,152	5.0	1,164	5.0
Enfant	1,339	8.6	1,011	6.4	1,008	6.3
Maeil Joeun	774	6.8	614	5.4	611	5.3
Sangha Mokjang	1,153	9.0	917	7.0	917	7.0
Sohwaga Jaldoeneun	510	7.4	394	5.7	390	5.6
Milk Master	150	5.8	122	4.7	120	4.6
Absolute W Milk	230	8.7	177	6.6	176	6.5

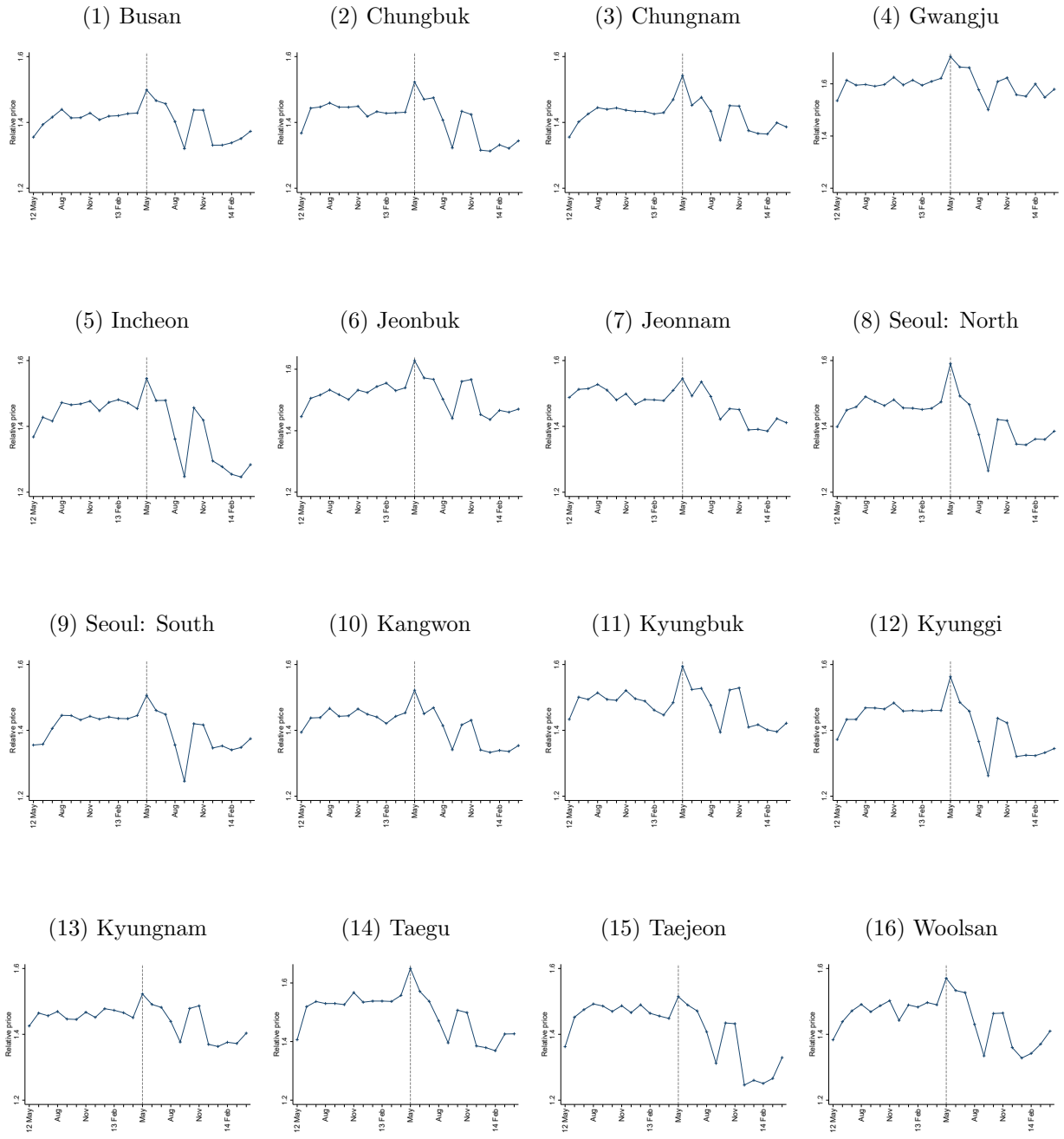
Note: The table reports the sales and revenue effects of the boycott under a scenario in which Namyang did not make any price adjustments after the boycott outbreak. Predicted sales and revenues are simulated with (i) 100 draws of y and v and (ii) counterfactual prices of boycotted brands calculated by using two alternative pre-boycott price ratios: the price ratio in April 2013, the last pre-boycott month, and the price ratio in the same month of the previous year. Sales and revenue gaps are in 1,000 liters and million KRW, respectively.

Figure D1: Relative price trend of GT



Note: The figure plots the trend in GT's price relative to the volume-weighted average price of non-boycotted brands in each of the 16 regions of South Korea.

Figure D2: Relative price trend of Einstein



Note: The figure plots the trend in Einstein's price relative to the volume-weighted average price of non-boycotted brands in each of the 16 regions of South Korea.

References

PELTZMAN, S. (2000): "Prices rise faster than they fall," *Journal of Political Economy*, 108(3), 466–502.

TAPPATA, M. (2009): "Rockets and feathers: Understanding asymmetric pricing," *The RAND Journal of Economics*, 40(4), 673–687.