Retrospective Merger Evaluation: GSK-Pfizer Consumer Health

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Motivation

- Merging parties often argue efficiency defenses for a merger. There is surprisingly little affirmative checking whether efficiencies are realized and passed through.
- Merger within an oligopoly of two smaller companies is rarely examined. We consider a situation where there was a merger of two small companies. Here we have two among the top 5, where the top 5 have 95% market share.
- Debate on efficiency and pass through in merger context is enduring.
- Ex-post merger evaluations are, more generally, rare in developing countries, particularly with nascent competition authorities. We do so in the context of health care with evidence from the Philippines.

Contribution

- We estimate the effect on prices of the products of the merging parties using standard diff-in-diff and event analysis and find that prices decrease post merger.
- We then use demand estimation methods to estimate the change in marginal costs that would rationalize the drop in prices; we also compute the effect on the prices of the competitors due to cost efficiency gain of the merging party
  - A standard merger simulation follows demand estimation where the estimated parameters are used to back out marginal costs which are then assumed constant. The change in ownership matrix gives price predictions (which are higher by construction if MC is constant).
  - Instead we use pre-merger period to estimate demand parameter and then use pre-merger and post merger price data to compute change in marginal costs of the merging parties.

The Market

Consumer Health products represent 40% of the value of the entire pharmaceutical sector, about 1.73 Bn USD in 2020. In 2018, sales of Cough and Cold Remedies in the Philippines was worth an estimated 160 Mn USD where 94.4% is represented by only 5 firms.

Table 1: Market Shares, Product and Active Substance Counts in 2018

Firm	Product	Prop Label	Non-Prop Label	Private Label	Active Substance	Share (%)
United Lab	23	18	0	5	18	67.90
Pfizer	4	4	0	0	4	8.34
Sanofi Aventis	2	2	0	0	2	7.19
GSK	3	3	0	0	2	6.02
Pascual	2	2	0	0	2	4.97
Others (47)	71	66	5	0	21	5.58
Total	105	95	5	5	49	100

Note: Table shows the largest firms, brands and active substances computed based on total values of sales in 2018

Shares per Molecule same as GSK and Pfizer

The Market

Table 2: Market Share by Product Attribute, 2008-2018

Attribute	mean	sd	min	max
Proprietary Label	0.9957	0.0007	0.9941	0.9968
Foreign	0.2714	0.0329	0.2011	0.3530
Combination INN	0.5048	0.0349	0.4219	0.5852
Solid Form	0.6350	0.0335	0.5649	0.7294
Flavored	0.0794	0.0154	0.0478	0.1007

Note: Figures above are computed based on total sales value

The Acquisition

Acquiring entity: GlaxoSmithKline Consumer Healthcare Holdings, Ltd. (GSK)
Acquired business: Pfizer Inc.'s Consumer Healthcare Buisness (Pfizer)

The Philippine Competition Commission was notified of the proposed purchase on 18 January 2019. After undergoing Phase 1 and Phase 2 reviews, the transaction was cleared on 27 June 2019.

Table 3: Products of Merging Parties in Cough and Cold Remedies

FIRM	PRODUCT	ACTIVE SUBSTANCE	THERAPEUTIC CATEGORY	FORMS
Pfizer	Robitussin	Dextromethorphan+Guaifenesin	Expectorant, Antitussive	Capsule Soft Gel, Syrup
	Robikids	Carbocisteine	Expectorant	Suspension
	Loviscol	Carbocisteine	Expectorant	Capsule, Drops, Syrup
	Dimetapp	Brompheniramine+Phenyleprine	Antihistamine, Decongestant	Syrup
GSK	Ambrolex	Ambroxol	Expectorant	Capsule, Drops, Syrup, Tablet
	Sinecod	Butamirate	Antitussive	Coated Tablet, Syrup
	Sinecough Expel	Ambroxol	Expectorant	Drops, Syrup, Tablet

Datasets

- IQVIA's Philippine Pharmaceutical Index (PPI) and Philippine Hospital Pharmaceutical Audit (PHPA), Q1 2008 to Q4 2020
- IQVIA's MIDAS World Review Pack (WRP) Database, Indonesia, Malaysia, Singapore, and Thailand, Q4 2009 to Q4 2021

  Attributes (selected):
    - Provides actual nationwide sales information per Stock Keeping Unit (SKU)
    - *Firm*: Corporations, Manufacturers
    - *Channel*: Retail, Hospital
    - Drug: Product, Pack Description (Form, Strength, Size), Anatomical Therapeutic Class 3, New Form Code 3, Active Substance
    - *Measures*: Revenue, Counting Unit and Dosage Unit
- Pre merger period of Q1 2008 to Q2 2019 (46 Qtrs) and post merger period of Q3 2019 to Q4 2020 (6 Qtrs)
- **Product** $j \in J$ is Corporation+Product+Active Substance+NFC, where $J = 54$ Selection
    e.g. *PFIZER+ROBITUSSIN+GUAIFENESIN+LIQUID ORDINARY RELEASE SYRUP*
- A **Market** t is a country-quarter combination which has information on product j's
  Total revenue r_{jt} and volume in **Dosage units** q_{jt}, used to compute **Price** $p_{jt} = r_{jht}/q_{jt}$

Reduced Form Merger Evaluation: Event Study

$$\ln p_{jt} = \alpha_j + \gamma_t + \beta_y \left(M_{jt} \times \sum_{\substack{y=-9 \\ y \neq -1}}^{5} I\left(t - t^* = y\right) \right) + \sum_{q=1}^{3} \theta_q Q_{jt} + \varepsilon_{jt},$$
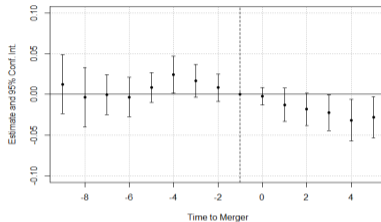
Reduced Form Merger Evaluation: Event Study

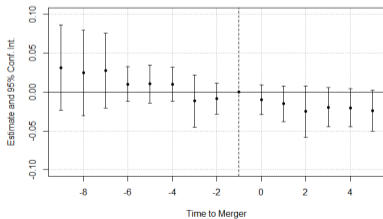**Std Ave Price, Control: Private Label, Cough and Cold**
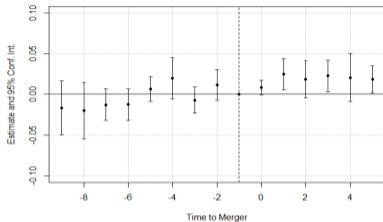
$F_{8,113} = 1.62237, \; p = 0.126105$

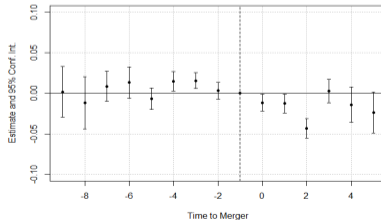**Std Ave Price, Control: Proprietary Label, Cough and Cold**

$F_{8,317} = 1.3657, \; p = 0.210777$

Std Ave Price, Control: Proprietary Label Analgesics

$F_{8,419} = 0.52251, \; p = 0.839675$

Std Ave Price, Control: Hypertension Drugs

$F_{8,1314} = 0.562825, \; p = 0.808917$

Reduced Form Merger Evaluation: DD

$$\ln p_{jt} = \alpha_j + \gamma_t + \beta^M \left(M_{jt} \times P_{jt} \right) + \sigma X_{jt} + \varepsilon_{jt},$$

$$\ln p_{jt} = \alpha_j + \gamma_t + \beta^G \left(GSK_{jt} \times P_{jt} \right) + \beta^{Pf} \left(Pfizer_{jt} \times P_{jt} \right) + \sigma X_{jt} + \varepsilon_{jt},$$

Reduced Form Merger Evaluation: DD

Table 4: Merger Price Effect, Philippine Comparisons

| | Cough & Cold[a] | | Analgesics | Hypertension |
	Private Label	Proprietary Label	Proprietary Label	All
Standard Average Price				
Aggregate Effect				
M×P	0.015**	−0.035***	−0.026***	−0.029*
	(0.007)	(0.007)	(0.010)	(0.015)
Separate Effects				
GSK×P	0.035***	−0.015	−0.007	0.009
	(0.008)	(0.010)	(0.016)	(0.025)
Pfizer×P	0.005	−0.045***	−0.036***	−0.038**
	(0.007)	(0.008)	(0.012)	(0.018)
Stone Price Index, Q4 2017 weights				
Aggregate Effect				
M × P	−0.062***	−0.145*	−0.005	−0.017
	(0.018)	(0.080)	(0.059)	(0.013)
Separate Effect				
GSK×P	−0.088***	−0.172	−0.031	−0.044**
	(0.021)	(0.124)	(0.095)	(0.022)
Pfizer×P	−0.049**	−0.132	0.008	−0.004
	(0.019)	(0.093)	(0.070)	(0.015)
Stone Price Index, Q3 2020 weights				
Aggregate Effect				
M × P	0.001	−0.175*	−0.245***	−0.292***
	(0.218)	(0.100)	(0.066)	(0.035)
Separate Effect				
GSK×P	0.250	−0.074	−0.003	−0.044
	(0.265)	(0.153)	(0.105)	(0.059)
Pfizer × P	−0.123	−0.299***	−0.369***	−0.416***
	(0.230)	(0.115)	(0.078)	(0.042)
Product FE	✓	✓	✓	✓
Time FE	✓	✓	✓	✓
Observations	132	327	477	1,420

Note:[a] Products with the same active substance as GSK and Pfizer products;

Retrospective Merger Evaluation, Model Based

1. **Merger Simulation**. Reflecting the ownership structure after the acquisition, holding marginal cost and demand parameters fixed, new equilibrium prices can be calculated using ex-ante data.

2. **Efficiency Calculation**. Using ex-post data and holding demand parameters fixed, calculate the change in marginal cost by first finding the costs associated with actual observed prices such that the difference between model predicted equilibrium prices and actual observed prices is minimized, then compare with pre-acquisition marginal costs.

$$\Delta \mathbf{c} = (\mathbf{c}_{Post}/\mathbf{c}_{Pre}) - 1$$

Parameter Estimates

Table 5: Demand and Cost Parameter Estimates

| | OLS | 2SLS | | Random Coefficient Logit Demand Side | | |
	Logit	Logit	Nested Logit	$\overline{\beta}$	σ_β	Cost Side
Constant	−8.186***	−7.258***	−3.649***	6.5025***	0.0000	−0.0270
	(0.207)	(0.356)	(0.205)	(0.835)	(0.026)	(0.022)
Price	10.518***	−15.662*	−4.134**	−23.609***	13.213***	
	(1.715)	(8.121)	(1.647)	(0.085)	(0.074)	
Subgroup (σ_1)			0.851***			
			(0.043)			
Group (σ_2)			0.844***			
			(0.045)			
No. of Packs	0.615***	0.541***	0.091***	0.494***		−0.0029
	(0.051)	(0.059)	(0.023)	(0.021)		(0.014)
No. of INN [a]	0.0439	0.0472	−0.0263	0.8447***		
	0.1241	0.1243	0.0543	(0.224)		
Foreign[a]	−0.8048***	−0.8351***	−0.1869*	−3.743***	3.469***	
	0.2692	0.2641	0.129	(1.072)	(0.030)	
Solid Form[a]	−0.1493	−0.0165	0.822***	−3.586***	5.836***	
	0.2588	0.2723	0.134	(0.746)	(0.052)	
Flavored[a]	−0.4672	−0.4016	−0.1782	4.877***		
	0.4508	0.4168	0.1925	(2.279)		
PH Exchange rate						1.010***
						(0.0003)

Notes: 1,985 observations were used from the period Q4 2009 to Q1 2019. Demand side specifications include 38 quarter fixed effects and 54 product fixed effects. Supply side specification includes 18 molecule fixed effects and controls for country specific currency cross rates in USD. [a] Mean utility coefficients of time invariant variables are computed via second stage minimum distance projection of estimated product fixed effects on characteristics.
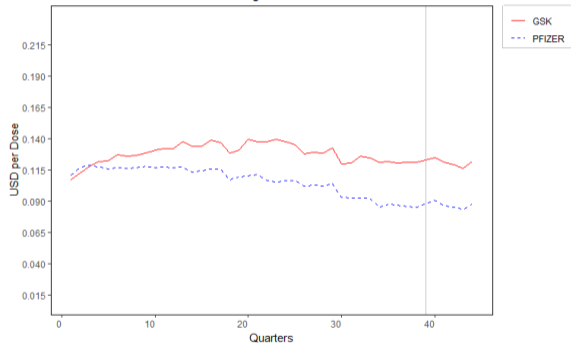
# Mark-ups and Marginal Cost

Table 6: Price Elasticity and Markups

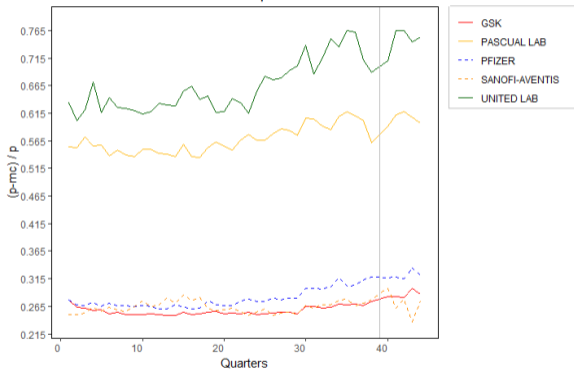| Product level, Price Elasticity	mean	sd	min	max
Own price elasticity	−3.0948	1.3951	−14.9117	−0.1754
Cross price elasticity	0.0125	0.0412	4.1136^{-10}	1.4705
Markups $(p - c)/p$	% (Pre)	% (Post)		
GSK	26.7490	28.7338		
Pfizer	30.5731	32.2263		
Pascual	60.5669	60.8475		
Sanofi Aventis	27.2035	26.2562		
United Lab	75.2394	75.5907		
Foreign	33.4501	34.0857		
Local	89.3802	89.7838		

Pre and Post Merger Costs
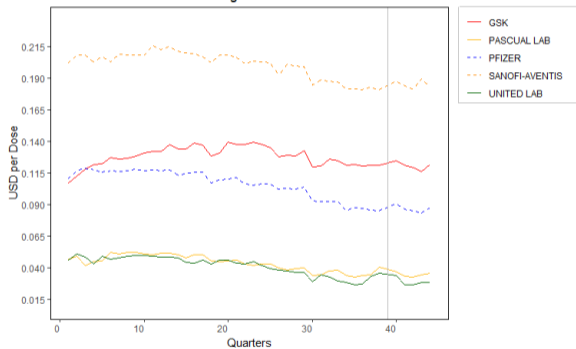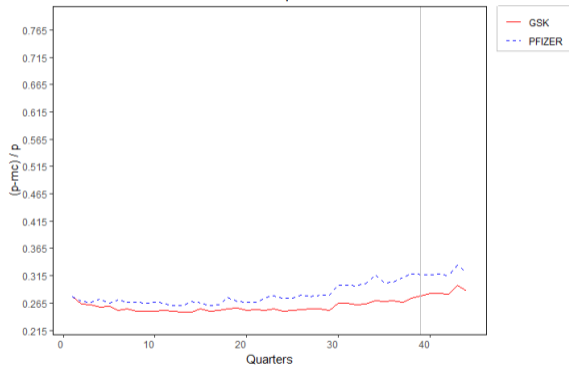
Comparison of Outcomes

Table 7: Comparison of Predicted Outcomes

Product Line	Merger Simulation, Using Pre-acquistion Data		Estimated mc Using Post-acquistion Data	
	%Δprice	mc	mc	%Δmc
GSK	2.2869	0.1219	0.1193	−2.1073
Pfizer	1.6835	0.0877	0.0854	−2.5997
Combined	1.8846	0.0991	0.0967	−2.3978

Merger Specific Efficiency Gain

We use marginal costs in the pre-merger periods, Q4 2017-Q3 2018, and post-merger marginal costs in Q4 2019-Q3 2020 to estimate the effect of the merger via diff-in-diff.

Table 8: Efficiency from the Merger via Marginal Cost

	(1)	(2)
GSK		-2.568***
Pfizer		-2.279***
Combined	-2.376***	
Obs	416	416
R-squared	0.997	0.997

[1] Coefficients are adjusted by 100*(beta/avg.mc), avg.mc $= 0.1$.

Alternative algorithms

Alternative ways to estimate post-merger marginal costs:

1. Benchmark post-merger prices using DiD model (a combined reduction of -2.9%, or +0.9% for GSK and -3.8% for Pfizer). Determine the change in MC associated with equilibrium market prices that matches the predicted prices of the DiD model.
2. Assume parameters estimated from the demand model remain unchanged. Using observed prices post-merger, directly back out the marginal costs.
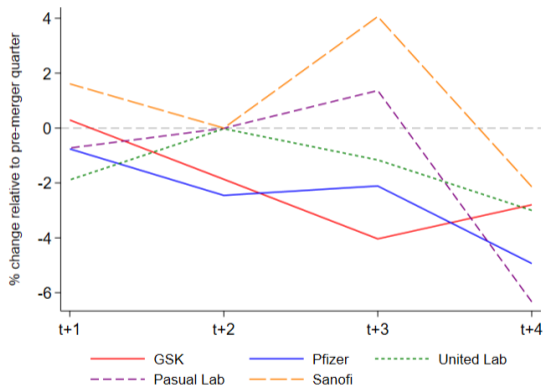
Table 9: Estimated %Δ MC drop from alternatives algorithms

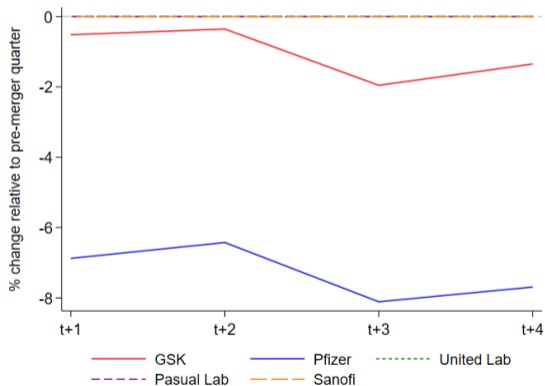| Product Line	Post Merger Prices	
	Actual observed	DiD prediction
GSK	−2.11	−1.05
Pfizer	−2.60	−7.28
Combined	−2.40	−4.95
Non-merging	−0.16	0

Thank you.

Marginal Cost Evolution

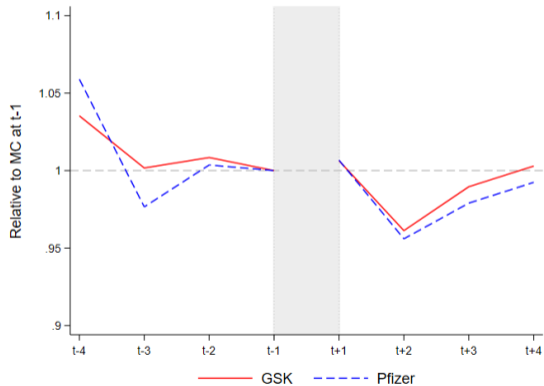% change of MC compared to corresponding pre-merger quarters
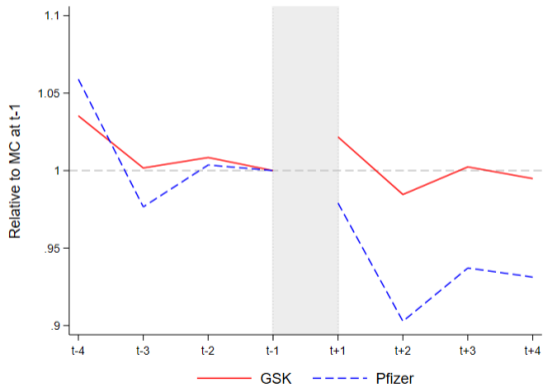

Using actual observed prices

Using DiD predicted prices

Marginal Cost Evolution

Evolution of MC relative to values in t-1 (Q3 2018)

Using actual observed prices

Using DiD predicted prices

Marginal Cost Evolution

Evolution of MC relative to values in t-1 (Q3 2018), Top 5 firms

Using actual observed prices

Using DiD predicted prices
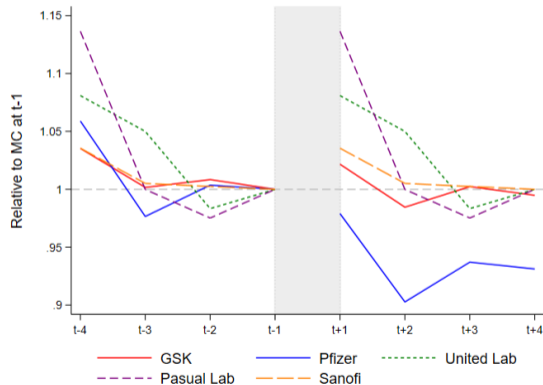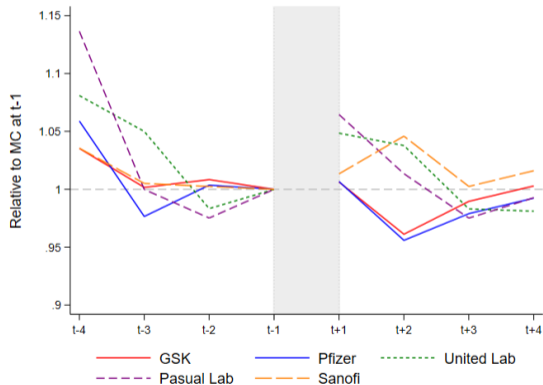
Market Shares by Active Substance

Table 10: Market Shares of Top 4 Firms in 2018 by Active Substance shared with GSK or Pfizer

	Carbocisteine	Ambroxol	Butamirate	Dextromethorphan +Guaifenesin	Guaifenesin	Brompheniramine +Phenylephrine	Total
United Lab	18.52	2.33					20.85
Pfizer	0.92			3.89	3.29	0.24	8.34
Sanofi Aventis		6.61					6.61
GSK		1.15	4.87				6.02
Total	19.44	10.09	4.87	3.89	3.29	0.24	41.82

Note: Figures above are computed based on sales value in 2018

The Market

Product Set Selection

Table 11: Product Set Average Shares (2008-2018)

Count	Product ID	Share	CumSum	Count	Product ID	Share	CumSum
1	160	0.2085	0.2085	28	22	0.0080	0.8561
2	138	0.1076	0.3162	29	84	0.0076	0.8637
3	168	0.0808	0.3970	30	171	0.0074	0.8711
4	173	0.0372	0.4341	31	159	0.0073	0.8785
5	77	0.0323	0.4665	32	118	0.0057	0.8842
6	178	0.0317	0.4982	33	20	0.0054	0.8895
7	89	0.0283	0.5264	34	24	0.0051	0.8946
8	143	0.0271	0.5536	35	114	0.0047	0.8993
9	78	0.0265	0.5800	36	109	0.0046	0.9040
10	161	0.0246	0.6046	37	86	0.0046	0.9086
11	150	0.0243	0.6289	38	76	0.0046	0.9132
12	185	0.0188	0.6477	39	153	0.0044	0.9176
13	149	0.0180	0.6657	40	112	0.0043	0.9219
14	44	0.0175	0.6833	41	155	0.0041	0.9260
15	144	0.0175	0.7008	42	116	0.0040	0.9300
16	91	0.0172	0.7180	43	172	0.0039	0.9339
17	23	0.0169	0.7349	44	108	0.0039	0.9378
18	163	0.0144	0.7493	45	179	0.0038	0.9417
19	90	0.0129	0.7621	46	133	0.0034	0.9450
20	170	0.0129	0.7750	47	88	0.0031	0.9482
21	162	0.0121	0.7871	48	145	0.0031	0.9512
22	146	0.0113	0.7984	49	68	0.0031	0.9543
23	9	0.0104	0.8088	50	115	0.0028	0.9571
24	82	0.0102	0.8190	51	8	0.0024	0.9595
25	87	0.0102	0.8292	52	85	0.0024	0.9618
26	106	0.0098	0.8391	53	113	0.0023	0.9641
27	117	0.0090	0.8481	54	70	0.0022	0.9663

Data set

Additional Demand Estimation Results

Table 12: Summary of Between and Within Variation of Variables

Variable	Description	mean	min	max	s_O^2	s_B^2	s_W^2
Share variables							
s_{jt}	Share of product j	0.003	0.000	0.066	0.006	0.006	0.002
s_{0t}	Share of outside good	0.829	0.767	0.903	0.032	0.002	0.032
$\ln(s_{jt}/s_{0t})$	Dependent variable	-6.468	-18.445	-2.455	1.614	1.362	0.953
$\ln(s_{jt}/s_{hg})$	Within subgroup log share	-1.236	-15.953	0.000	1.522	1.430	0.666
$\ln(s_{hg}/s_g)$	Within group log share	-2.523	-13.482	-0.418	1.333	1.262	0.654
Product characteristics							
p_{jt}	Price (USD) per dose	0.139	0.008	0.792	0.095	0.093	0.015
x_{1jt}	# of pack varieties	1.811	1.000	12.000	1.231	1.157	0.405
x_{2jt}	# of molecules	1.769	1.000	11.000	1.494	1.497	0.000
x_{3jt}	Dummy (Foreign/Local)	0.477	0.000	1.000	0.500	0.503	0.000
x_{4jt}	Dummy (Flavor/No Flavor)	0.096	0.000	1.000	0.294	0.293	0.000
x_{5jt}	Dummy (Solid/Not Solid)	0.413	0.000	1.000	0.492	0.499	0.000
Instruments							
z_{1t}	Exchange rate	0.022	0.019	0.024	0.002	0.000	0.002
z_{2jt}	# of products (other firms)	92.057	62.000	134.000	16.009	12.682	9.988
z_{3jt}	# of molecules (other firms)	64.001	43.000	105.000	13.458	10.247	8.862
z_{4jt}	# of molecules (other firms, within same group)	5.698	0.000	23.000	6.809	6.726	1.925
z_{5jt}	# of molecules (other drugs by same firm,within same group)	24.102	11.000	42.000	5.794	4.803	3.216
z_{6jt}	# of brands (other firms, within same group)	26.502	11.000	50.000	9.337	7.038	6.179
z_{7jt}	Price of product j in other ASEAN countries	0.089	0.001	0.770	0.097	0.086	0.044

Table 13: Logit and Nested Logit, First-Stage Estimates

	Logit	Nested Logit		
	$log(p_j)$	$log(p_j)$	$log(s_{jhg})$	$log(s_{hg})$
Number of products (comp)	0.002***			
	(0.0003)			
Number of mol (comp)	−0.001***			
	(0.0002)			
Number of brand (k not j, group)		0.002***	−0.014	0.159***
		(0.001)	(0.029)	(0.029)
Number of pack (k not j, group)		−0.002***	−0.091***	0.043***
		(0.0002)	(0.014)	(0.014)
Number of mol (k not j, group)		0.001***	0.042***	−0.055***
		(0.0002)	(0.011)	(0.011)
Number of brand (comp, group)		0.00005	−0.001	0.045***
		(0.0003)	(0.014)	(0.014)
ASEAN price	0.045***	0.070***	−0.425	−1.115***
	(0.007)	(0.007)	(0.408)	(0.409)
F-test excluded instruments	33.2274	23.6265	11.6272	11.3548

Notes: 1,985 observations were used from the period Q4 2009 to Q1 2019. Demand side specifications include 38 market fixed effects and 54 product fixed effects.