Divestiture of US Business May Fail as a Merger Remedy: The Case of the US Beer Industry

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Abstract

Divestiture is used by justice department to resolve anticompetitive concerns in recent mergers. This paper study a new form of divestiture (divestiture of whole US business) applied in recent beer industry merger – The Anheuser-Busch and Grupo Modelo Merger. We show, both theoretically and empirically, that the new divestiture may fail to protect US beer market structure and consumer surplus due to some specific reason, capacity constraint in this case. Our theoretical model is based on Herfindahl-Hirschman Index (HHI) calculation and a simple equilibrium analysis. Using UPC scanner data, we use both "before-after" and "difference-in-difference" estimation to verify our theoretical predictions. We first found that the US beer market gets more concentrated after the merger. Secondly, the Mexican beer segment has a higher price and lower volume sales after the merger. Finally, compare to their competitors in the Mexican beer segment, the merger brands have a higher relative price and lower relative volume sales after the merger.

Section 1 – Introduction

For merger raises anticompetitive concerns, normally structural merger remedy is applied. It requires merger firms to divest either assets or existing business entity to other firms outside the merger to keep the market competitive. The US food related industries witness several applications of merger remedy (divestiture) in recent years. In these cases, the justice department requires merger firms to divest either brands, regional branches or whole US business. Divestiture of US business is a new form applied for the beer industry merger, since the beer industry has already concentrated globally. Understanding the impact of this new divestiture requirement has great value for the policy makers.

Recent literature studies the impact of classic divestitures in different industries. Divestiture of brands has been studied by Tenn and Yun (2011) in the pharmaceutical industry, Pham and Prentice (2013) in the Australian cigarette industry, and Friberg and Romahn (2015) in the Sweden beer industry. Using both reduced-form analysis ("before-after" estimation and "difference-in-difference (DID)" estimation) and structural analysis ("merger simulation"), they all found that the price of divested brands drops after the merger. Divestiture of regional branches has been studied by Rogers and Hollinger (2004) in the oil industry and Burke (1997) and Piloff (2002) in the bank industry. Based on the price and market share, they suggest that divestitures were successful. Nevertheless, few literature has studied the divestiture of US business, which is the void this paper try to fill. To our knowledge, this paper is also one of few study of divestiture in the US food related industry.

In this paper, we study the Anheuser-Busch InBev (ABI) and Grupo Modelo merger in 2013. The US Department of Justice (DOJ) requires ABI to divest Grupo Modelo's US business to a third company Constellation Brands (CB) to get the merger approved. The divestiture includes not only the licenses to exclusively distribute Grupo Modelo's beers in US, but also a factory to produce. The DOJ expect CB to fully replace Grupo Modelo in the US market so that the market remains as competitive as before. However, the factory divested to CB has capacity constraint, it can only self-supply approximately half of CB's US demand. The residual demand is purchased from ABI's other factories after the merger. The trade of residual demand may fail the divestiture from two perspectives. First, the US beer industry gets more concentrated in terms of Herfindahl-Hirschman Index (HHI) measure. ABI gets CB's partial revenue from the trade, which raises ABI's revenue share while shrinks CB's. This gives US beer industry a higher HHI. Second, the price of merger brands and their close substitutes may rise. The trade between CB and ABI may associate with transaction cost, which increases CB's marginal cost. A higher marginal cost gives CB incentives to set a higher price. As a consequence, CB's close competitors may increase price as well.

In this paper, we provide both theoretical predictions and empirical analysis. The theoretical section first shows the HHI raises after the divestiture. Then we construct a simple equilibrium model involves merger brands and their close substitutes within the same beer segment. The reason for focusing on only close substitutes is that recent beer demand literature suggests cross-price elasticity for different types of beer is close to zero (Toro-Gonzalez, McCluskey, & Mittelhammer, 2014). Using the equilibrium outcome, we show that the segment price increases and the segment volume (quantity) drops after the merger. We also show that, compare to their substitutes, the relative price of merger brands is higher and the relative volume

of merger brands is lower. Empirically, using "before-after" estimation, our theoretical

predictions on HHI and segment price and volume are verified in the Mexican beer segment.

Using DID estimation, we also verify our predictions of relative price and relative volume in the

Mexican beer segment.

The paper is organized as follows. In Section 2, we discuss the merger background. In

Section 3, we present our theoretical predictions. In Section 4, we discuss the empirical

strategies. Section 5 discusses the data and Section 6 presents our empirical results. In section 7,

we conclude.

Section 2 – Merger Background

There are mainly three campaigns in the US import lager market before the merger. The first campaign is ABI with 39% US market share. It owns European lager brands such as Stella Artois. The second campaign is a joint venture Crown Import owned by Grupo Modelo and CB. It owns Mexican lager brands such as Corona and Modelo Especial, which account for 7% US market share. In this campaign, the beer is produced by Grupo Modelo in Mexico and is imported and distributed by Crown Import. CB is a wine and spirit company without other major beer business. The third campaign is Heineken International. It holds European lager brands such as Heineken and Mexican lager brand Dos Equis. The merger is between first two campaigns. It was announced on Jan.31st, 2013 and was approved on Apr.19th, 2013.

Before the merger, ABI holds 35.3% of Grupo Modelo's direct interests, the merger is for ABI to acquire the rest. The combination reduces two competitors – Modelo and ABI – into one, which raises anticompetitive concerns. To resolve such concern, the DOJ requires ABI to divest Grupo Modelo's US business to CB so that CB can replace Grupo Modelo as an independent competitor in US. The divestiture includes the US license of Grupo Modelo's major brands ("Corona", "Modelo Especial" and etc.), the Grupo Modelo's interests in the Crown Import LLC, and the Grupo Model's most advanced brewery Piedras Negras. Ideally, the divestiture makes CB an independent beer company with self-produce capabilities, so US beer market structure and consumer surplus are protected.

Unfortunately, CB is still not an independent competitor after the divestiture. According to CB's annual reports, the Piedras Negras brewery can only self-supply approximately half of

CB's US demand. The residual demand is purchased from ABI's other factories, which is governed by the Interim Supply Arrangement between ABI and CB. This trade distributes CB's partial revenue to ABI, which changed the market structure in terms of HHI. This trade may also cause transaction cost between two firms, which raises CB's marginal cost and will further affect CB's pricing strategy. Although DOJ requires CB to expand its capacity, such circumstance continues three years in-a-row since the merger, it will only end until CB can fully self-supply its US demand. From these perspectives, we conjecture that the divesture may fail as merger remedy in this case.

Section 3 – Theoretical Predictions

In this section, we first show the merger impact on market concentration through HHI calculation. We then construct a simple equilibrium model, using the equilibrium outcomes to further predict the merger effect on price and volume.

Section 3.1 – Market Structure

HHI is a common measure for market concentration. It is calculated by summing up squared revenue share of all firms:

$$HHI_t = \sum_{i=1}^{I} (s_{it})^2, HHI_t \in [0,10000]$$

where s_{it} denotes revenue share of firm i at time t. A higher HHI indicates a more concentrated industry. In the ABI and Grupo Modelo merger, the pre-merger HHI is

$$HHI_t^{Pre} = (s_t^{ABI})^2 + (s_t^{GM})^2 + \sum_{j=1}^{J} (s_{jt})^2 \quad (1)$$

where s^{ABI}, s^{GM} and s_{jt} denotes revenue share of ABI, Grupo Modelo and rest firms, respectively. After the merger, DOJ expects CB can replace Grupo Modelo through the divestiture, then DOJ's expected HHI is

$$HHI_t^{DOJ} = (s_t^{ABI})^2 + (s_t^{CB})^2 + \sum_{j=1}^{J} (s_{jt})^2 \quad (2)$$

where s^{CB} denotes revenue share of CB after the divestiture. DOJ expect the divestiture can protect market structure, so HHI^{pre} and HHI^{DOJ} are expected to be very close.

However, since CB cannot self-supply its US demand, CB purchase residual demand from ABI. This trade distributes CB's partial profit to ABI, which leads to actual HHI as follows:

$$HHI_t^{Actual} = (s_t^{ABI} + k \cdot s_t^{CB})^2 + \left((1-k) \cdot s_t^{CB}\right)^2 + \sum_{j=1}^{J} (s_{jt})^2 \quad (3)$$

where k denotes the percentage of CB's profit distribute to ABI. Taking a difference, we will have

$$HHI^{Actual} - HHI^{DOJ} = 2k \cdot s_t^{CB} \cdot (s_t^{ABI} + (k-1) \cdot s_t^{CB}) > 0$$

It indicates the divesture may fail to protect market structure in this case since the market gets more concentrated.

Proposition 1: The divestiture may not prevent HHI from raising due to CB's capacity constraint.

Section 3.2 – Equilibrium

Antitrust literature suggests that for merger involves differentiated products, other variables, especially price, should be examined beyond HHI (Shapiro, 1995). In the import beer market, brands differentiate beers. Therefore, we construct a simple equilibrium model with two

competing differentiated product. We assume there are only two products within the market segment. On the demand side, we have two products (beers)

$$q_1 = \alpha_1 - \beta p_1 + \gamma p_2$$

$$q_2 = \alpha_2 - \beta p_2 + \gamma p_1$$

where β and γ measures own-price and cross-price effect. For simplicity, we first assume the price effect is same for two products. Secondly, we assume $\beta > \gamma > 0$, so the own-price effect dominates cross-price effect. We use q_1 to denote the merger brand.

On the supply side, we have two firms each owns a product. Firm 1 is the firm being merged, i.e. Grupo Modelo in our case. Before the merger, firm 1 has two factories to produce beer. One is more efficient factory A with lower marginal cost c_1^A, i.e. Piedras Nigras brewery, and the other factory B is lower efficient with higher marginal cost $c_1^B (c_1^B > c_1^A)$. The more efficient factory A has capacity constraint $\bar{q}$. On the other hand, firm 2 has single factory with marginal cost c_2. The firm 1's profit maximization is

$$\max_{\{p_1, q_1^A, q_1^B\}} \pi_1 = (p_1 - c_1^A)q_1^A + (p_1 - c_1^B)q_1^B$$

$$s.t. \begin{cases} q_1^A \leq \bar{q} \\ q_1 = q_1^A + q_1^B \end{cases}$$

And firm 2's profit maximization is

$$\max_{\{p_2, q_2\}} \pi_2 = (p_2 - c_2)q_2$$

After the merger, firm 1 (Grupo Modelo's US business) is sold (to CB). Since CB has the exclusive right, due to the divested license, to supply Grupo Modelo's beer to US, the profit

maximization structure remains. The q_1^A is decision for how much to produce from its own factory, i.e. Piedras Nigras brewery acquired from the divestiture, and q_1^B for how much to purchase from ABI to meet the residual demand. The divestiture raises the marginal cost c_1^B to $\tilde{c}_1^B = (1+m)c_1^B$. The higher marginal cost is caused by the transaction cost between two firms, i.e. CB and ABI, which affects the equilibrium outcomes.

Solving the two equilibriums (details in Appendix 1), we have two sets of equilibrium outcomes for pre-merger and post-merger, respectively: $\{p_1^{Pre}, q_1^{A,Pre}, q_1^{B,Pre}, p_2^{Pre}, q_2^{Pre}\}$ and $\{p_1^{Post}, q_1^{A,Post}, q_1^{B,Post}, p_2^{Post}, q_2^{Post}\}$. Using the two sets of equilibrium outcomes, we have following propositions.

Proposition 2. The segment (includes q_1 and q_2) price raises and segment volume falls after the merger.

Proof: Appendix 2.

The intuition for Proposition 2 is that the price of product 1 raises due to a higher marginal cost. The higher price lowers demand for product 1, so the volume of product 1 falls. Some consumers are switched to product 2 instead, so firm 2 produce more product 2 to pick up the "switched demand". Also, the higher price of product 1 gives firm 2 incentive to raise price of product 2 without concerns of losing consumers. Raising price of product 2 slightly less than what product 1 did, firm 2 can not only pick up majority "switched" demand, but also make extra profit from existed demand. The segment volume drops in our setting due to our assumption that own-price effect dominates cross-price effect.

Proposition 3. Compare to its substitutes, product 1 has a higher relative price and has lower relative volume sales.

Proof: Appendix 3.

The intuition for Proposition 3 is that the price of product 1 raises due to a higher marginal cost, so it gives incentives for firm 2 to raise price. As explained above, raising price of product 2 slightly less than what product 1 did is best for firm 2's interest. Hence, product 1 has a higher relative price. On the other hand, product 1 volume falls while product 2 volume raises after the merger, so product 1 has a lower relative volume.

Section 4 – Empirical Strategy

Our empirical strategy contains two parts. We first use "before-after" estimation to examine Proposition 1 and 2. Then we use DID estimation to examine Proposition 3. In both analysis, we use monthly retail panel data. The reason to use panel data is that each state market is separate in US (Ashenfelter, Hosken, & Weinberg, 2015). The US state laws requires that beer producers cannot be distributors. It also requires distributors differ across states. Using monthly retail panel data, we can utilize the geographic variations to test our predictions.

Section 4.1 – Before-after Estimation

The "before-after" estimation is used to study merger effect on HHI. We first construct actual HHI measure. According to CB's annual report, CB's self-supplied 60%, 55% and 50% of its US demand in 2013, 2014 and 2015, respectively. Assuming these percentages are also the revenue that CB kept, we can calculate actual HHI according to (3). Then we use following equation for the estimation:

$$HHI_{st}^{Actual} = \beta \cdot After_t + \delta X_{st} + s_s + \tau_t + \epsilon_{st} \quad (4)$$

where $After_t$ is a dummy variable, which equals to 1 after the merger. X_{st} is control variables includes state-level income and unemployment rate. s_s and τ_t are state fixed effect and time trend.

We also use "before-after" estimation to study merger effect on segment price and segment volume. The equations we estimated are

$$price_{ist} = \beta \cdot After_t + \delta X_{st} + \alpha_{is} + \gamma_{mt} + \epsilon_{ist} \quad (5)$$

and

$$volume_{ist} = \beta \cdot After_t + \delta X_{st} + \alpha_{is} + \gamma_{mt} + \epsilon_{ist} \quad (6)$$

where index i, m, s, t corresponds to brand, company, state and time, respectively. α_{is} is a full set of brand and state fixed effect. γ_{mt} is a full set of company, year and month fixed effect. Similar fixed effect controls are used in recent beer merger analysis (Ashenfelter, Hosken, & Weinberg, 2015).

Section 4.2 – DID Estimation

"Before-after" results might be caused by the merger, but we cannot rule out the impact of other exogenous demand and supply shocks. To address such concerns, we also use DID estimation on the brand level to further test our predictions. Assuming exogenous demand and supply shocks has similar impacts on merger brands and their close substitutes, we can test the pure merger impact based on relative price and relative volume according to Proposition 3. The treatment is merger on the involved brands. Our treated groups are two Grupo Modelo brands: Corona Extra Lager and Modelo Especial Lager. We use three control groups. The first one is a Mexican beer not involved in the merger: Dos Equis Special Lager. The second one is a European beer not involved in the merger: Heineken Lager. The third one is another European beer involved in the merger: Stella Artois Lager (owned by ABI). We estimated following equations:

$$price_{ist} = \theta \cdot Treat_i \cdot After_t + \psi \cdot Treat_i + \beta \cdot After_t + \delta X_{st} + \alpha_{is} + \gamma_{mt} + \epsilon_{ist} \quad (7)$$

and

$$volume_{ist} = \theta \cdot Treat_i \cdot After_t + \psi \cdot Treat_i + \beta \cdot After_t + \delta X_{st} + \alpha_{is} + \gamma_{mt} + \epsilon_{ist} \quad (8)$$

where $Treat_i$ is dummy variable, which equals 1 if the brand is involved in the merger. The other specifications remain consistent with (5) and (6).

Section 5 – Data

We collected data from the Information Resources Incorporated (IRI). The IRI collects volume sales and price from scanning the Universal Product Code (UPC). IRI has different channels for data collecting, such as Grocery, Drug store and etc. Our dataset includes those from convenience store chains and from food services. The IRI data is collected at a 4-week base from Jan.2011 to Dec.2015, which has been convert to monthly base by us. Our IRI dataset is a state-level monthly panel data. It includes 18 major brands in 45 states, we list them in the Appendix 4. The summary statistics of main variables are presented in Table 1. The controls variables such as monthly unemployment rate and quarterly earnings data are collected from the Bureau of Labor Statistics.

Table 1 -- Descriptive Statistics						
Variables		Definition	Unit	Overall Average	Short-run Average (Jul.2012 -- Dec.2012 & May.2013 -- Oct.2013)	Long-run Average (Jul.2012 -- Dec.2012 & Nov.2013 -- Dec.2015)
Mexican Beer	Price	Price of a 24-pack case	$	30.06 (3.11)	29.61 (2.88)	30.51 (2.76)
	Volume	Number of 24-pack case	Case	34017.08 (89387.73)	34707.16 (87620.44)	37795.33 (97658.44)
Import Beer	Price	Price of a 24-pack case	$	31.61 (4.1)	31.16 (3.91)	32.06 (3.9)
	Volume	Number of 24-pack case	Case	28713.45 (75234.62)	29392.56 (74432.79)	31307.98 (81392.64)
HHI^(DOJ)		Before merger: Direct HHI calculation; After merger: Direct HHI calculation.		4147.05 (1072.01)	4242.67 (958.21)	4163.55 (961.98)
HHI^(Actual)		Before merger: Direct HHI calculation; After merger: Direct HHI calculation after distribution k% CB's revenue to ABI.		4343 (1063.46)	4390.9 (945.96)	4460.37 (923.2)

Section 6 – Empirical Results

Below, we present the empirical results from both "before-after" estimation and DID estimation. With "before-after" estimation, we first study the merger effect on market structure based on two set of HHI measures: DOJ expected HHI and actual HHI. Secondly, we examine the merger effect on the price and volume of Mexican and import beer segment. Finally, due to the concern that "before-after" estimation on beer segment may be affected exogenous demand and supply shock, we use DID to verify the pure merger effect.

Section 6.1 – Merger effect on market concentration (HHI)

The "before-after" estimation results on HHI is presented in table 2. DOJ expects, with the divestiture requirement, the US beer market structure should be protected, so the HHI should be more or less the same after the merger. From table 2, HHI^DOJ statistically remain same in the short-run and drops in the long-run, after the merger. The falls of long-run HHI^DOJ may be caused by the emerging craft-beer industry. However, the HHI^Actual raises in both short-run and long-run, which contradicts DOJ's expectation. It indicates that the DOJ's divestiture requirement may not be able to protect US market structure in this case. Considering the HHI^Actual is calculated on the assumption that the CB's self-production percentage is also the revenue percentage itself kept, we focus more on the qualitative results here.

Table 2: HHI^DOJ vs HHI^Actual			Dependent Variable	
			HHI^DOJ	HHI^Actual
	After	Coefficient	5.6	238.75*
		Std. Dev	(50.73)	(52.56)
Short-run Analysis (Jul.2012 -- Dec.2012 & May.2013 -- Oct.2013)		F-test Value	2242	1345.2
		P-value for F-test	0.00	0.00
		No of Month	12	32
		No of State	45	45
	After	Coefficient	-93.1*	203.21*
		Std. Dev	(41.85)	(41.23)
Long-run Analysis (Jul.2012 -- Dec.2012 & Nov.2013 -- Dec.2015)		F-test Value	2843.73	2389.35
		P-value for F-test	0.00	0.00
		No of Month	12	32
		No of State	45	45

Section 6.2 – Merger effect on segment price and volume

The "before-after" estimation results on segment price and volume are presented in Table 3 and Table 4. From Proposition 2, we expect the segment price raises and segment volume falls. From Table 3, Mexican beer price and Import beer price raise in both short-run and long-run. Using Mexican beer for example, the price on average raises 30 cents per 24-pack cases in the short-run. For the segment volumes in Table 4, the Mexican beer segment sells less in the short-run while remain the same in the long-run statistically. In the short-run, the Mexican beer volume drops on average 9659.31 cases (24-pack-case), which is about 9% of its short-run monthly average sale. The insignificant long-run volume may be caused by the increasing demand for beer overall. For the import beer volume, which includes also European lagers, the

volume drops significantly in the long-run, but not in the short-run. In the short-run, the increasing sales of European beer offsets the falling Mexican beer sales. In the long-run, the falling sales is caused by European beer, given that Mexican beer volume is stable. The falling sales of European beer may be caused by some exogenous demand or supply shock. In summary, the merger effect on the segment price and volume are as our expectation in the Mexican beer segment. However, change of segment price and volume may be caused by either merger or other exogenous demand or supply shock, so we need further analysis on the pure merger effect.

Table 3: Segment Price			Dependent Variable -- Price	
			Mexican Beer Segment	Import Beer Segment
Short-run Analysis (Jul.2012 -- Dec.2012 & May.2013 -- Oct.2013)	After	Coefficient	0.3*	0.83*
		Std. Dev	(0.13)	(0.19)
		F-test Value	517.24	902.99
		P-value for F-test	0.00	0.00
		No of Observations	1617	2661
Long-run Analysis (Jul.2012 -- Dec.2012 & Nov.2013 -- Dec.2015)	After	Coefficient	0.44*	0.49*
		Std. Dev	(0.13)	(0.18)
		F-test Value	751.75	1181.10
		P-value for F-test	0.00	0.00
		No of Observations	4317	7101

Table 4: Segment Volume			Dependent Variable -- Volume	
			Mexican Beer Segment	Import Beer Segment
Short-run Analysis (Jul.2012 -- Dec.2012 & May.2013 -- Oct.2013)	After	Coefficient	-9659.31*	-513.11
		Std. Dev	(2917.19)	(660.40)
		F-test Value	292.58	408.65
		P-value for F-test	0.00	0.00
		No of Observations	1620	2676
Long-run Analysis (Jul.2012 -- Dec.2012 & Nov.2013 -- Dec.2015)	After	Coefficient	-2502.14	-7503.85*
		Std. Dev	(3353.28)	1207.28
		F-test Value	388.36	548.61
		P-value for F-test	0.00	0.00
		No of Observations	4320	7136

Section 6.3 – Merger effect on relative price and volume of merger brands

The DID estimation results on merger brands' relative price and volume are presented in Table 5 and Table 6. The results for different control groups are presented separately. From Proposition 3, we expect the merger brands have a higher relative price and a lower relative sales compare to their competitors. In the Mexican beer segment, we expectations are only significant in the long-run analysis, but not in the short-run. The reason is that it takes time to fully implement new pricing and sales strategies. However, compare to European beers, the relative price and volumes does not behave as we expected. As suggested by recent beer demand analysis (Toro-Gonzalez, McCluskey, & Mittelhammer, 2014), cross-price elasticity for different types of beer is close to 0. The flavor of Mexican Lager and European Lager may differentiate them into different types of beer, so the merger effect is mainly within Mexican beer segment.

			Dependent Variable -- Price		
Table 5: DID Price			Control #1 Dos Equis Lager Mexican+Third Party	Control #2 Heineken Lager European+Third Party	Control #3 Stella Artois Lager European+Merger Firm
Short-run Analysis (Jul.2012 -- Dec.2012 & May.2013 -- Oct.2013)	Treat*After	Coefficient Std. Dev	0.15 (0.14)	-0.29* (0.15)	-0.38 (0.22)
	F-test Value P-value for F-test		441.22 0.00	497.49 0.00	909.19 0.00
	No of Observations		5,869	5,872	5,836
Long-run Analysis (Jul.2012 -- Dec.2012 & Nov.2013 -- Dec.2015)	Treat*After	Coefficient Std. Dev	0.62* (0.21)	0.07 (0.2)	0.27 (0.24)
	F-test Value P-value for F-test		443.06 0.00	630.1 0.00	1150.12 0.00
	No of Observations		6,769	6,772	6,676

			Dependent Variable -- Volume		
Table 6: DID Volume			Control #1 Dos Equis Lager Mexican+Third Party	Control #2 Heineken European+Third Party	Control #3 Stella Artois Lager European+Merger Firm
Short-run Analysis (Jul.2012 -- Dec.2012 & May.2013 -- Oct.2013)	Treat*After	Coefficient Std. Dev	4211.68 (2582.4)	10595.65* (2829.48)	2641.64 (2571.47)
	F-test Value P-value for F-test		362.65 0.00	415.93 0.00	366.34 0.00
	No of Observations		5,940	5,940	5,916
Long-run Analysis (Jul.2012 -- Dec.2012 & Nov.2013 -- Dec.2015)	Treat*After	Coefficient Std. Dev	-6989.81* (3090.89)	-1380.83 -3043.11	13049.71* (4319.67)
	F-test Value P-value for F-test		326.64 0.00	401.88 0.00	321.27 0.00
	No of Observations		6,840	6,840	6,776

Section 7 – Conclusion

This paper shows that a new divestiture form used by DOJ may fail to resolve anticompetitive concerns of ABI and Grupo Modelo merger in 2013. Theoretically, we use HHI calculation and a simple equilibrium analysis to show why divestiture of US business may fail in current case. Using UPC scanner data, we conduct both "before-after" and DID estimation to test our predictions. Empirically, we first found that the US beer market is more concentrated after the merger. Secondly, the price raises and volume falls in the Mexican beer segment. Finally, we found that the merger brands have a higher relative price and lower relative volume after the merger, compared to their close substitutes in the Mexican beer segment. We understand that in merger analysis, structural approach such as merger simulation can provide different perspective than reduced-form analysis. We leave this for future work. Also, the dataset we used is from convenience store chain and food services, future work is also need to test if the results are robust in other channels such as grocery and etc.

From the policy point of view, merger remedies are applied to the US food related industry since these industries are highly-concentrated. The ongoing consolidation will make other industries similar to beer industry, which is concentrated globally. Similar divestiture requirement such as divestiture of US business might be applied more often in the future. The very recent ABI and SABMiller merger is settle with same divestiture. This paper shows that divestiture of US business may fail because of some specific reasons, i.e. capacity constraint in this case. Future applications of such divestiture should be cautious.

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Appendix

Appendix 1 – Equilibrium Outcomes

Solving firm 1 and 2's optimization, the equilibrium results are as follows. Before the merger, we have

$$p_1^{Pre} = \frac{2\beta(\alpha_1 + \beta c_1^B) + \gamma(\alpha_2 + \beta c_2)}{4\beta^2 - \gamma^2}$$

$$p_2^{Pre} = \frac{2\beta(\alpha_2 + \beta c_2^B) + \gamma(\alpha_1 + \beta c_1^B)}{4\beta^2 - \gamma^2}$$

$$q_1^{A,Pre} = \bar{q}_1, \qquad q_1^{B,Pre} = \alpha_1 - \beta p_1^{Pre} + \gamma p_2^{Pre} - q_1^{A,Pre}, \qquad q_2^{Pre} = \alpha_2 - \beta p_1^{Pre} + \gamma p_1^{Pre}$$

Similarly, the post-merger equilibrium outcomes are

$$p_1^{Post} = \frac{2\beta(\alpha_1 + \beta \tilde{c}_1^B) + \gamma(\alpha_2 + \beta c_2)}{4\beta^2 - \gamma^2}$$

$$p_2^{Post} = \frac{2\beta(\alpha_2 + \beta c_2^B) + \gamma(\alpha_1 + \beta c_1^B)}{4\beta^2 - \gamma^2}$$

$$q_1^{A,Post} = \bar{q}_1, \qquad q_1^{B,Post} = \alpha_1 - \beta p_1^{Post} + \gamma p_2^{Post} - q_1^{A,Post}, \qquad q_2^{Post} = \alpha_2 - \beta p_1^{Post} + \gamma p_1^{Post}$$

Appendix 2 – Proof of Proposition 2

We have $\tilde{c}_1^B = (1+m)c_1^B$, then $\Delta p_1 = p_1^{Post} - p_1^{Pre} = \frac{2\beta^2 c_1^B m}{4\beta^2 - \gamma^2} > 0$ and $\Delta p_2 = p_2^{Post} - $

$p_2^{Pre} = \frac{\gamma\beta c_1^B m}{4\beta^2 - \gamma^2} > 0,$

the segment price raises after the merger.

Similarly, since $\beta > \gamma > 0$, $\Delta q_1 = q_1^{Post} - q_1^{Pre} = \frac{\beta c_1^B m(\gamma^2 - 2\beta^2)}{4\beta^2 - \gamma^2} < 0$, $\Delta q_2 = q_2^{Post} - $

$q_2^{Pre} = \frac{\gamma c_1^B m\beta(2\beta - \gamma)}{4\beta^2 - \gamma^2} > 0$, and $\Delta q_1 + \Delta q_2 = \frac{\gamma c_1^B m\beta(2\beta - \gamma)}{4\beta^2 - \gamma^2} < 0$, so the segment volume falls after

the merger.

Appendix 3 – Proof of Proposition 3

$$\text{We have } \Delta p_1 - \Delta p_2 = \frac{\beta^2 c_1^B m(2\beta - \gamma)}{4\beta^2 - \gamma^2} > 0 \text{ and } \Delta q_1 - \Delta q_2 = -\frac{2\beta^2 c_1^B m(\beta + \gamma)}{4\beta^2 - \gamma^2} < 0.$$

Appendix 4 – List of States and Brands in our data

List of 45 states included in our analysis:

Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

List of 18 beer brands included in state-level analysis:

AB InBev: Budweiser, Bud Light, Busch Light, Stella Artois Lager

MillerCoors: Miller Genuine Draft, Miller Lite, IceHouse, Coors Light, Keystone Light

Heineken International: Heineken, Dos Equis XX Lager Especial

Constellation (Grupo Modelo before the merger): Corona Extra, Modelo Especial

Diageo: Guinness Draught

Craft beers: YuengLing Traditional Lager, Samuel Adams Boston Lager, Sierra Nevada Pale Ale, New Belgium Fat Tire Amber Ale.