Vertical Integration and Entry in Two-Sided Markets

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Abstract

The paper evaluates vertical integration in two-sided markets. Vertical integration can have anti-competitive effects driven by foreclosure and can have pro-competitive effects by eliminating double marginalization. In the two-sided market, vertical integration facilitates the expansion of product variety and the growth of the consumer base through indirect network effects. I show theoretically that the impact of vertical integration on consumer welfare highly depends on the consumer installed base which affects the indirect network effects. I develop a model of platform's optimal pricing, third-party firms' entry and pricing, consumer adoption and purchasing, and estimate using data on the single-serve coffee industry. Counterfactual simulations show that, in the absence of indirect network effects, the platform's optimal decision would be setting a ten times higher licensing fee where foreclosure effects dominate. Accounting for the indirect network effect and firms' entry, vertical integration increases consumer welfare by 0.14% due to increased product variety.

Introduction

Economics theory suggests that vertical integration can result in anti-competitive consequences since the platform may foreclose rivals (Mathewson and Winter, 1987; Hart and Tirole; 1990; Rey and Tirole, 2007; Bresnahan and Levin, 2013). On the other hand, vertical integration has pro-competitive benefits which eliminates double marginalization (Spengler, 1950) and encourages investment (Marvel, 1982). Often the platform provides its own branded products to expand consumers' choices and boost consumer participation (Caillaud and Jullien, 2003; Hagiu and Spulber, 2013).

This paper focuses on the unique relationship between Keurig's K-Cup system and partner coffee brands in the single-serve coffee industry when Keurig gradually formed partnerships with over thirty brands and exploits the variation due to patent expiration on Sep. 2012. The market was barely growing in the United States until 2006 when several mergers and acquisition happened. Since then, single-serve coffee pods have grown into a $5.7 billion industry in 2016. This paper aims to address the following questions: How does vertical integration affect consumer welfare in two-sided markets?

Methods and Materials

Empirical Model:

Products are grouped into 3 groups: g=1, K-Cup; g=2, Ground/Whole bean coffee; and g=0, No purchase. There are two types of consumers. Consumers who have adopted the Keurig brewer are denoted as K. The product profile for K-type consumers contains K-Cup, Ground coffee, and No purchase. The consumers who haven't adopted the Keurig brewer are denoted as NK.

- **Consumer i's** indirect utility for the platform (brewer) j:

$$u_{hct} = \alpha^{\Gamma} * \Gamma_{ct}^{K} - \alpha^{B} p_{hct} + \sigma_h + \sigma_c + NovDec + \varepsilon_{hct}$$

  - Where α^{Γ} measures consumer's responsiveness to attractiveness of the platform. Γ_{ct}^{K} is the attractiveness of the consumable goods available in the platform. α^{B} measures the price sensitivity to brewer. σ_h , σ_c and $NovDec$ are brewer fixed effects, city fixed effects and seasonality indicators.
- **Consumer i's** indirect utility of purchasing the consumable goods j .

$$\mathrm{U}_{\mathrm{ij}}^{\mathrm{co}} = x_j\beta + \alpha^{CO} p_{jct} + \sigma_j^D + \tau_t^D + \nu_c^D + \xi_{jct} + \zeta_g + \lambda_g * \epsilon_{jct}$$

  - Attractiveness of the consumable goods $\Gamma_{ct}^{K} = \frac{1}{1-\beta} \ln\left(1 + \Sigma \mathrm{e}^{\delta_j^{co}}\right)$
  - where x_j is a vector of observable product characteristics, p_{jct} is the retail price, σ_j^D , τ_t^D , ν_c^D are the brand, time, and city-specific fixed effects, ξ_{jct} is the unobserved quality valuation. ϵ_{jct} is the type 1 extreme value shock. λ_1 is the nesting parameter for K-Cup, λ_2 is the nesting parameter for Ground coffee. Γ_{ct}^{K} is derived from the inclusive value of K-Cup products.
- **Firm j 's** entry decision χ_j and pricing decision p_j.
  - Firm's payoffs in a market are given by

$$\Pi_j(\chi, p, F) = \chi_j * [(p_j - c_j - \tau_j) * s_j * N_1 - F_j]$$

  - Assumption 1: After having entered, each firms knows the identities, cost of all firms in the markets and play a Bertrand-Nash pricing game.
  - Assumption 2: When making the entry decision, each seller knows its own type, cost, and other firms' types, and costs. But the fixed cost draw is private information to the sellers and are independently and identically distributed draws.
- **Platform** choses licensing fee to maximizes its licensing profit and profit from selling its own consumable goods and partial consumer surplus which captures the indirect network effects.

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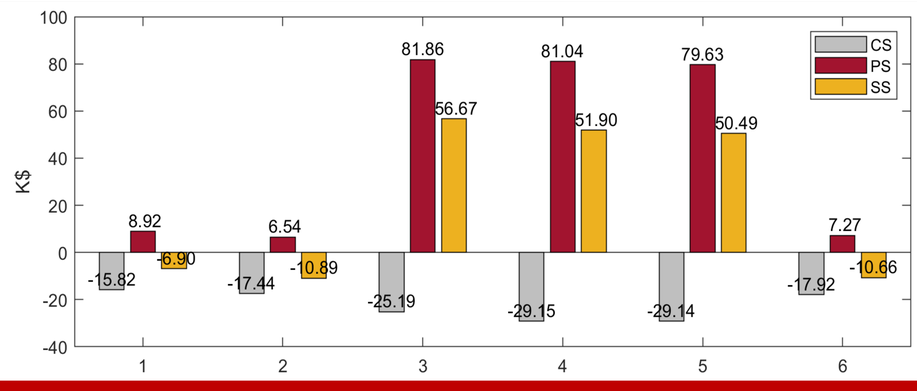
Counterfactual Analysis-1

Given demand and supply estimates, I conduct counterfactual simulations to evaluate the effect of vertical integration in the single-serve coffee industry. For the welfare analysis, all the numbers shown are the percentage differences relative to the ``separated" (7) scenario.

- Column (1) shows that vertical integration increases producer surplus by $8.92K monthly in a city relative to the "separated'' baseline and a comparison to (2) shows that price efficiency contributes 27% of the gain.
- A comparison between (1) and (3), or (5) and (7) shows that the indirect network effects help increase consumer welfare and increase third-party firms' profit but reduce the platform's profit.
- A comparison between (2) and (6) indicates that foreclosure effects are not the dominant factor. Overall, the gain from the price efficiency and cross-network effects are outweighed by the loss stemming from increased market power. This assessment is based on the evaluation of the outcome given the observed entry.

	1	2	3	4	5	6	7
	merged	merged	merged	merged	separated	merged	separated
Unilateral Effect	yes	yes	yes	yes	no	yes	no
Foreclosure	yes	yes	yes	yes	no	no	no
Efficiency:	yes	no	yes	no	no	no	no
Cross-network Effect	yes	yes	no	no	no	yes	yes



Counterfactual Analysis-2

The above counterfactual simulation keeps the entry outcome fixed. The following table shows the expected consumer surplus factoring in changes in entry decisions resulting from merger and licensing fees.

- The post-merger licensing fee would be 9.53% higher, reflecting the balance between indirect-network effects and foreclosure effects. And third-party firm's entry probability increases by 5.28% after the merger because of more concentrated markets and higher profitability.
- The overall consumer welfare experiences an increase of 0.14%, compared to a 2.54% decrease in consumer surplus when entry is not factored in.

	merger (i)	merger $\kappa = 0$ (ii)	separate $\kappa = 0$ (iii)	separate (iv)
Licensing fee	0.05258	0.49588	0.49574	0.04800
	percentage change compared to case (iv)			
Δ Licensing fee	9.53%	933.09%	932.81%	-
Δ Consumer Surplus	0.14%	-14.84%	-15.19%	-
Δ Entry probability	5.28%	-51.05%	-53.47%	-

Conclusions

This paper evaluates vertical integration in the single-serve coffee industry. The primary contribution of the paper is to assess the welfare effects in two-sided markets by incorporating firms' entry decisions, their responses to the platform's pricing, and consumers' responses to product variety. I find that while vertical integration may result in higher licensing fees for third-party coffee makers but the overall harm to consumers is mitigated by increased market entries and a wider range of products provided by the platform in the market. On the one hand, the outcome is driven by the growing importance of indirect network effects as the platform's profit becomes more reliant on market size. On the other hand, vertical integration solves the "chicken and egg" problems by increasing product variety in the consumable goods market to induce brewer adoption. Without vertical integration, third-party firms face the risk of exiting the markets. Failing to account for the benefits of increased entry and product variety leads to underestimating the benefit of vertical integration.

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More references are cited in paper at the www.zheyu-ni.com.