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Dynamics of Platform Competition between an Entry and an Incumbent Occupier

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ABSTRACT

This paper focuses on the dynamic process when two platforms are competing and occupy market share. Specifically, this paper focus on the process of the entry of a new platform in the case of an incumbent occupying the market. This paper then concludes potential factors that will affect the profit of the entrant platform. In this work, an empirical analysis towards the potential final market form is performed, and an extension model describing the time-price-change event is set up and analyzed.

Keywords: *Two-sided platform market, network effect, network externality, dynamics of platform competition.*

1. INTRODUCTION

Competing Networking platforms has been a popular topic within discussion that would date back to the study of the network externality and increasing return theory [1,2]. As online retailing and services rise in popularity, double-sided networking platform markets have been seen achieving a tremendous amount of increase in number. A common characteristic of these retailing or service platforms is its conduction of transactions between 2 distinctive customer bases. Usually, one side sells its product or services in exchange for profit, and another side purchases these products with capital. These two customer kinds are referred to as sellers and buyers, respectively, throughout the paper. During the process the platform is expected to act as an agent of communication. Real life examples for these platforms are numerous, including online retailing platforms, Delivery platforms and other service platforms.

Though offering online platforming services does not demand a high average or marginal cost, it is noticeable that most double-sided network platforming markets are monopoly or oligopoly structured. This roots to the presence of the network effect: a high number of buyers would raise the utility of the sellers, and vice versa. The fact that a newly constructed platform often lacks a steady customer flow compared to the established ones with a considerable number of buyers and sellers is the main cause of the high barrier to entry in the market. In the past times, we often see a winner-take-all or winner take-most market – one platform dominates the market [3,4]. This market dominance may be more or less long lived, depending on the frequency of radical (as opposed to incremental) innovations. Nevertheless, real life examples of oligopoly, or at least a duopoly market has been more dominant in presence than a single firm occupying the whole market. Though research has analyzed and concluded that it would be impossible for platforms to earn profit in the process of an ongoing competition in a basic model, certain extensions can be added the model both to imitate real life constraints but also allowing the co-presence of multiple platforms in competition [5,6]. Three main extensions that is predominant in real life markets would be Product differentiation (Etsy, that focus mainly on the hand crafting work exchange market, differentiates itself from traditional retailing platforms like Amazon), Exclusive sellers/providers (the competition between Xbox series and PlayStation series provide a good example), and Captive consumers (consumers that prefers a certain firm over the others). In the second part analysis of the model, we mainly focus on the influence of the captive consumers in the market, and how these customers might affect the barrier of entry of the business in general.

2. ASSUMPTIONS

In this paper, two competing platforms is considered, an entrant E and an incumbent I. Platform A is originally the only platform in the market, which is a monopoly. And platform B is a new company try to enter the market.

2.1 The Long-run Equilibrium Model

This model focused on the analysis of to what extent do companies' act influence users' utility, and how the dynamic process works, also whether the long-run equilibrium could be achieved when the dynamic process function repeatedly. The assumptions of the model are as followed. 1. Each platform is associated with a group of customers and sellers on each side of the market. 2. The two platform technologies are incompatible with each other: product sold for one platform cannot be sold on the other platform. 3. Each product seller supplies one product. 4. Each customer is assumed to make purchase on one platform only. 5. The platforms are priced at the same level. 6. Each customer allocates a fixed budget, y, to purchase products in each period.

2.2 The Subsidy Model

In this model, an attempt to seek for potential influences various other variables might pose on a dynamic process of an entrant trying to entry a monopoly market with an incumbent firm earning steady profit by offering subsidy is performed. The basic dynamic process is modeled as followed: 1. an established monopoly platform in the market achieving a maximized profit. 2. A new platform enters the market and its subsidy period price for both sides. 3. After a certain time, the new platform announces its new long-term equilibrium price. Several assumptions that differ 2.2 from the previous model are 1. The two competing platform technologies are compatible with each other now, meaning that sellers might be present on both platforms at once. 2. Each consumer does not adopt one platform only. 3. Captive, or "leaning" consumers are taken into consideration.

3. THE MODEL

3.1. Model 1

3.1.1. Set up and timing

The timing is set up as follows divided by time periods, (1) Consumers would choose platforms and purchase desirable products, (2) New sellers choose the platforms, determine their fixed costs, and sell their products to the currently available base of consumers. These two actions are modeled to occur simultaneously. In the following period, the same set of actions is repeated. It is also assumed, for simplicity, that each consumer sets a fixed budget, marked with y, in each period, for their total purchase of product.

3.1.2. Long-run equilibrium Model analyze:

i. Customer Consuming:

We use $\boldsymbol{b_{jt}}$and $\boldsymbol{d_{jt}}$ to denote the current number of customers and the total number of sellers on platform $\boldsymbol{j} \in \{\boldsymbol{E}, \boldsymbol{I}\}$ at the beginning of period $\boldsymbol{t}$. Another variable $\boldsymbol{Q_j}$ is used to denote the quality of platform $\boldsymbol{j}$ .It is assumed that $\boldsymbol{Q_j}$ is constant throughout the timing of the model. Then, following the approaches in previous findings (e.g., Church and Gandal 1992; Nair et al. 2004), we are able to model the utility of each independent customer with the following formula during period $\boldsymbol{t}$:

$$\boldsymbol{V_{jt} = \ln y + \frac{\ln Q_j}{\rho_j} + e \ln d_{jt}} \tag{1}$$

Which $\boldsymbol{\rho_j}$ is the price of the product and $\boldsymbol{e > 0}$ is a constant. Equation suggests that the customer's utility increases with its total budget set for the products, the quality of the platform, and the amount of product (number of sellers) present on the platform[7].

ii. Seller entry:

We follow the approach due to Gandal et al. (2000), to analyze deeper on the dynamics on the sellers' side. Obviously, the goal of sellers is to choose platforms to maximize total profits over the life cycle of their applications. Hence using the free-entry condition on the sellers' side, we can model the number of sellers presenting on platform$j$ in period t, Δd_{jt},

$$\Delta d_{jt} = \alpha t \cdot b_{jt}/F_{jt}, \tag{2}$$

where αt is a function of t ,and F_{jt} is the fixed cost of platform j in the modeled time period [7]. The equation suggests that a reduction in the fixed cost (F_{jt}), and an increase in the number of consumers (b_{jt}) can encourage sellers to enter the market.

iii. Long-run Equilibrium:

Now this model extends the current single-period model into multiple periods. Here, $\delta b \in (0, 1)$ and $\delta d \in (0, 1)$ are used to denote the "rate of decay" (the rate which the number of consumers is diminishing) of the consumer base and fellow products.[7] Let M_t be the total number of new customers at time t. The change of the customer base of platform E is:

$$b^*_{Et} = \Delta b_{Et} - \delta_b b_{Et} = Mt \cdot S_{Et} - \delta_b b_{Et} = Mt \cdot (Q \cdot d^e_{Et})/(d^e_{Et} + d^e_{It}) - \delta_b b_{Et}. \tag{3}$$

The change of the customer base of platform E is the number of new customers choosing platform E minus the number of existing consumers who exit the customer base in the modeled period. By introducing δ_b, this model now allows consumers to re-enter the market and switch platforms. In expectation, δ_b shall decrease with switching cost: the more costly it is to switch; the lower is the rate of decay of the consumer base would be.

iv. Conclusion:

The long-run market structure depends on the strength of platforming network effects, e. Conclusively, when $e > 1$, the market evolves towards a monopoly. That is, one platform eventually dominates the market. When $e < 1$, the market evolves towards an oligopoly. That is, both platforms co-exist in the long run. In the long-run equilibrium, the ratio between the number of consumers in the two platforms is $Q^{\frac{1}{1-e}}\ F^{\frac{e}{1-e}}$, and the ratio between the number of developers is $(QF)^{\frac{1}{1-e}}$.

However, in the case when $e = 1$, 3 subcases are as follow: if $QF > 1$, the market evolves towards a monopoly and the new platform would eventually dominate the market. If $QF < 1$, the market evolves towards a monopoly and the incumbent platform I would eventually dominate the market. If $QF = 1$, the market evolves towards an oligopoly where both platforms can co-exist. Therefore, we are able to conclude that the equilibrium market shares on both sides depend on initial installed bases and the two ratios, Q and F.

3.2. Model 2

3.2.1. Model Set up and Timing

Customers arrive in the market at a constant rate which is normalized to 1[5]. The dynamic stages are 1. Platform announces price for both sides in the discount period. 2. Sellers make choice to enter the platform or not base on if they are expecting a profit. 3. Customers arrive at the market and leaning customers start to convert. 4. Platform announces its final price. For simplicity, we assume that another platform is unbothered throughout the process.

i. Consumers:

Consumers are divided into two distinctive groups, indifferent customers and leaning customers. For indifferent customers, their customer utility is given by: $u_i = v_i - p + e{*}k_i$, where $v_i \in [0,1]$, and is evenly distributed on the disclosure, p is determined by the seller and the platform, k is the numbers of sellers on the platform, e denotes the Network effect constant. Every customer would purchase the product if and only if $u_1 \geq u_2 \geq 0$.

In the model, it is assumed the presence of Leaning Customers, who are customers preferring one platform over another. They are described as follows: Leaning customers take up a certain fraction Θ of the overall customer population, which Θ $\in [0,1]$. Leaning customer utility is determined by:

$$u_l = v_l - p + e * k_i \quad (4)$$

Where $v_i \in [a, 1+a]$, and is evenly distributed on the interval. a is a given constant, marking how "Captive" these customers are towards their preferred platform. For the sake of simplicity, we suppose leaning customers are evenly distributed among all platforms – every platform in the market would have the exact equal number of customers leaning towards their platform in potential.

ii. Platform:

Platform controls service fee for both sides of the market, marked by p_c and p_s. It also controls the "one-time joining fee" for sellers in the market, marked by c. Here in the model, c, p_c and p_s might be negative numbers (showcasing a subsidy) if necessary. The eventual goal of the platform would be to maximize its profit in its overall life cycle, marked by T0.

iii. Sellers:

As we previously have stated, sellers can be present on both platforms in the model. They pay a one-time fee to be on a platform, and platform deducts a service fee from every successful transaction. Sellers' profits are marked by p - p_c - p_s, and we assume that sellers will only join the platform if they see their utility as positive in the long run.

3.2.2. Subsidy Model Analyze

i. Sellers Entry

It is assumed that sellers will only enter a platform if their utility is positive in the long run. Here sellers would expect consumer positive externality from leaning customers only, as they would have expected a customer loss after the platform removes its subsidy offered to the buyers. Their utility is given by:

$$u_s = \left(e * \frac{\theta}{n}\right) + (p - w - p_s - p_c) - c \quad (5),$$

where n is the total number of platforms in the market, in this case, 2; and w denotes the cost of the product.

Since all sellers are homogenous, all of them either congruously expect positive payback from the platform or not. Thus, the new platform would either host every single seller in the market, or 0 sellers.

ii. Subsidy

In this stage, fixed constants are the constant rate which buyers enter the market (normalized to 1), and k_i which denotes the number of sellers on platform i. In this case, k_i is either 0 or equal to the total number of sellers present in the market. Suppose Leaning customers "convert" to their new preferred platform at a rate of $\mu(u_i - u_0)$, the overall time taken for all the customers to convert would be:

$t_1 = \mu(u_i - u_0)$.

Thus, the profit for the platform would equal to:

$$\pi_1 = k_i c + (p_{ic} + p_{is})((1-\theta) * Pr\{u_i \geq u_0\} +$$

$$\int_0^{t_1} \mu(p_0 - p_i) * Pr\{u_i + a \geq u_0\} + \int_0^{t_1} (\frac{\theta}{2} - \mu(p_0 - p_i) * Pr\{u_i \geq p_0 + a\} \quad (6)$$

The differentiation only goes up to t_1, as it is obvious there is no point in remaining the subsidy after all potentially leaning customers has been converted to the new platform.

iii. Price Change

In this stage, the platform re-sets its price towards the two sides of the market, which is likely going to cause a lost in the buyer base as the subsidy's being removed. The profit of the platform in this stage is calculated to be:

$$\pi_2 = (T0 - t_1)*((p_{i2c} + p_{i2s}) *((1-\theta)* \Pr\{u_{i2} \geq u_0\} + (\theta/2)*\Pr\{u_{i2} + a \geq u_0\}. \quad (7)$$

And Platform seeks to maximize $\pi_1 + \pi_2$.

iv. Conclusion:

The barrier of entry is marked by the profit loss in the first subsidy period of the model. Respectively, a higher e (network effect constant) marks a higher barrier of entry, more leaning consumers presence in the market marks a higher barrier of entry, and a low conversion rate of leaning customers marks a higher barrier of entry.

When adding the third stage into consideration, we can conclude that harsher "entering" condition marks higher profit in the 3rd dynamic stage. However, such harsh entering condition is only desired of *T0* is large enough; as if the supposed life cycle of the platform isn't long, entering such a market might not be the most desirable choice.

4. CONCLUSION

What marks a competition between two-sided platform distinguishable from traditional one side market analysis is that competition among two-sided platforms involves the presence of network externalities. Intuitively, it is reasonable for one to conclude a stronger network effect in general, which would likely to cause a market out of pure monopoly. It has shown that such condition will ultimately result in a winner-take-all or at least winner-take-most market.

The second model differs from the first set-up majorly by bringing Leaning consumer in the model, and here we are actually achieving a similar conclusion from different models and assumptions. The bringing in of leaning customers in the presence of the market would likely to ensure the market being a winner-take-all one as well, which could be counter-intuitive from first sight. This paper works only as an initial attempt, to capture certain market characteristics including both indifferent customers and profit - sensitive sellers. We find that both platforms are more likely to co-exist in the short run under the condition of a lower network externality constant, a higher percentage of leaning customers, and a higher leaning customer conversion rate.

However, it is noticeable that a high enough percentage of leaning customers might eventually result in a corner solution. In the most extreme case where all customers are potential leaning customers, the entrant platform certainly can raise its eventual balancing price up to *p0+a*, which is even higher than the original monopoly price. In these extreme cases, the entrant platform completely abandons the indifferent customer base, and seeks to maximize its profit purely by raising its price to its extrema for the leaning customers.

Our findings provide possible explanations for some real-life past observations where some platforms failed to enter certain markets whereas certain others remained and co-existed in equilibrium with the incumbent platform. In real-life cases, the corner solution strategy is actually more predominant: Platforms would offer heterogeneous services/contents, so as to capture more leaning customers that are loyal and willing to purchase service from their platform even at the expanse of a higher price. However, the importance of leaning customer base to platforms might result in controversial prices raises conducted by the platforms, including improper price discrimination: when the platform offers distinct prices for first time comers of their platform and already captivated consumers. Also, our results offer insights for entrepreneurs and new entrant firms who need to examine the profitability of these competitive markets. Still, we need to conduct further research to take more variables into consideration, namely the differentiation between platforms, to provide our current research with more applicability in real life.

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