

Impact of network on E-commerce economy, Analysis on a price competition model

Navid Nikakhtar* and Yang Jianzheng

Business School, University of Shanghai for Science and Technology, Shanghai 200093, China.

Nikakhtar.navid@yahoo.com

Abstract: Network effects play an important role in e-commerce. Network effect strategy allows companies in e-commerce to set up a network with noncompetitive prices. In e-commerce network effects are important in areas including trade, money transaction and all applications where the interaction between users exists. There is also relevance of network effects on trade with Trust Credibility. There are many studies on competitive behavior of intermediaries (brokerage services) and network effects on electronic marketplaces and virtual auctions worldwide. A comprehensive scientific study of the importance and impact of network effects in e-commerce does not exist yet. This work is a first step to fill this gap. Here we will have an overview on the development of e-commerce, an illustration of the importance of network effects in the two areas of e-commerce and electronic mediation (intermediation). Then we classified network theory and discuss case by case. In particular, the two aspects of adoption and compatibility issues are considered in more detail. In adoption, problems for execution of networks are examined. The focus of the compatibility issues are business decisions about the compatibility with competitors. Finally, the two basic questions of Network Economics are analyzed in the context of e-commerce based on network economic models. In this study the situation of a market in electronic retailer, which is facing a potential competitor in the context of price competition, is studied. First and foremost, it is discussed the question of how to explain the observed price dispersion in electronic trading by network effects. We also examine the compatibility decision of electronic intermediaries. The focus is on the consequences of network effects for the deviation of the common decisions on the welfare optimum.

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Introduction

Since the founding of the first internet-based company in the middle of the 1990s, it is developed within a short time into a dynamic market for Internet transactions (electronic commerce, in short: E-commerce). Today hundreds of thousands of e-commerce companies are active. Due to the strong growth and the development of ecommerce, economic implications of e-commerce are very important.

At first the major task of ecommerce was digitization of offered price and comparisons for users. The comparability of prices on the Internet as well as price promotion should make the price leveled and reduce the price dispersion. Particularly in the last years price comparison services (so-called shop bots) become more common, which automatically scan a large number of e-commerce sites in a seconds and allow a price list of providers for a desired product:

„ With perfect information about prices and products, consumers can quickly and easily find the best deals. In this new world retailers' profit margins will become lower, as they are all forced to compete clearly with others... [The Economist (2012)]

A further argument for the perfect competition in e-commerce was that the structure ecommerce for customers that simplifies and thus the competition for

physical markets were significantly more difficult since there are more clear with price and quality comparison.

The cost of switching from a famous Ecommerce retailer to another retailer is almost zero on the Internet. It's just one click away... [Jiawei Chen (2011)].

It also appeared in the e-commerce for building a new company which is very easy and can be easily built up with simplified settlement through automated and digitized processes with significant cost savings:

„ The Internet is a great equalizer, allowing even the smallest businesses access markets and have a presence that allows them to compete against the giants of the industry, [Chris Denny-Brown and Andria Thomas (2013)]

In addition, it could be observed more companies with lower price also easier for commitment of relabeling of goods in the e-commerce than conventional markets, since it requires only a change in database.

The following table provides an overview of the characteristics of e-commerce for fulfillment the premises of perfect market [Knight (1921), p. 76].

Tab. 1: Fulfillment of the premises of the perfect market through e-commerce

Premise of the perfect market	Compliance by e-commerce
- atomistic market structure	- Global access of buyers and sellers
- no barriers to entry	- Low cost of creating a website - Cost savings through automated processes
- no preferences of consumers	- Elimination of personal contacts - geographical proximity insignificant
- infinite rate of reaction	- low cost menu for Sellers - Low switching costs for buyers
- complete information regarding price and product quality	- low costs for price comparisons - descriptions of multimedia products on the Internet available
- no transaction costs	- Time Transactions and anywhere possible in seconds

So the competition in the electronic market, which can balance price as well as the dispersion compared to physical markets significantly, has been increased;

„The Internet is a nearly perfect market because information is instantaneous and buyers can compare the offerings of sellers worldwide. The result is fierce price competition, dwindling product differentiation, and vanishing brand loyalty.” [Kuttner (1998), S. 12]

In reality, these expectations have not been fully accomplished. As an indicator of the efficiency of e-commerce markets in the industrial economics in recent years mainly analyzed prices on the internet and compared them with conventional markets.

It showed a mixed view. The results of the studies shows, however, a higher level of efficiency by e-commerce in the form of lower price levels and lower price dispersion existed but in comparison to traditional markets Ecommerce still has some weaknesses.

It appears Civic Consulting (2011) in its study that the average prices for books, CDs and software in the in e-commerce were even higher than in traditional trade. He also notes comparatively higher price dispersion in e-commerce.

Lee (1998) concluded in its study found that cars are sold in electronic auctions on average higher prices than conventional used car auctions.

Methodology

Caillaud / Jullien (2001) describe their model of price competition between two electronic intermediaries. Here summarize the definition of electronic intermediary closely by their role in the mediation process, i.e. restrict the search for a suitable partner. An electronic intermediary is therefore an Internet-based database that recognizes partner among its members and other associates. Such databases allow much more efficient implementation of mediation processes, thus enabling

a significant increase in applications from intermediaries.

The core of the model of Caillaud / Jullien is asymmetric network effects that result from the fact of probability of finding a consumer (for example, buyer and seller or partner-seeking women and men).

The number of individuals of each class is normalized to one, where there is exactly one class for each individual an appropriate counterpart of the other class. Due to the large number of potential partners, the individuals are not able to find its matching counterpart independently. The electronic intermediaries, however, have a technology that allows the correct assignment of two suitable individuals for free, if both parties are registered with the same intermediary.

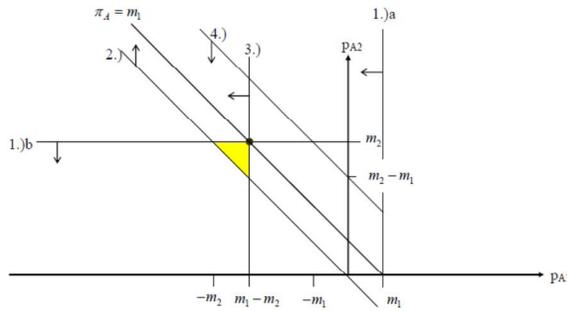
The expected benefit of an individual of type k, which is registered in intermediary i, is calculated according to (4.1) depending on the registration fee

P_{ik} , ticks of the transaction fee, the benefits of a successful mediation t_{ik} and the number of registered individuals of the other group l at this intermediary n_{il} :

$$EU_{ik} = n_{il} (m_k - t_{ik}) - P_{ik}$$

As the number of individuals of a class is normalized to one, n_{il} can also be interpreted as a probability that an individual of type k will be suitable counterpart for intermediary i. Furthermore,

apply $m_1 < m_2$.



After the intermediaries simultaneously their prices have been determined, the individuals decide whether and in which an intermediary or register. An important role is played by their expectations regarding the registration decisions of individuals of another class. For different market situations, equilibrium is considered to fulfill expectations.

A monopolist intermediary

A Case as a basis for comparison for the first duopoly and monopoly situation will be analyzed. Equilibrium of the monopoly case is the complete failure to register.

Similarly, equilibrium is for all $P_{Ak} + t_{Ak} \leq m_k$ ($k = 1, 2$), if full registration is expected and actually registers all individuals in the monopolistic intermediary. The monopolist then draws A consumer surplus from complete:

$$P_{Ak} + t_{Ak} = m_k \quad k = 1, 2$$

$$\pi_A = m_1 + m_2$$

In order to secure the monopoly profit excluding π_A and the equilibrium of a complete non-registration, the intermediary may set a (very small) negative registration fee and thus subsidize the recruitment of individuals of both classes. This will ensure that all individuals actually register, and can fully absorb the transaction fee by the consumer surplus.

Duopoly, if only registration fees are levied P_{ik} :

As part of the analysis of the duopoly will first consider the case that set the price only as intermediary's P_{ik} registration fees and no transaction fees t_{ik} . Assume further that A is the dominant intermediary company, accept all of the individuals that the consumer of the other side of the market to register it. Consequently, the only individuals in a market competitor B side gain k , if he sets the registration fees as low that the benefit of consumers of a higher register despite its network

would disadvantage with regards A. This is the case for

$$P_{Bk} < P_{Ak} - m_k.$$

For this pricing strategy of the intermediary B individuals of the other side of the market I expect rationally that all individuals choose the side of the market for intermediary k B. Thus

$$P_{B1} \leq m_1 + \min \{P_{A1}, 0\}$$

$$\max_{k=1,2} \{P_{Ak} - m_k + m_1 + \min \{P_{A1}, 0\}\}.$$

The market side I wins completely.

$$P_{A1} \leq m_1 - m_2$$

In equilibrium, A sets its prices fixed intermediary so that the competitors can obtain B by the same pricing strategy shown no positive profit. This would be in negative registration fees in both markets would be the case, however, lead to a loss in intermediate A. Similarly, set A is not an intermediary for both groups a positive price, then B as an intermediary for the poaching of group 1, a

negative price $-m_1 < P_{B1} < 0$ and sets the resulting loss of its profits more than offset by

group 2 ($P_{B2} = m_2$). Consequently, intermediate A is in equilibrium a negative price for group 1 and a positive price for group 2 to determine the optimal pricing strategy of intermediate A, the following constraints are observed:

1) The registration fees do not exceed the respective benefits brokerage.

$$a) P_{A1} \leq m_1 \quad b) P_{A2} \leq m_2$$

2) A makes no loss

$$P_{A2} + P_{A1} \geq 0$$

3) A prevents B achieved by poaching of group 1 and group 2 followed by skimming a positive gain.

4) A prevents B obtained by siphoning off of group 2 and group 1 followed by skimming a positive gain.

$$P_{A2} \leq m_2 - m_1 - P_{A1}$$

These constraints can be illustrated graphically; with the two cases must be distinguished

$$m_2 \geq 2m_1$$

and $m_1 < m_2 < 2m_1$!

Figure 1: Case 1: The benefits of mediation group 2 are significantly larger than the benefits of mediation group 1 ($m_2 \geq 2m_1$)

The graphics can easily determine the balance. The gray triangle represents the set of price combinations for which all constraints are satisfied, the upper right corner of the profit maximizing intermediary A. Because the benefits of mediation group 2 significantly from those of group 1 exceeds

B is an intermediary for $m_2 \geq 2m_1$ its investment in the recruitment of group 2 cannot be compensated by the skimming of group 1. Thus, the fourth constraint is not binding. Since it is within the possible price combinations (triangle) is just one that maximizes profits for intermediary A (achieving the highest possible iso-profit line), is the unique equilibrium:

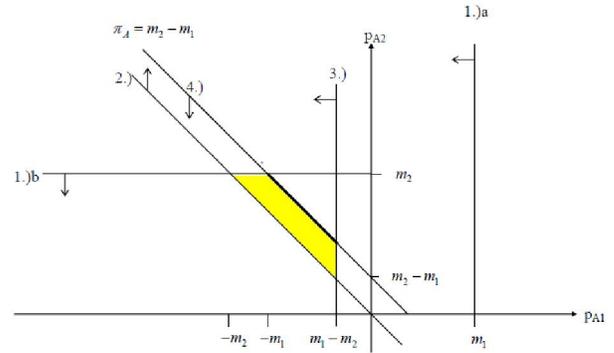
$$\begin{aligned} P_{A1} &= m_1 - m_2 \\ P_{A2} &= m_2 \\ \pi_A &= m_1 \end{aligned}$$

In this equilibrium, the consumer surplus of group 2 is skimmed off completely, so that the benefit of the individuals of group 2 is as high as in the monopoly case. In contrast, the members of Group 1 are better off because A subsidized this group to prevent market entry of B intermediary. Intermediary A fully covers this balance in both markets.

Figure 2; Case 2: The operator benefits from group 2 are not significantly greater than the benefits of mediation group 1 ($m_1 < m_2 < 2m_1$)

In the second case as shown in the graph on the ISO-profit line $\pi_A = m_2 - m_1$ a variety of equilibrium, this can be characterized as follows:

$$\begin{aligned} P_{A1} &\in [-m_1, m_1 - m_2] \\ P_{A2} &= m_2 - m_1 - P_{A1} \\ \pi_A &= m_2 - m_1 \end{aligned}$$



In equilibrium intermediate A can thus enter the market of intermediate B to prevent, by subsidizing

one group with $P_{A1} = -m_1$ and skims the consumer surplus of group 2 with $P_{A2} = m_2$ completely. Alternatively, A can raise, starting from this equilibrium, the price for group 1 and by the same amount the price of group 2, thus the profit of A remains constant. However, it must not exceed the price for group 1 $\pi_A = m_2 - m_1$, otherwise could achieve intermediate B by poaching of group 1 and group 2 of skimming profits.

The opposite strategy of intermediate B prevents A intermediary, so that the total income does not exceed $m_2 - m_1$.

Based on the considerations discussed a potential multiplicity of equilibrium are determined. Thus, the representations of Caillaud / Jullien [2001] extends significantly, as will be shown in their article only a single equilibrium with $P_{A1} = \min\{-m_1, m_1 - m_2\}$ and $P_{A2} = m_2$.

Where P_{ik} and registration fees, transaction fees are charged t_{ik}

Even if transaction fees are charged in addition to registration fees, consumers may Intermediate B class k only win by setting the registration fee. Since all market participants assume the dominance of intermediate A, which plays an intermediary transaction fee of B does not matter, as appropriate partners are assumed only for intermediary A and therefore attract a registration with an intermediary for a transaction B.

The consumers of the class k decide to be registered with B, if this increases their value over and above the registration with the dominant intermediary A. This is the case with the following pricing strategy of intermediate B

$$P_{Bk} < P_{Ak} + t_{Ak} - m_k$$

It decides the consumer class k to be registered with intermediary B, who can then charge a transaction fee of $t_{Bk} = m_k$ set. Thus reduce the cost of intermediary B-solicitation of consumer class k to m_k and B can now reap the same extent as an intermediary A is the consumer surplus of class k.

After recruiting the group k defines an intermediary set B for the individuals of the other group one of the following prizes:

$$P_{Bl} + t_{Bl} = m_l + \min\{P_{Al}, 0\}$$

The maximum profit, the intermediate B with the price achieved overall strategy is therefore marginally smaller than

$$\max_{k=1,2} \{P_{Ak} + t_{Ak} + m_l + \min\{P_{Al}, 0\}\}.$$

In order to achieve any positive profit intermediary B, A must set its prices as follows:

$$P_{Ak} + t_{Ak} \leq -m_l - \min\{P_{Al}, 0\}$$

Thus A has at most a total profit of

$$\pi_A = -m_1 - m_2 - \min\{P_{A1}, 0\} - \min\{P_{A2}, 0\} \tag{4.14}$$

This is immediately apparent that the profit of intermediary A cannot be positive. Even if both registration fees are set P_{A1} and P_{A2} less than zero as promotional offers, nevertheless, the absolute value of the sum $|P_{A1} + P_{A2}|$ not is greater than the sum of the exchange value $m_1 + m_2$. Maximum can be skimmed off that is just a total amount of $m_1 + m_2$, the transaction fees, otherwise reject the offered mediation to individuals. To maintain its monopoly intermediary must set A that eventually made a profit of zero. The reason for this is that its initial competitive advantage no longer exists as an established intermediary, as now intermediate B has the ability to compensate for its investment in the recruitment of an individual class in the form of a negative registration fee directly by charging a transaction fee in the same class.

Regardless of the price of instruments used in the model arises because of the asymmetric network effects as a basic strategy to focus on a group that is recruited by low prices in order to offset the subsidies

paid by skimming the other group. This strategy can also be described as a rule (divide and conquer).

Caillaud / Jullien show that the profit of a former monopolist threatened by entry of a potential competitor decreases. They also show that the introduction of transaction fees an even more intense price competition resulted, so that will not ultimately profitable.

Results

The starting point of this study was the observation that the introduction of the Internet and the spread of e-commerce entirely different economic consequences entailed that has been widely accepted. Contrary to widespread predictions of a perfect market cannot be discussed by the digitization of supply and demand. On the contrary in many areas of e-commerce even a trend towards a quasi-monopoly has large price spread and a partially higher absolute level of prices in retail stores as shown.

The cause for this development in the presence of network effects at e-commerce has been identified. Dealing with e-commerce shows that network effects play a dominant role for many areas. Competing with the stationary competitive, companies can use the Internet network effects in order to generate added value for consumers and thus gain a competitive edge.

Based on network effects in electronic commerce are mainly on reputation issues, so in the field of electronic intermediation direct interaction exist between the responsible individuals.

Here is the brief result come out from this study:

1 Result on Analysis of equilibrium in the one-period model

The demands and profits are as follows:

$$\begin{aligned} D_A &= \frac{1}{2} + \frac{\alpha n_0 - \Delta c}{6(r - \alpha)} \\ D_B &= \frac{1}{2} - \frac{\alpha n_0 - \Delta c}{6(r - \alpha)} \tag{3.5} \\ \pi_A &= 2(r - \alpha) \left[\frac{1}{2} + \frac{\alpha n_0 - \Delta c}{6(r - \alpha)} \right]^2 \\ \pi_B &= 2(r - \alpha) \left[\frac{1}{2} - \frac{\alpha n_0 - \Delta c}{6(r - \alpha)} \right]^2 \end{aligned}$$

The equilibrium results suggest the following statements:

Corollary:

a) If A has no installed base ($n_0 = 0$), wins with lower costs and is the market leader, with network effects ($\alpha > 0$) it lead a tightening competition.

b) Company B, despite an installed base of $(n_0 > 0)$ is the market leader, if it gains a significant cost advantage of $\Delta c > \alpha n_0$.

c) While network effects $(\alpha > 0)$ generally reduce the absolute level of prices through increased competition and has an installed base of A with an opposite effect.

d) Company B is only at a clear cost disadvantage of $\Delta c < -2\alpha n_0$ with a higher price than Company A.

2 Result on Comparison of market performance and welfare optimum

$$\frac{\partial W}{\partial \bar{x}} = 4\alpha\bar{x} - 2r\bar{x} + \alpha n_0 - 2\alpha + r - \Delta c = 0 \Leftrightarrow \bar{x} = \frac{1}{2} + \frac{\alpha n_0 - \Delta c}{2r - 4\alpha}$$

$$\frac{\partial^2 W}{\partial \bar{x}^2} = 4\alpha - 2r$$

$$\bar{x}^{W_{max}} = \frac{1}{2} + \frac{\alpha n_0 - \Delta c}{2r - 4\alpha} \quad r > 2\alpha$$

$$\bar{x}^{W_{min}} = \frac{1}{2} + \frac{\alpha n_0 - \Delta c}{2r - 4\alpha} \quad r < 2\alpha$$

Corollar

a) With low network effects with $r > 2\alpha$ is the full market coverage welfare-maximizing by a company only if the cost advantage of B (Δc) and the weighted network advantage of A (αn_0) differ substantially with height $(\Delta c - \alpha n_0 > |3(r - \alpha)|)$.

b) In case of strong network effects, with $r < 2\alpha$ the welfare is always maximized, if a company serves the entire market.

In both cases, could get higher welfare compared to the market equilibrium by increasing the share to larger company.

3 Result on Equilibrium analysis in multi-period model

$$D_{At} = \frac{1}{2} + \frac{\alpha \Delta n_{t-1} - \Delta c}{6(r - \alpha)}$$

$$D_{Bt} = \frac{1}{2} - \frac{\alpha \Delta n_{t-1} - \Delta c}{6(r - \alpha)}$$

It yields the following benefits:

$$\pi_{At} = 2(r - \alpha) \left(\frac{1}{2} + \frac{\alpha \Delta n_{t-1} - \Delta c}{6(r - \alpha)} \right)^2$$

$$\pi_{Bt} = 2(r - \alpha) \left(\frac{1}{2} - \frac{\alpha \Delta n_{t-1} - \Delta c}{6(r - \alpha)} \right)^2$$

From the equilibrium results identify the following statements are derived which are explained below.

Corollary:

a) If A has no installed base in the initial period $(n_0 = 0)$, is for $\alpha = 0$ in each period, the same result, whereas higher values cause of α greater interdependence of the individual periods.

b) In the initial period The Company which obtained the higher market share may continue to extend its dominance in each period until it is finally monopolist.

c) Existence of network effects $(\alpha > 0)$ set both companies lower prices, unless they were able to build a significant advantage in terms of their installed base compared to its competitors.

d) While the dominant company can use its leadership to price increases in subsequent periods, the competitor's price decrease continuously.

Discussions

The market for electronic intermediation has been characterized for several years through a process of consolidation. While some intermediaries have opted for mergers, others set to access schemes with the aim to broaden its customer base. These developments, the strong network effects in this area. There is deference between intermediation of other markets and in the market for electronic intermediation so the mediation process is done electronically through Internet-based machines, so the aggregation of data from various intermediaries and compatibility between different intermediaries relatively is easier to implement. Thus the focus of this study was the analysis of the implementation of various compliance regimes based on a network-economic model. In comparison to the presented under 2.3.2 approaches that deal just with compatibility issues with network effects, the model comes from Katz / Shapiro (1986) from 2.3.2.3 my model considered compatibility as a result of business decisions. However, I consider the heterogeneity of consumers with regard to their appreciation of network effects, whereby a vertical product differentiation is possible.

As an important model result can be stated that both intermediaries have an incentive to implement unilateral compatibility over their competitors, while both sides is compatible with zero profits for both competitors.

While results for unilateral and bilateral compatibility are a welfare-optimal solution, that market equilibrium is in terms of its incompatibility as a suboptimal welfare.

Furthermore, it was shown that the coordination problem in the manufacture of compatibility with cheap talk is completely dissolved, if compatibility can be produced by a unilateral decision.

While the monopoly analysis shows that at low autonomic benefits of aggregate duopoly profit for unilateral compliance will be higher than the monopoly profit, the intermediaries put in symmetric information because of the associated information gain higher prices and higher profits.

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Corresponding Author:

Navid Nikakhtar

Business School, University of Shanghai for Science and Technology, Shanghai 200093, China. Email: Nikakhtar.navid@yahoo.com

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