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Electronic versus traditional B2B market from intermediary’s perspective

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This paper studies the pricing behaviour of an intermediary who creates a B2B e-marketplace in an existing vertical oligopoly. The intermediary invests in value-added services for firms that transit from traditional to electronic market and extracts revenues by imposing membership fees to these firms. The analysis suggests that the intermediary’s optimal pricing policy can include the imposition of membership fees to both sides of the industry, while the level of fees is strongly related with his investment decisions and market conditions. The proposed model also shows the strategic interaction among firms in the traditional and electronic markets and highlights the strong positive and negative network externalities in such business systems.

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1 Introduction

Electronic marketplaces constitute one of the basic business models in the so-called new economy. In the e-commerce literature, e-marketplaces are broadly defined as Internet platforms that concentrate many buyers and sellers who transact electronically. Nowadays, this kind of platforms are used for business-to-consumer (B2C) transactions (e.g. e-malls), for consumer-to-consumer (C2C) transactions (e.g. eBay, flea.com), as well as for business-to-business (B2B) transactions (e.g. RetailExchange.com). It is generally argued that the success of B2B e-commerce is due to significant advantages B2B e-marketplaces offer to participating firms relative to the traditional B2B markets.

Business-to-business e-marketplaces are classified according to several criteria in e-commerce literature. Popovic (2002) classify B2B e-marketplaces according to their ownership structure and their industry focus. In terms of industry, a B2B e-market is characterized "vertical" when is specified in a specific industry or industry segment, and "horizontal" when it offers services across multiple industries. In terms of ownership structure, there is a classification "independent" (or "third-party") and "dependent" (or "consortia") B2B marketplaces. The third-party marketplaces (e.g. Citadon) are owned and managed by independent entities who are neither sellers nor buyers. In contrast, consortia e-marketplaces (e.g. Covisist) are built by a small number of industry agents (buyers or sellers), usually leaders that dominate their respective industries. Especially in the first wave of B2B e-commerce, the majority of e-marketplaces were created by independent firms like venture capitalists or technology firms. This trend still exists with the vast majority of them having vertical industry focus and being owned by third-parties (Popovic, 2002).

Regardless of the ownership structure, the B2B e-marketplaces are characterized by the existence of indirect network effects, i.e. participating buyers expect higher utility in e-markets that house many suppliers and vice versa. This feature combined with the presense of an intermediary, categorizes e-marketplaces as two-sided markets. As Evans (2003) defines them, two-sided markets are characterized by the combination of three main features: first, the presence of two distinct categories of agents (here buyers and sellers); second, the existence of positive indirect network effects; third, the agents' inability to internalize these indirect benefits efficiently and, thereby, the scope for intermediation. Such multi-sided systems[1] usually present complicated network externalities among the large number of participating agents (in e-marketplaces we have three kinds of agents: buyers, sellers, intermediaries). As Katsamakas and Bakos (2004) mention "…many aspects of these networks are not well understood, such as the determinants of participants' benefits, the implications of actions by the intermediary, and how the value created by the network is allocated between the two sides and the intermediary".

Modern Internet B2B e-marketplaces are open systems, offering many advantages to participating firms, either buyers or suppliers, such as reduction in transaction and communication costs, variety of suppliers/ buyers, several transaction mechanisms (exchanges, catalogs, auctions, etc), services that lead to more efficient supply chain management, finance services, etc. Many researchers categorize the services that e-markets' owners offer to participating firms. Bailey and Bakos (1997) synopsize intermediary's services in aggregation of buyer demand and suppliers' products, enhancing trust between participants, market facilitation, and matching buyers and suppliers. More modern classifications in intermediaries' services focus less on their aggregation and matching nature and put more emphasis on the value-added nature of the services (Kaplan and Sawhney, 2000; Wise and Morrison 2000). Bhargava and Choudhary (2004) classify intermediary services into two categories: matching services, that facilitate establishment of a buyer-seller agreement, and value-added services that provide additional value to participants[2]. Obviously, the value-added services are less connected with the "liquidity" of the e-marketplace, i.e. the increased number of firms from the demand and supply side of the market. Bhargava and Choudhary (2004) further distinguish two kinds of value-added services: standalone and enhanced matching services. In this research we focus on a kind of standalone services because they are more related with the effectiveness of the e-marketplace and can be easily connected with the reduction in transaction cost firms benefit in an electronic platform.

The aim of this paper is to investigate the firms' strategic interaction

[1] Besides e-marketplaces, characteristic examples of two-sided markets are credit cards, advertising in media markets, pricing complementary software products and competing offline marketplaces.

[2] Matching services could be listing, price discovery, and matching of buyers and sellers, while value-added services refer to workflow coordination, transaction management, industry reports, account management, etc.(Bhargava and Choudhary, 2004)

and the intermediary's pricing and investment strategy in an e-marketplace which competes with a traditional B2B market. We develop a theoretical model that corresponds to a scenario where an intermediary creates an independent, vertical B2B e-marketplace in an existing two-tier industry. Before the creation of the e-market, downstream and upstream firms (buyers and suppliers) in the industry transacted only with traditional means (traditional market). The scope of the intermediary is to attract in his platform a proportion of firms from both sides of the industry in order to maximize its profits. The intermediary extracts revenues by imposing membership fees to firms that move from traditional to electronic market. In order to attract a number of firms, the intermediary should invest so as to offer specific standalone, value-added services to participating firms. These services are strongly connected with the quantity exchanged in the electronic platform. The proposed setting allows us to address, among others, the following questions: Which is the optimal pricing strategy for an intermediary who creates an e-market in an existing industry? How does the investment strategy affect the participation of buyers and suppliers in the e-market, and how this strategy is related with intermediary's pricing behavour? How does the structure of the industry affect owner's decisions and vice versa? In which side of the market the intermediary should impose higher membership fees or offer more services?

The analysis suggests that the intermediary's optimal pricing policy can include the imposition of membership fees to both sides of the industry, and not subsidizing the participation of firms in the e-market. The investment decisions of the intermediary are strongly related with his pricing behaviour, since higher level of investments allow the intermediary to impose higher membership fees. The investment level will be greater for the side of the market with the larger number of firms, while in case of an industry with more downstream firms the demand side has to pay relatively higher membership fees comparing to supply side. It is also suggested that because of the existence of several kinds of network externalities, the intermediary's main objective is not the attraction of all (or the majority of) the players in the industry in order to create the higher possible liquidity in the e-market. Under specific market conditions, the intermediary can gain maximum profits by allowing a relative small proportion of buyers and sellers to join the e-market.

Contribution

This paper is related to several strands in the literature of network externalities, two-sided-markets and e-commerce in general. Although there is an extensive literature that focuses on economics networks appear only direct network effects, that is on networks with a single type of participants whose benefits accruing to an additional agent[3] (e.g. Katz and Shapiro 1985; Economides 1996), the literature on two-sided systems is relatively new. Rochet and Tirole (2004) propose a useful and general introduction for the two-sided market literature.

A part of two-sided markets' literature investigates the pricing behaviour of market owners. Contributions to this direction in case of internet platforms are given by Rochet and Tirole (2003), Evans (2003), Caillaud and Jullien (2003), Yoo et. al. (2003), Dai and Kauffman (2003), Armstrong (2004), Katsamakas and Bakos (2004), Julien (2004), Nocke et. al. (2004), Bhargava and Choudhary (2004), and Sulzle (2005)[4]. These research works investigate how the intermediaries' pricing policy is affected by several two-sided aspects, such as the single or multi-homing of buyers and sellers in e-marketplaces, the strength of positive and negative network effects, the product differentiation in intermediary's services, etc. Some of them focus on the impact of the ownership structure of e-market on the optimal strategies of agents (e.g. Katsamakas and Bakos, 2004; Yoo et. al., 2003).

Therefore, this literature follows similar formulation and approaches for modeling utility functions of the agents under network-related benefits. Specifically, general valuation functions of type $a + b{\cdot}N$ are used, where a usually represents an ad hoc (exogenous) benefit gained by the participation in e-market and bN represents a benefit due to the network (b is the strength of the network effect and N the number of agents). In such settings the major pricing instrument for e-platform owners is the membership fee, which appears in the utility function of buyers and sellers as a fixed cost (e.g. $-p + a + bN$). In some cases (e.g. Julien 2004) a kind of two-part addictive valuation that considers also fixed transaction fees is adopted. Nevertheless, this kind of approache presents the benefits of participants in a B2B e-market in a very stochastic form, which from one hand facilitates the analysis of network externalities but from the other hand does not allow further analysis in the participants' strategic decisions, like the level of produced quantity. Contrary to this, the model developed in this paper follows a more traditional economic formulation which incorporates the quantities of inputs-outputs

[3]Examples of such networks are telecommunications networks and software application networks

[4]A more extended presentation of this kind of research is given in Kourgiantakis and Mandalianos (2007).

that are exchanged through the e-marketplace. In this manner, important strategic decisions of participating firms and the intermediary can be determined endogenously.

There are a few research papers in the e-marketplace literature, that use a similar to ours setting, however they do not address the same questions as we do. Belleflamme and Toulemonde (2004) develop a theoretical model that examines two-sided aspects of an independent B2B e-marketplace, endogenizing both buyers' and suppliers' payoffs but excluding from the analysis intermediary's investment policy, and so the authors by-pass "effectiveness" aspects of an emerging e-market. In addition, they focus only on the optimal strategy of the intermediary regarding the side of the market that should be attracted first and examine commissions as an alternative pricing tool for the intermediary. Similar models for the analysis of e-marketplaces are given in Kourgiantakis and Petrakis (2006a; 2006b) but these models do not examine the competition among traditional and electronic markets. Finally, another example of a similar setting, which however address different questions, is Milliou and Petrakis (2004), who investigate buyer-firms' incentives to join a public e-marketplace or to create a private B2B electronic network.

The rest of the paper is organized as follows. The next section presents our model. Section 3 includes the analysis and particularly it investigates buyers and suppliers strategic decisions, depending on whether the participate or not in the e-marketplace, as well as the intermediary's pricing and investment policy. Finally, concluding remarks are included in Section 4.

2 The Model

Consider a two-tier industry consisting of N_b downstream firms – final good producers and N_s upstream firms – input suppliers. The upstream, as well as the downstream firms are identical. The upstream firms (suppliers) produce a homogeneous input and the downstream firms (buyers) produce homogeneous final goods, transforming one unit of input into one unit of final good. Transactions between the two sides of the market could take place either in the traditional market or in a vertical B2B e-marketplace. We assume single-homing, i.e. buyers and suppliers can participate and transact only in one platform, traditional market or e-market, but not in both of them. A number of buyers n_b, ($n_b \leq N_b$), and thus of suppliers n_s, ($n_s \leq N_s$), can participate in the electronic platform and thus benefit by enjoying lower transaction costs. The reduction in transaction costs is expressed by parameters r_b and r_s, which correspond to the benefit buyers and suppliers gain respectively for every unit of input exchanged in the e-market.

The e-marketplace is owned by an independent intermediary, who does not own or price the goods or services exchanged in the e-market; he only provides services to facilitate buyers-suppliers interactions. The intermediary is a profit maximizer and the price instruments he uses are the membership fees p_b and p_s charged to every participating buyer and supplier respectively. In this setup no firm will join the e-marketplace if it has no extra benefit from its participation. Hence, the proportion of buyers and suppliers joined the e-marketplace is zero ($n_b = n_s = 0$) when there is no participation benefit for buyers and suppliers ($r_b = r_s = 0$).

The utility of the representative consumer is given by the quasi-linear function:

$$U\left(q_1, q_2, .., q_3\right) = \sum_{i=1}^{N_b} a q_i - \frac{1}{2}\left(\sum_{i=1}^{N_b} q_i^2 + \sum_{i=1}^{N_b}\sum_{j=1}^{N_b} q_i q_j\right) - \sum_{i=1}^{N_b} p_i q_i + m_e \quad (1)$$

The variable q_i denotes the quantity of the downstream firm i's product, $i, j = 1, 2, \ldots, n_b$, $i \neq j$, while m_e represents consumer's expenses on the rest of the goods. The above utility function implies that each consumer spends only a small part of his income on the products of the specific industry. Hence, income effects on this industry can be ignored and a partial equilibrium analysis can be applied.

The solution of the utility maximization problem of the representative consumer leads to the inverse demand function faced by each downstream firm i, $p_i = a - q_i - Q_{-i}$, where $Q_{-i} = \sum q_j$ denotes the aggregate output produced by its rivals. The aggregate output Q produced by all downstream firms is the sum of the quantity Q^e produced by the buyers participating in the e-market and the quantity Q^t produced by these buyers remaining in the traditional market: $Q = Q^e + Q^t$. Hence, the aggregate output produced by its rivals Q_{-i} is given by $Q_{-i} = Q^e_{-i} + Q^t$ for buyers participating in the e-market and $Q_{-i} = Q^t_{-i} + Q^e$ for buyers in the traditional market.

Assuming negligible transformation costs, a typical downstream firm (buyer) in the traditional market faces a variable cost stemming from the input price w, charged by the upstream firms. We assume that buyers in the e-market can face a lower input price, $w - k$, due to the fact that the e-market offers to its participating suppliers cost reduction that allows them to impose a lower input price than the suppliers in the traditional market. Without loss of generality, parameter k can take values from 0 to r_s and of course, smaller than w ($k < w$). The buyers in e-market have also to pay an entry fee p_b, charged by the e-market owner.

Given that buyer i in the e-market produces q_i^e quantity of output, while buyer i in traditional market produces q_i^t, the buyers' profit functions in traditional and electronic market are given respectively by:

$$\Pi_{bi}^e = -p_b + q_i^e(a - q_i^e - (Q_{-i}^e + Q^t) - (w - k) + r_b), \qquad i = 1, 2, ..n_b \quad (2)$$

$$\Pi_{bi}^t = q_i^t(a - q_i^t - (Q_{-i}^t + Q^e) - w), \qquad i = n_b + 1, ..., N_b \quad (3)$$

where superscripts e and t indicate buyers in the e-market and the traditional market respectively.

All the upstream firms (suppliers) compete by adjusting their quantities simultaneously and independently (Cournot competition). Since there is one-to-one transformation of input to output, the total quantity of the outputs (Q) is equal to the total quantity of the input (X). Moreover, single-homing implies that the total quantity of the output from buyers in the e-market (Q^e) is equal to the total quantity of the input sold by suppliers in the e-market (X^e) and the total quantity of output from buyers in the traditional market (Q^t) is equal to the total quantity of the input sold by suppliers in the traditional market (X^t). Every supplier l ($l = 1, 2, 3, \ldots, n_s$) sells x_l^e quantity of input if it participates in the e-market and x_l^t if it remains in the traditional market. Like the buyers, also suppliers in the e-market face a fixed entry fee p_s. In this way, the profits of each upstream firm l, $l = 1, 2, 3, \ldots, n_s$, in the electronic and traditional market are respectively given by:

$$\Pi_{sl}^e = -p_s + x_l^e(w - k + r_s), \qquad l = 1, 2, 3, \ldots, n_s \quad (4)$$

$$\Pi_{sl}^t = x_l^t \; w, \qquad l = n_s + 1, ..., N_s \quad (5)$$

Finally, the intermediary extracts revenues by both suppliers and buyers, using entry (membership) fees (p_b, p_s) for their participation in the e-marketplace. Assuming negligible maintenance costs for the operation of the e-market, the only cost for the intermediary is the investment in the proper technology that will provide to participating buyers and suppliers the benefits r_b and r_s respectively. We express this cost as an increasing stricty convex function of type $z\, r_d^2$ ($r > 0$, $d = b, s$). The parameter z represents the effectiveness of intermediary's investment technology. A higher z implies that to provide a given cost reduction r_b and r_s for buyers and suppliers respectively, the intermediary has to incur higher costs. Hence, higher z denotes a less effective e-marketplace, *ceteris paribus.*

A consequence of all the above is that the profit function for the intermediary is:

$$\Pi_I = p_b\, n_b \;+\; p_s\, n_s \;-z\, r_b^2 \;-z\, r_s^2 \tag{6}$$

We consider a four-stage game. In particular, the sequence of events is as follows:

Stage 1: The Intermediary sets membership fees (p_b, p_s) for buyers and suppliers participating in the e-marketplace. These prices are public information and all downstream and upstream firms have perfect information about the intermediary's decisions.

Stage 2: Buyers and suppliers select one transaction platform, that is the traditional market or the e-marketplace.

Stage 3: All the input suppliers (in both traditional and electronic markets) compete in the upstream market by setting their quantities simultaneously and independently.

Stage 4: All the downstream firms (in both traditional and electronic markets) buy their inputs from suppliers, transform them into final goods and compete in the downstream market by setting their quantities simultaneously and independently.

We use subgame perfection as the equilibrium concept and solve the game by backward induction.

3 Analysis

3.1 Strategic decisions for upstream and downstream firms

In the last stage of the game, downstream firms in both platforms decide simultaneously and independently their level of final goods quantity. In the e-market, each buyer chooses the quantity q_i^e in order to maximize its (gross) profit given in eq.(2), and simultaneously each buyer remaining in traditional market chooses q_i^t in order to maximize its profit given in eq.(3). Applying first-order conditions (foc), and solving the system of equations, we get the following level of quantity produced by each buyer in the e-market (superscript e) and the traditional market (superscript t) respectively:

$$q_i^e = \frac{a + (N_b - n_b + 1)\ (k + r_b) - w}{1 + N_b} \tag{7}$$

$$q_i^t = \frac{a - \ n_b\ (k + r_b) - w}{1 + N_b} \tag{8}$$

The above expressions show that not only in the traditional market, but also in the e-market, buyer i's output is decreasing with the number of buyers in the e-market (higher n_b). The latter indicates that our setting takes into account the negative externalities that two-sided markets, like e-markets, usually present. Negative externalities or negative direct network effects refer to situations where the benefits accruing to an agent of one category decrease as the pool of members from the same category enlarges. In addition, eq.(7) and (8) reveal that online buyers will produce more output than the offline buyers, since $q_i^e - q_i^t = k + r_b$, which is always positive (k, $r_b > 0$).

Then in the e-market and the traditional market, the equilibrium aggregated output and firms' (gross) profits are respectively:

$$Q^e = \ n_b\ \frac{a + (N_b - n_b + 1)\ (k + r_b) - w}{1 + N_b} \tag{9}$$

$$\Pi_{bi}^e = -p_b\ + \frac{(a + (1 + (1 - m)\ n_b)\ (k + r_b) - w)^2}{(1 + n_b)^2} \tag{10}$$

$$Q^t = (N_b - n_b)\frac{a - \ n_b\ (k + r_b) - w}{1 + N_b} \tag{11}$$

$$\Pi_{bi}^t = \frac{(a - m\ n_b\ (k + r_b) - w)^2}{(1 + n_b)^2} \tag{12}$$

The above expressions show that in the e-marketplace, buyer i's profits (Π_{bi}^e), as well as the aggregate quantity Q^e, are increasing in the discount made by their suppliers, k, and the benefit r_b gained by their participation into the e-marketplace. While they are decreasing in the input price w and the number of buyers in the e-market (higher n_b). In the traditional market, the higher the n_b is, the lower are the buyer's profits and the higher is the aggregate quantity Q^t. The sum of aggregate quantities in two transaction platforms $(Q^e + Q^t)$ leads to the total aggregate output in equillibrium, Q:

$$Q = \frac{N_b(a-w) + n_b\ (k + r_b)}{1 + N_b} \tag{13}$$

which is positively related to the number of buyers participating in the e-market and their gained benefits $(k + r_b)$. From eq.(13) we get the input price w:

$$w = a + \frac{n_b(k + r_b) - (1 + N_b)\ Q}{N_b} \tag{14}$$

In the third stage, all the upstream firms (suppliers) compete by adjusting their quantities simultaneously and independently (Cournot competition). Because of the one-to-one transformation of input to output, the total quantity of the output (Q) is equal to the total quantity of the input (X) and thus eq.(14) gives the inverse demand function faced by the suppliers. Given the aggregate input X and the input price w, a typical supplier in the e-market chooses its quantity x_i^e in order to maximize its profits given in eq.(4), while a supplier remaining in traditional market chooses quantity x_i^t in order to maximize its profits given in eq.(5). The focs of eq.(4) and (5) imply that in a symmetric Cournot equilibrium, each supplier l in the e-market and in the traditional market respectively produces a quantity:

$$x_l^e = \frac{aN_b + k\ (n_b - N_b(N_s - n_s + 1)) + n_b r_b + N_b r_s - N_b n_s r_s + N_b N_s r_s}{(1 + N_b)(1 + N_s)} \tag{15}$$

$$x_l^t = \frac{aN_b + n_b(r_b + k) - N_b n_s(rs - k)}{(1 + N_b)(1 + N_s)} \tag{16}$$

Hence, the total quantity exchanged on each platform (X^e and X^t), as well as the total quantity exchanged in the whole market (on both platforms), X, are equal to:

$$X^e = Q^e = \frac{n_s(aN_b + k\ (n_b - N_b(N_s - n_s + 1)) + n_b r_b + N_b r_s - N_b n_s r_s + N_b N_s r_s)}{(1 + N_b)(1 + N_s)} \tag{17}$$

$$X^t = Q^t = \frac{(N_s - n_s)(aN_b + n_b(r_b + k) - N_b n_s(rs - k))}{(1 + N_b)(1 + N_s)} \tag{18}$$

$$Q = X = X^e + X^t = \frac{aN_bN_s + n_bN_s(k + r_b) + n_sN_b(r_s - k))}{(1 + N_b)(1 + N_s)} \tag{19}$$

As expected, the quantity exchanged in the e-market (Q^e, eq.(17)) increases with the number of participating buyers (n_b) and suppliers (n_s). However, it is quite interesting that Q^e is decreasing in k, i.e. in the discount per quantity provided by the suppliers in the e-market. This fact indicates that k is a parameter that reduces the positive effect of r_s in the supplier's profit function, that is, k reduces the suppliers' incentive to join the e-market. Consequently, the smaller the number of suppliers in the e-market, the smaller the quantity exchanged electronically. This effect of k is also confirmed in eq.(19) which gives the total quantity exchanged in the whole market, Q. Eq.(19) also shows how the intermediary's services (expressed by r_b and r_s) can affect the structure of the B2B market, i.e. they increase the produced quantities in the market.

Substituting eq.(19) and (14) into equations (10) and (11), the buyers' profits in traditional and electronic markets, in equillibrium are:

$$\Pi_{bi}^{e\prime} = -p_b + \frac{(a + (N_b - n_b + 1)(k + r_b) - \frac{aN_b + n_b(k+r_b) - N_bn_s(r_s-k)}{Nb(1+N_s)})^2}{(1 + N_b)^2} \tag{20}$$

$$\Pi_{bi}^{t\prime} = \frac{(a - n_b(k + r_b) - \frac{aN_b + n_b(k+r_b) - N_bn_s(r_s-k)}{Nb(1+N_s)})^2}{(1 + N_b)^2} \tag{21}$$

In the same manner, by substituting eq.(15) and (16) into eq.(4) and (5), we obtain the suppliers' profits in the traditional and the electronic market respectively:

$$\Pi_{sl}^{e\prime} = -p_s + \frac{(aN_b + n_b(r_b + k) + N_b(N_s - n_s + 1)(r_s - k))^2}{N_b(1 + N_b)(1 + N_s)^2} \tag{22}$$

$$\Pi_{sl}^{t\prime} = \frac{(aN_b + k(n_b + N_bn_s) + n_br_b - N_bn_sr_s)^2}{N_b(1 + N_b)(1 + N_s)^2} \tag{23}$$

Equations (20) and (22) show clearly how firms' profits in the e-marketplace are affected by all the parameters of the model. Concerning the liquidity of the e-market, i.e. how the number of participants affects firms' profits, strong negative direct and positive indirect network externallities are observed for both sides of the market participating in the e-marketplace. That is, a decrease in n_b (n_s) or an increase in n_s (n_b) leads to higher profits for buyers (suppliers) in the e-marketplace. On the other hand, the number of buyers (n_b) and suppliers (n_s) participating in the electronic platform affects in an opposite way the profits of firms remaining in the traditional market (eq. (21) and (23)). The latter is expected since the products in both downstream and upstream markets, are perfect substitutes.

Another indicator for the existance of positive indirect network externallities is the fact that buyers' and suppliers' profits in the e-market are increasing in r_s and r_b respectively ($\frac{\partial \Pi^{e\prime}_{bi}}{\partial r_s} > 0$, $\frac{\partial \Pi^{e\prime}_{sl}}{\partial r_b} > 0$). Clearly, higher values of r_b, for instance, attract more buyers in the e-market and more buyers imply a larger market for suppliers, whose willingness to join the e-market increases. Of course, it is also shown from eq.(20) and (22) that the profits of one side of the market are increasing in the benefit the e-market offers to that side ($\frac{\partial \Pi^{e\prime}_{bi}}{\partial r_b} > 0$, $\frac{\partial \Pi^{e\prime}_{sl}}{\partial r_s} > 0$).

The parameter k plays a contradictory role for buyers and suppliers. As stated before, k seems to reduce supplier's incentive to join the e-market ($\frac{\partial \Pi^{e\prime}_{sl}}{\partial k} < 0$), but at the same time it increases buyers' profits ($\frac{\partial \Pi^{e\prime}_{bi}}{\partial k} > 0$) in the e-market.[5]

In the second stage of the game, downstream and upstream firms select a transaction platform, that is, they decide either their transition to the e-marketplace or their stay in the traditional market. Firms decide their participation into the e-market according to the "free entrance" condition, i.e. firms from one side of the market will join the e-market until their profits become equal to those of their competitors remaining in the traditional market. The free entrance conditions for buyers and suppliers are respectively given by the following equations:

$$\Pi^{e\prime}_{bi} = \Pi^{t\prime}_{bi} \tag{24}$$

$$\Pi^{e\prime}_{sl} = \Pi^{t\prime}_{sl} \tag{25}$$

By substituting eq.(20) - (23) and solving the system of the above equations (24) and (25), we obtain the number of buyers and suppliers joining the e-market:

$$n_b(p_b, p_s) = \frac{(2a + r_b + r_s)(r_b + k) + N_b(r_b + k)^2 - p_b(N_b + 1) - \frac{p_s(1+N_b)(k+r_b)}{N_b(r_s-k)}}{2(r_b + k)^2} \tag{26}$$

[5]The role of k is further explored in the next subsection

$$n_s(p_b, p_s) = \frac{N_b(1+N_b+N_bN_s) - \frac{(1+N_b)(1+N_b+N_bN_s)p_s}{(r_s-k)^2} + \frac{N_b(1+N_b)(-p_b+(r_b+k)(2a+r_b+k)}{(r_s-k)(r_b+k)}}{2N_b^2} \quad (27)$$

Lemma 1 The level of membership fees for the one side of the market affect negatively and significantly the participation of the other side to the e-market.

Proof. From (26) and (27), we have that $\frac{\partial n_b}{\partial p_b} < 0$, $\frac{\partial n_b}{\partial p_s} < 0$, $\frac{\partial n_s}{\partial p_b} < 0$, $\frac{\partial n_s}{\partial p_s} < 0$. ■

Lemma 1 indicates different aspects of the e-market's liquidity for participating firms and for the intermediary. Actually, this finding reveals a paradox for the incentives of the intermediary. On the one hand, it is a stylized fact in the literature that the incentive of buyers (suppliers) to participate in an e-market is increasing in the number of joined suppliers (buyers). The lemma confirms the literature, while a high membership fee for suppliers (buyers) decreases their participation in the e-market, and in turn, the incentive of buyers (suppliers) to join the electronic platform is decreasing. Following this pattern, the finding in Lemma 1 shows that the intermediary can not charge very high memberhip fees for both buyers and suppliers, if he wishes great liquidity and success in his e-market.

On the other hand, a profit maximizer intermediary, who has membership fees as the only pricing tool, in order to reach higher revenues will opt for high membership fees and a large number of participants from both sides of the market. According to Lemma 1, an increase in membership fee p_b reduces both n_b and n_s and so it is difficult to determine whether the intermediary's revenues $(p_b n_b + p_s n_s)$ increase or decrease. Even in cases where intermediaries impose fees only to one side of the market and allow free entrance to the other side (e.g. $p_b > 0$, $p_s = 0$), a high level of membership fee do not ensure higher profits and greater liquidity in the e-market. In contrast to the bulk of the related literature, it seems that the liquidity is not the most significant objective for the intermediary and consequently for the success or the economic viability of his e-marketplace. The disputable value of liquidity in e-market from the intermediary's perspective is also refered in a couple of other papers in the recent literature (Belleframme and Toulemonde, 2004; Kourgiantakis and Petrakis, 2006).

3.2 Pricing strategy and investment decisions of the intermediary

In the first stage of the game, the intermediary maximizes its profits by selecting the level of the membership fees imposed to buyers and suppliers participating in the e-marketplace. Taking as given the participating firms' number, the intermediary's profit function (eq.(6)) becomes:

$$\Pi_I = p_b \; n_b(p_b, p_s) + \; p_s \; n_s(p_b, p_s) \; - z \; r_b^2 \; - z \; r_s^2 \tag{28}$$

Substituting equations (26) and (27) into eq.(28) and applying first order conditions, the equilibrium values for membership fees and the intermediary's investments are given by:

$$r_b^* = R_b = \frac{2aN_bN_s + (1+N_b)(kN_b(1+N_s-8z) - 16az)}{8(2+N_b(3+N_b+N_s)) - (1+N_b)(N_b(1+N_s)+64z^2)} \tag{29}$$

$$r_s^* = R_s = \frac{2a(1+N_b)(N_b-8z) + kN_b(1+N_b+N_s+N_bN_s-8N_sz)}{8(2+N_b(3+N_b+N_s)) - (1+N_b)(N_b(1+N_s)+64z^2)} \tag{30}$$

$$p_b^* = \frac{(k+R_b)(2aN_s + (k+R_b)(1+N_b)(1+N_s))}{2\;(1+N_b)(1+N_s)} \tag{31}$$

$$p_s^* = \frac{N_b(2a + (R_s-k)(1+N_s))(R_s-k)}{2\;(1+N_b)(1+N_s)} \tag{32}$$

for any z that fullfills the non-negativity and other constraints for all the outcomes in equillibrium[6,7].

[6] Equillibrium outcome equations suggest some restrictions for parameter z. The non-negativity constraint for the outcomes in equations (29)- (41), as well as the other constraints ($n_b^* < N_b$, $n_s^* < N_s$, $k < r_s$ and $k < w$), suggest that $\frac{\Gamma+0.5(\sqrt{4\Gamma^2-64aN_b(1+N_b)^2(1+N_s)(2a+k(Ns+1))}}{16(1+N_b)(2a+k(Ns+1))} \leq z \leq \frac{N_b\Delta+(\sqrt{N_b^2(\Delta^2+(-32aN_s(2a(N_b+1)+3kN_bN_s)}}{16(2a(1+N_b)+3kN_bN_s)}$

where $\Gamma = k(N_b+1)(N_s+1)(2+N_b) + 2a(3+N_s+N_b(4+N_b+2N_s))$ and $\Delta = 2a((1+N_b+4N_s)+k(7N_s-1+N_b(3N_s-1)))^2$

This restriction will be imposed to the parameter z in the remaining of the analysis.

[7] For simplicity in the analysis and without loss of generality, the equillibrium prices for r_b^* and r_s^* are not substituted as they are in the rest equilibrium outcomes, but they replaced by R_b and R_s respectively.

The first interesting finding from eq.(31) and (32) is that the level of membership fee to one side of the market is independent of the level of the intermediary's investmest for the other side. In eq.(31), for example, it is easily checked that p_b^* depends only on R_b (or r_b^*) and not on R_s. Furthermore, as expected, the level of p_b^* and p_s^* is increasing in the level of the intermediary's investment R_b and R_s respectively (always $\frac{\partial p_b^*}{\partial R_b} > 0$ and $\frac{\partial p_s^*}{\partial R_s} > 0$).

Proposition 1 *: In equillibrium, the intermediary's pricing policy in a vertical B2B e-marketplace includes imposition of membership fees for both buyers and suppliers participating to the platform, as long as* $k < r_s$ *.*

Proof. For any value of parameters n_b, n_s, r_b, r_s, a and k, with $k<r_s$, the prices of p_b^* and p_s^* are always positive (eq. (31) and (32)). For $k \to r_s$, $lim(p_s^*) = 0$. ■

Combined with Lemma 1, Proposition 1 states clearly that when the e-marketplace offers standalones value-added services to both sides of the market, the owner of the platform can certaintly attract a number of buyers and suppliers and extract revenues from both firm's types.

In contrast to the bulk of the e-commerce literature[8], the latter proposition reveals that the intermediary does not have to subsidize the participation of one side of the market in the platform, in order to attract the other side. Of course, the current setting has some different features than other models in the literature: a) It takes into account Cournot competition among agents which endogenizes in a better way the interaction, the network effects and, hence, the strategic decisions in both upstream and downstream market, and b) it assumes that the platform offers specific benefit to one side of the market (e.g. the transaction costs' reduction for buyers r_b) which is not (directly) related with the number of participants of the other side (e.g. suppliers, n_s).

The level of investments that the intermediary sets for buyers and suppliers value-added services in the e-marketplace (r_b^* and r_s^*) are given in eq. (29) and (30) respectively. Besides the fact that both investment levels are affected negatively by the effectiveness of the e-market (z)[9], the following

[8] Belleframme and Toulemonde (2004) support also the finding in Proposition 1, stating that "the intermediary always makes profits and extracts positive fees from both types of firms" in case of an emerging e-marketplace.

[9] The first derivatives of r_b^* and r_s^* in eq. (29)-(30) in respect to z are negative ($\frac{\partial r_b^*}{\partial z} < 0$, $\frac{\partial r_s^*}{\partial z} < 0$). From eq.(31)-(32) it is also proved the negative effect of z in p_b^* and p_s^* ($\frac{\partial p_b^*}{\partial z} < 0$, $\frac{\partial p_s^*}{\partial z} < 0$). Both findings are considered normal since less effectiveness of the e-market (higher z) doesn't allow the intermediary to invest and price lower.

Proposition and analysis reveal a comparison among r_b^* and r_s^* under different market conditions.

Proposition 2 *: The intermediary's investment for the demand side of the market (r_b^*) is greater than the investment for the supply side (r_s^*), when* $N_b > \frac{a(N_s-1)-k((4z-1)(N_s+1))}{a-k(N_s+1-4z)}$.

Proof. From equations (29) and (30) it is easily proved that $r_b^* - r_s^* \geq 0$ when $N_b \geq N_b^{(r)} = \frac{a(N_s-1)-k((4z-1)(N_s+1))}{a-k(N_s+1-4z)}$. ■

The above proposition shows that the intermediary should consider basic feature of the market structure before taking decisions for the allocation of investments in the e-marketplace. The intermediary will make the same investment for buyers and suppliers ($r_b^* = r_s^*$) when the proportion of downstream and upstream firms is equal to $N_b^{(r)}$. Otherwise, the intermediary should invest more to buyers' value-added services when $N_b > N_b^{(r)}$ or to services for suppliers when $N_b < N_b^{(r)}$. Practically, the positive relation between the N_s and $N_b^{(r)}$ ($\frac{\partial N_b^{(r)}}{\partial N_s} > 0$) shows that in a given B2B market with a large number of suppliers (large N_s) and a relative small number of buyers (N_b), the intermediary will invest more to services for the supply side of the market, and vice versa.

The level of $N_b^{(r)}$ also depends on the effectiveness of e-market (z), as well as on the pricing behaviour of online suppliers (k). Ceteris paribus, $N_b^{(r)}$ is increasing in the effectiveness of the e-marketplace ($\frac{\partial N_b^{(r)}}{\partial z} < 0$), i.e. in a given B2B market the lower the effectiveness of the e-market is, the higher is the investment in buyers' services relatively to the suppliers' services. Regarding the impact of the discount from online suppliers in input price (k), the $N_b^{(r)}$ is negatively related with k ($\frac{\partial N_b^{(r)}}{\partial k} < 0$). In the polar case of $k = 0$, $N_b^{(r)} = N_s - 1$, which practically means that the intermediary will invest more to the buyer side when in B2B markets the number of buyers is equal with or greater than the number of suppliers.

The negative relation between $N_b^{(r)}$ and k is a novel finding, since a higher k offers greater utility for buyers (eq.(2)). Hence, it would be reasonable that the intermediary's investment for buyers' services could be lower than the investments in suppliers' services. In general, the role of k is not straighforward. Equations (29)-(32) show that when the intermediary expects that the online suppliers will make a great discount in input price (high k), he selects lower investments and membership fees for suppliers ($\frac{\partial r_s^*}{\partial k} < 0$, $\frac{\partial p_s^*}{\partial k} < 0$) and higher investments and fees for buyers ($\frac{\partial r_b^*}{\partial k} > 0$, $\frac{\partial p_b^*}{\partial k} > 0$). A possible interpretation for the intermediary's behaviour when it facing a higher k is the following: High values of k means lower prices for suppliers' membership fees (lower p_s^*) and this causes a reduction in the intermediary's revenues. The intermediary will try to "prevent" high values for k by investing low r_s^*, since $k < r_s^*$. By retaining the level of k relative small, online buyer's utility becomes smaller and this forces the intermediary to invest more for buyers' services (higher r_b^*). In turn, the latter allows the intermediary to impose higher buyers' membership fees (high p_b^*).

The above results lead also to the following Proposition.

Proposition 3 *When the number of buyers in the industry is greater than $N_b^{(r)}$, the intermediary imposes higher membership fees to buyers than to suppliers.*

Proof. For $k = 0$, $N_b^{(r)} = N_s - 1$ and for this level of the $N_b^{(r)}$, $r_b^* = r_s^*$. By substituting $r_b^* = r_s^* = R$ (or $R_b = R_s = R$) and $N_b = N_b^{(r)} = N_s - 1$ in eq.(31)-(32), the difference between membership fees to buyers and suppliers is positive ($p_b^* - p_s^* = \frac{R(2a+R(N_s+1))}{2N_s(N_s+1)} > 0$). Finding that $\frac{\partial N_b^{(r)}}{\partial k} < 0$, $\frac{\partial p_b^*}{\partial k} > 0$ and $\frac{\partial p_s^*}{\partial k} < 0$, the difference $p_b^* - p_s^*$ becomes bigger with an increase in k, so $p_b^* > p_s^*$ for any $N_b \geq N_b^{(r)}$ and k, ceteris paribus. ■

Propositions 2 and 3 indicate that an intermediary who wishes to create a vertical e-marketplace in an existing industry with more buyers than suppliers, will follow a pricing and investment strategy with higher level of investments and membership fees for the demand side of the market. Nevertheless, it is really hard to reach a clear conclusion on how the intermediary prices firms in industries with a number of suppliers sufficiently larger than the number of buyers.

Given the intermediary's strategy described previously, an interesting question is to determine the number of firms that will choose to participate in the e-marketplace. Substituting eq.(29)-(32) into eq.(26)-(27), the number of upstream and downstream firms participating in the e-market is respectively given by the simplified relationships ($r_b^* = R_b$ and $r_s^* = R_s$):

$$n_b^* = \frac{2a + N_b(k + R_b) + (R_b + R_s)}{4(k + R_b)} \tag{33}$$

$$n_s^* = \frac{2a(N_b+1)+(R_b+R_s)+N_b(R_b+R_s+N_s(R_s-k)}{4(k+R_b)} \qquad (34)$$

From the equilirium values of n_b^* and n_s^*, it is easily shown that the level of investments in buyers' and suppliers' services increases the participation of firms in the e-market. Theoretically, significant high values of R_b and R_s could cause a transition of all firms from the traditional to electronic market. But, high values of R_b and R_s lead to high membership fees p_b and p_s respectively and according to Lemma 1 this reduces the mass of participating firms. In essence, by setting r_b^* and r_s^*, the intermediary selects the number of firms from both sides of the industry in his e-market, which maximizes his profits. The multiparametric nature of relationships in eq.(33)-(34), does not allow us to determine clearly the proportion of online buyers and suppliers in a given industry. Based on comperative statics, it is show that the number of online buyers and suppliers is inceasing in the effectiveness of the e-market ($\frac{\partial n_b^*}{\partial z} > 0$ and $\frac{\partial n_s^*}{\partial z} > 0$), while the reduction of input price from online suppliers (k) has a contradictory inpact. On the one hand, it decreases the number of buyers in the e-market ($\frac{\partial n_b^*}{\partial k} < 0$) and on the other hand, it increases the number of participating suppliers ($\frac{\partial n_s^*}{\partial k} > 0$). The above lead to the following Proposition.

Proposition 4 *In a given industry, independently of the level of k, the number of suppliers will be greater than the number of buyers in the vertical electronic market.*

Proof. For $k = 0$, $n_s^* - n_b^* = 2z/N_b$ which is always positive. Because $\frac{\partial n_b^*}{\partial k} < 0$ and $\frac{\partial n_s^*}{\partial k} > 0$, the difference $n_s^* - n_b^*$ is bigger with an increase in k. ■

In other words, the intermediary will apply a pricing and investment strategy which will attract more suppliers than buyers in the electronic platform. This intermediary's strategy is consistent with the results stated in Propositions 2 and 3. In industries with buyers more than $N_b^{(r)}$, the intermediary imposes relatively high fees to buyers and relatively low fees to suppliers. Hence in that case, high p_b^* (low p_s^*) decreases (increases) the percentage of buyers (suppliers) willing to join the e-marketplace.

We finaly turn our attention to the other outcomes in equilibrium. By substituting eq.(29)-(32), the input price, the intermediary's profits, the profits of buyers and suppliers in the industry, as well as the total quantity and the quantities in traditional and in e-market become in equilibrium:

$$w^* = \frac{2a - (N_s + 1)(R_s - k)}{4(1 + N_s)} \tag{35}$$

$$\Pi^{I*} = \frac{4a(a(A+N_s)+B(R_b+R_s))+(N_s+1)(A^2R_b^2+N_bN_s(R_s-k)^2+A(k^2N_b+2kN_bR_b+2R_sR_b+R_s^2-8(R_b+R_s)z))}{16(1+N_b)(1+N_s)(R_b+k)^2} \tag{36}$$

$$\Pi_{bi}^* = \frac{(DC + 2a(k(1 - N_b(N_s - 2)) + R_b - N_b((N_s - 1)R_b + R_s)))^2}{16N_b^2(1 + N_b)^2(1 + N_s)^2(R_b + k)^2} \tag{37}$$

$$\Pi_{sl}^* = \frac{N_b\ (2a - (N_s + 1)(R_s - k))^2}{16\ (1 + N_b)(1 + N_s)^2} \tag{38}$$

$$X^* = \frac{C(k(N_s - N_b) + E) + 2a(k(N_s - N_b + 2N_bN_s) + E + 2N_bN_sR_b}{4(1 + N_b)(1 + N_s)(R_b + k)} \tag{39}$$

$$X^{e*} = \frac{((2a+C)((k^2-R_bR_s)(N_b(-3+N_b-4N_s))+(N_b+1)R_b^2+R_s(R_b-N_bR_s)+F+k(R_b+R_s+N_b((-1+N_b-4N_s)R_b+(5-N_b+4N}{16(1+N_b)(1+N_s)(R_b+k)^2} \tag{40}$$

$$X^{t*} = -\frac{((2a+R_b+(N_b-4N_s)(k+R_b)+R_s)(C(k+R_b-N_b(R_s-k))+F)}{16(1+N_b)(1+N_s)(R_b+k)^2} \tag{41}$$

where $A = 1 + Nb$
$B = (1 + N_b)(1 + N_s)$
$C = R_b + N_b(k + R_b) + R_s$
$D = (k(1 + N_b(2 + N_s)) + R_b + N_b(R_b(1 + N_s) - R_s))$
$E = N_sR_b + N_bR_s$
$F = 2a(k + 3kN_b + R_b + 2N_bR_b - N_bR_s)$
for any permissible z.

The complexity of the above relationships enforce us to provide a qualititative analysis, and particularly to constrain the analysis in comparative statics. We focus on the role of the parameter k in the agents' profits. An increase in k decreases the intermediary's profit ($\frac{\partial \Pi^{I*}}{\partial k} < 0$) and this may reveal that those profits are more sensitive to buyers' participation in the e-market, since an higher k leads to smaller n_b^* (ceteris paribus). On the contrary, firms' profits in equilibrium are positively related to k. In the case of buyers' profits this is an expected result because higher k means lower input prices $(w^* - k)$ and higher r_b^* for online buyers. On the other hand, the (unexpected) increase of suppliers' profits with k can be hardly explained in detail in the current setting. It maybe that optimal input price w^* given in eq.(35) is the key factor. It is shown that w^* is increasing with k ($\frac{\partial w^*}{\partial k} > 0$), i.e. the suppliers remaining in the traditional market tend to impose higher input prices to offline buyers whenever online suppliers decide to lower input price $w - k$ (for $k \neq 0$). Although they sell less input quantities, the higher w^* increases offline suppliers' profits. Additionally, considering that a higher k decreases p_s^*, i.e. k has also a positive effect on online suppliers' profits, in equilibrium, where the profits of both online and offline suppliers are equal, the final profit level for every upstream firm increases with k.

3.2.1 Numerical Examples

Due to complexity of the investigated system, we provide in this subsection two very simple numerical examples in order to illustrate in an alternative way the findings presented before. Consider a two-tier industry consisting of $N_b = 100$ downstream firms and $N_s = 80$ upstream firms – input suppliers. The inverse demand function faced by each downstream firm has a demand parameter a equal with $a = 100$. Let also assume that the suppliers transit to e-marketplace tend to offer a discount $k = 0.01$ (or $k = 0.1$ in the second example) in input price w that the offline suppliers offer, i.e. the online input price is $w - k$. Finally, taking into account the restrictions for parameter z, we assume the effectiveness of intermediary's investment technology $z = 30$.

For these parameters' values, the equilibrium outputs are given in the following table:

Outcome	*Equilibrium Value* (k=0.01)	*Equilibrium Value* (k=0.1)
r_b^*	1.45	1.52
r_s^*	1.25	1.21
p_b^*	2.50	2.89
p_s^*	2.29	1.97
n_b^*	$\simeq$ 59	56
n_s^*	$\simeq$ 61	66
w^*	0.30	0.34
Π^{I*}	178.45	179.82
Π_{bi}^*	0.14	0.0025
Π_{sl}^*	0.09	0.11
X^*	99.55	99.44
X^{e*} / X^{t*}	92.90 / 6.65	88.34 / 11.11

These results show that the proportion of total quantity in the industry semming from online firms is extremely larger than the quantity produced in the traditional market ($X^{e*} >> X^{t*}$). It is also shown that the intermediary applies a pricing policy that includes positive membership fees for both sides of the market. In the above examples, the number of buyers in the industry ($N_b = 100$) is larger than the number of suppliers ($N_s = 80$) and as Proposition 2 and 3 states, the intermediary invest more to services for the demand side ($r_b^* > r_s^*$) and at the same time it imposes higher membership fees to this market side ($p_b^* > p_s^*$). Concerning the impact of k, the differences in outcomes' values in the two last column of the table, confirm the analysis undertook in the Section 3.2. For instance, higher k leads to higher values of r_b^*, p_b^* and lower values of r_s^*, p_s^*.

Finally, the numerical examples show clearly another important finding of our analysis about the disputable value of liquidity in the e-marketplace for the intermediary. Note that in the first example where $k = 0.01$, the intermediary applies such strategies that allow the entrance of 59 (out of 100) buyers and 61 (out of 80) suppliers in its e-market, while in the second example with $k = 0.1$ the respective numbers increases to 56 and 66. In other words, these results reveal that the intermediary's main objective is not the attraction of all (or the majority of) the players in the industry in order to create the higher possible liquidity in the e-market and consequently to gain higher profits. Under specific market conditions, the intermediary can gain maximum profits by allowing small proportions of buyers and sellers to join the e-market.

4 Concluding Remarks

The aim of this paper is to investigate the strategic behaviour of all the agents in the framework of a vertical B2B e-marketplace which may emerge in an existing two-tier industry. We model this using two discrete groups of both downstream and upstream firms (offline and online agents) and an independent intermediary who creates the e-marketplace. The analysis is grounded on the assumption that the intermediary should invest in specific stand-alone services for participating buyers and suppliers. These value-added services are strongly connected with the quantity exchanged in the electronic platform. Furthermore, the intermediary has the ability to extract revenues using membership fees as its only pricing tool.

The analysis of the proposed model confirms the existing literature in that e-marketplaces are complicated systems with strong direct and indirect network effects, which should be taken under consideration by all participating agents (buyers, sellers and intermediary) on their strategic decisions.

The iIntermediary's investment and pricing strategies are strongly interelated and in such a way that the higher the investments are, the higher are the imposed membership fees. This fact creates a contradictory picture, since higher investments attract more firms in the e-marketplace but high membership fees affect negatively firms' participation. In essence, the latter phenomenon disputes the value of "liquidity" in the e-market, at least from the intermediary's point of view.

The optimal pricing policy of the intermediary includes the imposition membership fees to both sides of the industry, and not subsidization for the participation of firms in the e-market. The investment level will be greater for the side of the market with the larger number of agents, while in case of an industry with more downstream firms the demand side has to pay higher membership fees relatively to the supply side.

We are aware that the undertaken analysis has several limitations and could be extended towards various directions. In future work, it would be valuable to relax the assumption of single homing, i.e. to investigate cases where firms can join more than one transaction platform. In addition, the case where two or more e-marketplaces compete with each other, while competing with traditional market as well, could be investigated (in both single-homing and multi-homing pattern). The analysis of intermediary's pricing or investment policy under different kinds of e-marketplaces (e.g. buyer-driven e-markets) or different transaction mechanisms for buyers and sellers (e.g. auctions) could also contribute to the relevant literature, as well as in revealing the strategic aspects of real B2B e-marketplaces in practice.

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