Horizontal versus Vertical Electronic Business-to-Business Marketplaces

Henseler, Marco

Institute of Economics and Law, Department of Microeconomics and Spatial Economics, University of Stuttgart

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Marco Henseler†

University of Stuttgart

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Abstract

This paper analyzes the behavior of horizontal B2B marketplaces along the supply chain in case a vertical intermediary tries to enter by attracting industry-specific buy-side and sell-side firms.
It will be shown that an entrant can only integrate all firms along the vertical production chain in case the industry is strong buy-side dominated. For the remaining scenarios we will determine different levels of integration for buy-side and sell-side dominated branches, in which firms from upper stages will stay at the incumbent. Moreover, we will show that horizontal marketplaces for MRO and other simple goods will be driven out of the market in any case.

JEL-classification: C78, L13, L22, L86
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†Institute of Economics and Law, Department of Microeconomics and Spatial Economics, University of Stuttgart, Keplerstr. 17 70174 Stuttgart, Germany, email: henseler@ivr.uni-stuttgart.de

1 Introduction

So far the impact of internet services has sustainable influenced on the process of making economic decisions, especially by overcoming spatial distances, which has been often described as the 'death of distance'. Even if electronic networks offer the infrastructure to interconnect market-participants, only intermediary services can create a *cyberhome* for suppliers and buyers. In this context we differentiate in business-to-consumer (B2C) solutions, like *ebay*, and the rather unknown business-to-business (B2B) marketplaces, which we will focus on in the following. Therefore, it is worth mentioning that the majority of e-commercial transactions are being made between enterprises. In 2002 B2B represented almost 93% of all e-commerce and accounted for more than 16 per cent of all commercial transactions between firms in the United States (UNCTAD, 2004). Other studies estimate the portion of B2B transactions at 70% to 85% of total e-commerce (Milliou and Petrakis, 2004).

These numbers give a first impression of the great importance of electronic business-to-business intermediary services and stress the significance of analysis within the wide range of competing platforms. Therefore, platforms can be grouped along their ownership-structure in independent and collaborative marketplaces, where a consortium of participating firms from one market-side runs the platform. Additionally, we can distinguish horizontal and vertical marketplaces, where the distinctive mark refers to a platform's target. Vertical marketplaces are primarily industry focused, serving a particular branch, and are often established along traditional industry segments, like the automotive or the computing and electronics industry (Popović, 2002). One example for the automotive industry is *supplyon.com*, where manufacturers, distributors, first and second tier suppliers, buyers and development engineers can bargain. On the other hand, horizontal marketplaces are multi-industry and deal in indirect materials and services across industries. Initially, these marketplaces dealt in so called MRO goods (maintenance, repair and operations), meanwhile, horizontal platforms can even be found for construction materials or human resources services, like *employease.com*.

So far, most of economic literature concerning competing platforms has neglected these differentiations and usually assumed one independent monopolistic –vertical or horizontal– marketplace challenged by a single entrant (See Armstrong, 2005; Caillaud and Jullien, 2001; Rochet and Tirole, 2003).[1] In this approach, we will emphasize the vertical and horizontal relationship between independent marketplaces in particular. Therefore, we will especially concentrate on the question if vertical platforms deter horizontal interme-

[1] Exceptions are Belleflamme and Toulemonde (2004), who stress the vertical target in particular, Suelzle (2004) examined a scenario of different ownership structures, whereas Milliou and Petrakis (2004) analyzed a firm's incentive to create a private B2B e-marketplace.

diaries, as it has often been forecasted (Bogaschewsky and Mueller, 2002; Roland Berger Strategy Consultants, 2001). Thus we will examine an ideal typical environment with one monopolistic horizontal intermediary on each stage of the supply-chain and a vertical challenger, that tries to enter by attracting market participants from one branch along this chain.

There is considerable literature on business-to-business platforms which deal with the impact of two-sided (or multi-sided) markets. Rochet and Tirole (2003) analyze monopolistic and competing platforms, considering the matching process between buyers and sellers as given and surpluses from trade differing for each firm of the same type. In this context, they determine price setting for profit-maximizing platforms and *'not-for-profit cooperatives'* and compare these results with monopolistic and welfare-maximizing price structures. Belleflamme and Toulemonde (2004) examine the incentive of an independent, so called third-party intermediary to launch a new vertical B2B marketplace in a scenario of a platform's emergence, where buyers and sellers are previously 'unattached' and examine the more typical situation of a market entry. On this occasion, they aim at a negative competition effect that arises from an increasing number of identical agents and contrast this with the traditionally stressed positive network effect from the two-sided nature of marketplaces. Besides monopolistic and competing intermediaries for different pricing schemes, like group specific access fees, uniform prices, and a two-part tariff, Armstrong (2005) focuses on 'competitive bottlenecks', where one market-side can register to different platforms *('multi-home')*. Most in common to our paper are Caillaud and Jullien (2001, 2003), analyzing the entrant's strategy to avoid being deterred by the incumbent platform for independent marketplaces. Since they only deal with a positive network effect, the two-sided nature presents a 'chicken & egg' problem for the new intermediary, as the entrant should have a large base of registered sellers to attract buyers and vice versa. Therefore, they introduce a strategy of 'divide & conquer', the entrant trying to attract firms from one market-side by subsidies recovering the loss on the other side. In contrast to Rochet and Tirole they stress the matching process between buy-side and sell-side firms and deal with different scenarios of exclusive registration *('single-home')* for access and transaction fees. Furthermore, they give an approach of *'multi-homing'*. Suelzle (2004) modified this framework for a situation of an independent incumbent and a collaborative entrant, entering the market if the number of firms belonging to the consortium is sufficiently great. In this approach we will adopt a few basic assumptions by Caillaud and Jullien as well, however, we will only investigate the case of independent platforms for an exclusive registration and an access pricing structure.

The rest of the paper proceeds as follows. Section 2 presents the assumptions of our model. Section 3 shows the benchmark model of horizontal marketplaces in an ex-ante scenario. In Section 4 we analyze the behavior of competing intermediaries in case a vertical marketplace trying to enter.

Finally, Section 5 briefly concludes.

2 The Model

Creating a horizontal environment, we assume two different branches α, β, where all sell-side firms S and buy-side firms B belong to. Therefore we get four different groups of firms, each one consisting of a continuum of mass 1 and an entirely homogenous population of firms. Then each firm tries to find a matching partner on the other market-side, which is only possible by registering to an electronic intermediary, moreover, trade can only take place within the same industry. In the case of a perfect match the overall-trading surplus is 1, with b^B, b^S being the shares of agents B, S on the assumption that these shares cannot be equal, i.e. $b^B \neq b^S$ and $b^B, b^S \neq 0$. If no matching partner can be found profits are zero.
Ex ante there exist n horizontal monopolistic intermediaries I_N ('Incumbent') along the vertical production chain, labeled $N = 1, \ldots, n$ with $n \geq 3$, on which firms from both industries bargain. With the exception of the last stage, each buy-side firm becomes a sell-side firm on the next stage. The new vertical platform E ('Entrant') now intends to attract firms from both market-sides but only from the specific industry α. On this occasion, all intermediaries compete in access prices $P_k = \{p_k^B, p_k^S\}, k = I_N, E$ which can be negative representing a subsidy. The marginal costs of running an electronic marketplace are constant and assumed to be zero, participating firms will not have additional costs except for access prices. Then, on each single stage the (expected) profit for an agent i out of branch μ, with $i,\ j = \{B, S\}\ i \neq j$ and $\mu,\ \lambda = \{\alpha, \beta\}\ \mu \neq \lambda$, consists of the proportional share of participating firms from the other market-side[2], the own share from trade and the access price that has to be paid for registering at k, i.e. $\pi_k^{i,\mu} = x_k^{j,\mu} \cdot b^i - p_k^i\ \forall i, \mu$. Due to a lack of reputation, buy-side firms have to observe –as a necessary condition for their own participation– that sell-side firms have been already registered with E on the same stage. Moreover, sell-side firms will only register with E after having had positive experience as a buy-side firm with the entrant, which is related to a higher profit at E.[3] This induces that a vertical marketplace has to attract firms from both market-sides on the previous stage to get the chance of integrating firms from the next stage. But even if E tries to capture all firms of branch α, the entrant will also run a non completely-vertical integrated platform whenever profits are non-negative, which prevents free-riding by incumbents on lower stages. Additionally, firms will choose the incumbent in case profits are non-negative and identical at

[2] This share gives the probability to find a matching partner, which represents the positive network effect on two-sided markets.

[3] As sell-side firms on $N = 1$ will never be able to bargain on the other market-side, these firms will only decide along their profits.

both intermediaries E, I_N. Furthermore, agents have positive beliefs in I_N concerning the participation of firms from the other market-side whenever it is rational for them to do so.[4]
In the following we will analyze the behavior in a multistage-game: first the entrant sets access prices, whereon the incumbents will react sequentially in the following periods using the same pricing instrument. Finally, buy-side and sell-side firms will opt for a platform in the same order.

3 Ex ante Case

In a scenario with n horizontal monopolist intermediaries along the supply chain, platforms will sequentially set access prices, starting on stage $N = 1$. Hence, buy-side and sell-side firms have the choice between staying out of the market or doing trade on their appropriate markets. With positive beliefs, all firms will register to their platforms as long as overall profits do not become negative. Therefore, an intermediary does not only try to capture the surplus of participating firms on its stage, it will also try to include the gains from buying goods on the previous stage in the case of sell-side firms and the expected sell-side profits from buy-side firms on the next stage, if $N-1$ and/or $N+1$ exist. Figure 1(a) gives a graphic overview for $N = 2$.
Consequently, before any platform can observe prices of other marketplaces, each intermediary's pricing strategy can be formulated for buy-side firms as

$$p^B_{I_j} = b^B_j + b^S_{j+1} = 1, \;\; p^B_{I_n} = b^B_n \tag{1}$$

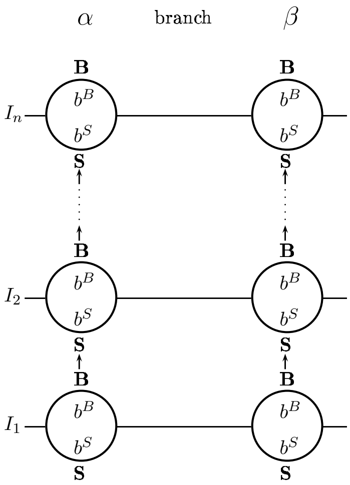
and for sell-side firms as

$$p^S_{I_j+1} = min\{b^B_j + b^S_{j+1} - p^B_{I_j}, b^S_{j+1}\}, \;\; p^S_{I_1} = b^S_1 \tag{2}$$

with $j = 1, \ldots, n-1$ and $b^i_1 = b^i_2 = \ldots = b^i_n = b^i \; \forall i$, in which $p^S_{I_j+1} \leq b^S_{j+1}$ guarantees the participation of a sell-side firm, whenever such a firm was registered as a buy-side firm on the previous stage.[5] Anticipating the behavior of the following intermediaries, conditions (1) and (2) lead to access prices given in figure 1(b).
Apparently, the entry deterrence of a vertical intermediary is most expensive for the monopolist on $N = 1$ and relatively cheap on the last stage $N = n$, as profits from industry β can always be realized.

[4]Without the assumption of positive or negative beliefs, there are two Nash-equilibriums where all or no firms will participate. Thus only positive beliefs guarantee –even in the case of positive access prices– the first equilibrium, whenever profits are non-negative.
With negative beliefs, firms would only register when access prices are non-positive. Hence, intermediaries' profits would become zero or surplus could only be acquired by transaction fees, which will be excluded in our framework so far.

[5]Since losses can be compensated as a sell-side firm on $j+1$, an access price $p^B_{I_j}$ can be greater than a buy-side firm's share b^B on stage j.



(a) Horizontal platforms

Access prices	Profit per branch
$p^B_{I_n} = b^B_n$ $p^S_{I_n} = 0$	b^B
$\vdots$	1 $\vdots$
$p^B_{I_2} = b^B_2 + b^S_3$ $p^S_{I_2} = 0$	1
$p^B_{I_1} = b^B_1 + b^S_2$ $p^S_{I_1} = b^S_1$	$1 + b^S$

(b) Price-Setting

Figure 1: Monopolistic intermediaries

4 Competing intermediaries

Using the instrument of access prices we will start on the last stage $N = n$, on which I_n reacts on $E's$ access prices and additionally on the behavior of all other horizontal marketplaces which were also stimulated by $E's$ pricing strategy.

Assuming that E attracted all sell-side and buy-side firms on all previous stages, I_n intends to defend its market-share by being more attractive for buy-side and sell-side firms on $N = n$ in branch α by offering a non-lower profit. Due to their participation ex ante, it is always rational for buy-side firms and sell-side firms to expect $x^S_{I_n} = 1$ and $x^B_{I_n} = 1$, respectively. Therefore, $\pi^{B,\alpha}_{I_n} \geq \pi^{B,\alpha}_{I_n}$ yields $p^B_{I_n} \leq p^B_E + b^B$, which leads together with $p^B_{I_n} \leq b^B$ to

$$p^B_{I_n} \leq min\{p^B_E + b^B, b^B\}. \quad (3)$$

Combining $\pi^{S,\alpha}_{I_n} \geq \pi^{S,\alpha}_{I_n}$ with $p^S_{I_n} \leq 1 - p^B_E$ and $p^S_{I_n} \leq b^S$, which corresponds to condition (2), yields for the other market-side

$$p^S_{I_n} \leq min\{p^S_E + b^S, b^S, 1 - p^B_E\}. \quad (4)$$

If conditions (3) and (4) hold, it is rational to assume that all firms on stage n from industry α will not register with marketplace E, i.e. $x^{i,\alpha}_{I_n} = 1\ \forall i$. Because of lacking alternatives and facing a non-negative profit at I_n, all the other firms from industry β will register with the horizontal marketplace, i.e.

$x_{I_n}^{i,\beta} = 1\ \forall i$, and so the incumbent's profit can be formulated as

$$\pi_{I_n} = 2 \cdot (min\{p_E^B + b^B, b^B\} + min\{p_E^S + b^S, b^S, 1 - p_E^B\}). \tag{5}$$

Whenever E was not able to capture buy-side firms on $N = n-1$, I_N will set prices along conditions (1)and (2) and makes a profit of $b^B + min\{1 - p_{I_{n-1}}^B, b_{I_n}^S\}$.

Under the assumption that buy-side firms have been vertically integrated on all previous stages, we can similarly formulate for all absolutely symmetric stages $l = n-1, \ldots, 2$

$$\begin{aligned} p_{I_l}^B &\leq min\{p_E^B + b^B, 1\} \\ p_{I_l}^S &\leq min\{p_E^S + b^S, b^S, 1 - p_E^B\} \end{aligned} \tag{6}$$

which differs to $N = n$ only in the fact, that I_l will try to capture the overall surplus 1 from each buy-side firm. Hence we obtain

$$\pi_{I_l} = 2 \cdot (min\{p_E^B + b^B, 1\} + min\{p_E^S + b^S, b^S, 1 - p_E^B\}). \tag{7}$$

Observing that buy-side firms have been only registered with I_{l-1}, a horizontal marketplace I_l will follow conditions (1) and (2) as well.

Finally, due to the absence of a previous marketplace I_1 will always set prices

$$\begin{aligned} p_{I_1}^B &\leq min\{p_E^B + b^B, 1\} \\ p_{I_1}^S &\leq min\{p_E^S + b^S, b^S\} \end{aligned} \tag{8}$$

and realizes a profit of

$$\pi_{I_1} = 2 \cdot (min\{p_E^B + b^B, 1\} + min\{p_E^S + b^S, b^S\}). \tag{9}$$

Turning to E's perspective, capturing firms from branch α requires to set prices p_E^B, p_E^S, which make fighting along conditions (5), (7) and (9) unattractive for incumbent marketplaces and still guarantee a positive profit for E. Such a boundary, which will preserve E from entry deterrence, is given by $I_N's$ profit as a monopolist for branch β, which can be taken from figure 1(b).
Consequently, E has to start on the first stage, otherwise he will not be able to integrate the market participants in the following stages. Additionally, starting on $N = 1$ follows the development of $E's$ pricing conditions: since deterrence is most expensive for I_1, vice versa, it will be relatively cheap for E to attract firms from stage $N = 1$, which leads to a first constraint. For

$N = 2, \ldots, n-1$ it will be more expensive for E to attract firms. Hence, whenever there exists a pricing condition for $N = l$ that still leads to a positive profit for E it will fulfill the first constraint as well. This logic generally holds up to the last stage.[6]
In the following we will focus on sell-side domination first, i.e. $b^B < b^S$, and analyze each case of $E's$ price-setting options separately.

Case 1: $p_E^B \geq 0$ and $p_E^S \geq 0$
Whenever E tries to attract firms from all n stages, it is rational to assume that firms will only register as long as profits are non-negative, which results in access prices that cannot be greater than the firms' surplus from trade, i.e. $p_E^B \leq b^b$, $p_E^S \leq b^S$. For $b^B < \frac{1}{2}$ we can consequently formulate $\pi_{I_1} < 1 + b^S$ as

$$p_E^B < -\frac{1}{2} + \frac{1}{2} b^S \tag{10}$$

which will never be fulfilled for $p_E^B > 0$ and $b^S < 1$. However E could consider a price setting of $p_E^B > b^b$, which will only exclude the integration of buy-side firms from $N = n$, intending the integration of firms from lower stages. Nevertheless this will not be rational either, as we obtain for $p_E^B \epsilon (b^B, b^S]$ condition (10) and for $p_E^B \epsilon (b^S, 1]$ expression $2 \cdot (1 + b^S) < 1 + b^S$, which cannot be fulfilled as well. Therefore we have to exclude the case of positive access prices.
Consequently, we will analyze the cases of a negative price, namely a subsidy, and a positive price for the other market-side in the following.[7]

Case 2: $p_E^B > 0$ and $p_E^S < 0$
As in the first case $\pi_{I_1} < 1 + b^S$ can be simplified and yields

$$p_E^S < \frac{1}{2} b^S - \frac{1}{2} - p_E^B. \tag{11}$$

It can easily be seen that subsidizing sell-side firms will not be profit maximizing for E, as the amount of a sell-side subsidy had to be greater than the positive access fee for buy-side firms and leads to the exclusion of a sell-side subsidy. Therefore, we have to examine the last case of a buy-side subsidy.

Case 3: $p_E^B < 0$ and $p_E^S > 0$
Simplifying $\pi_{I_1} < 1 + b^S$ results in

$$p_E^B < -\frac{1}{2} b^B \tag{12}$$

[6]Later on it will be seen, that there exist some scenarios, in which a previous condition will fulfill a constraint for $N = n$ as well.
[7]Paying a subsidy to both market-sides will also fulfill $\pi_{I_N} < \pi_{I_N}^M$ with $\pi_{I_N}^M$ being the monopolist profit, however this cannot be a profit maximizing strategy for E.

as a necessary condition for E. In this scenario, the highest possible profit for E writes as $\pi_E = p_E^B + p_E^S = 1 - \frac{3}{2}b^B$ with $p_E^B \lessapprox -\frac{1}{2}b^B$ ($\lessapprox$ meaning 'slightly smaller than') and $p_E^S = b^S$, which will be positive indeed. Capturing firms from the following stages l requires $\pi_{I_l} < 1$, which yields

$$p_E^B < -\frac{1}{2}. \tag{13}$$

If (13) holds, it is obvious that such a subsidy fulfills conditions (12) as well, and so attracting firms from stages $1, \ldots, n-1$ results in a profit of $(n-1) \cdot (\frac{1}{2} - b^B) > 0$ with $p_E^B \lessapprox -\frac{1}{2}$ and $p_E^S \lessapprox b^S$.[8] For the last stage, $\pi_{I_n} < b^B$ leads to $p_E^B < \frac{1}{2}b^B - 1$ and a maximum profit of $n \cdot (-\frac{1}{2}b^B)$, which will be definitely negative.

Finally, we have to compare the two different levels of possible profits, given from the third case. Therefore it will only be rational for E to integrate stages $N = 1, \ldots, n-1$ whenever $(n-1) \cdot (\frac{1}{2} - b^B) > 1 - \frac{3}{2}b^B$ holds, which leads to a boundary of

$$b^B < \frac{3-n}{5-2n} \tag{14}$$

that will satisfy $b^B < \frac{1}{2}\ \forall n$ at all.

Proposition 1 *In a scenario of a sell-side dominated branch, a vertical marketplace can never integrate all firms along $N = 1, \ldots, n$. Moreover positive profits are only possible in the case of a buy-side subsidy: For $b^B \geq \frac{3-n}{5-2n}$ the entrant will only attract firms from $N = 1$ with $p_E^B \lessapprox -\frac{1}{2}b^B$ and $p_E^S = b^S$ ('single integration'). Otherwise, all firms from $N = 1, \ldots, n-1$ will be vertically integrated with $p_E^B \lessapprox -\frac{1}{2}$ and $p_E^S \lessapprox b^S$ ('partial integration').*

In the following we will turn to a buy-side dominated industry, i.e. $b^S < b^B$, and examine the same pricing strategies as in the sell-side case.

Case 1: $p_E^B \geq 0$ and $p_E^S \geq 0$
Using equation (9) we can formulate $\pi_{I_1} < 1 + b^S$ as

$$min\{p_E^B + b^B, 1\} < \frac{1-b^S}{2}. \tag{15}$$

Therefore the left-hand side of condition (15) requires a negative value of p_E^B, which contradicts our assumption and leads to the exclusion of two positive access fees.

[8]Note that p_E^S has to be slightly smaller than b^S. With $p_E^S = b^S$ sell-side firms from stages $l = 2, \ldots, n-1$ could not be captured by E, as profits were the same between E and I_l.

Case 2: $p_E^B > 0$ and $p_E^S < 0$
In this scenario we have to examine different levels of buy-side-prices separately.
2.1: $0 < p_E^B \leq b^S$
Simplifying $\pi_{I_1} < 1 + b^S$ leads to

$$p_E^S < \frac{1}{2}(b^S - 1) - p_E^B \tag{16}$$

which requires a subsidy that has to be greater than the positive access fee on the other market-side and, consequently, implies a negative profit for E. Hence, we can exclude a low level of p_E^B as well.

2.2: $b^S < p_E^B \leq b^B$
Starting on $N = 1$ yields for $\pi_{I_1} < 1 + b^S$

$$p_E^S < -\frac{1}{2}(1 + b^S). \tag{17}$$

Taking the maximum amount of $p_E^B = b^B$, we obtain a profit of $\frac{1}{2}(1 - 3b^S)$, which will be positive for $b^S < \frac{1}{3}$. Hence, an integration of firms will never be possible for $b^S \epsilon [\frac{1}{3}, \frac{1}{2})$ by using this pricing scheme. Alternatively, the entrant will try to capture the following stages with $\pi_{I_l} < 1$ which induces

$$p_E^S < -\frac{1}{2} - b^S. \tag{18}$$

It is obvious, that this subsidy will fulfill condition (17) as well, hence, the maximum profit can be written as $(n-1)(\frac{1}{2} - 2b^S)$ which will be positive for $b^S < \frac{1}{4}$. Consequently, the entrant can only integrate stage $N = 1$ for $b^S \epsilon [\frac{1}{4}, \frac{1}{3})$, whereas an integration of upper stages will be possible for $b^S < \frac{1}{4}$. Assuming that the sell-side firms' share is less than $\frac{1}{4}$, we will focus on the last stage, which induces $\pi_{I_n} < b^B$ as a strategy for E, i.e.

$$p_E^S < -\frac{1}{2}(1 + b^S). \tag{19}$$

It can easily be seen that this term corresponds to condition (17), consequently condition (18) leads automatically to an integration of all firms along the vertical production chain and a maximum profit of $n \cdot (\frac{1}{2} - 2b^S)$. On the other side E can set a smaller subsidy, following condition (17), and integrate only firms from the first stage, which is related to a profit of $\frac{1}{2}(1 - 3b^S)$.[9] The comparison of these profits shows, that an integration of all firms will only be profitable for $b^S < \frac{n-1}{4n-3}$, which will be smaller than $\frac{1}{4}$ for all $n \geq 3$.

[9]Even if condition (17) is equivalent to condition (19), firms will only register on $N = 1$ with the entrant. Due to a lack of reputation all agents from $N = n$ will not participate, as firms from stages $N = 2, \ldots, n-1$ will definitely not register with E.

Hence we can summarize our results from this subcase as follows: for $b^S \epsilon (0, \frac{n-1}{4n-3})$ E will integrate all firms, for $b^S \epsilon [\frac{n-1}{4n-3}, \frac{1}{3})$ the entrant will only attract firms from the first stage and for $b^S \epsilon [\frac{1}{3}, \frac{1}{2})$ no integration will take place.

2.3: $p_E^B \epsilon (b^B, 1]$
The assumption of an access price $p_E^B > b^B$ excludes automatically the participation of buy-side firms on the last stage. Nevertheless such a pricing scheme could be rational as positive access prices become greater.
Focusing on the first stages $N = 1, \ldots, n-1$ results in conditions (17) and (18). Even buy-side firms will never register with E on the last stage, we have to examine sell-side firms' behavior on $N = n$, as these firms opt for trading on I_n or getting the subsidy on E. On the other side, I_n will only be interested in firms from branch α if profits are greater b^B, which will never be fulfilled if $p_E^S < -\frac{1}{2}(1+b^S)$ holds. As this condition corresponds to (19) it is obvious that E has only two options: attracting firms from the first stage, which results in a profit of $\frac{1}{2}(1-b^S)$ or deciding for a sub-integration with firms from $N = 1, \ldots, n-1$ and unintentional sell-side firms from the last stage, which leads to a profit of $n(\frac{1}{2} - b^S) - 1$.
By the comparison of these profits we obtain a critical boundary of $\frac{n-3}{2n-1}$, consequently E will decide for a sub-integration if $b^S \epsilon (0, \frac{n-3}{2n-1})$ holds, whereas the entrant will single integrate on $N = 1$ in a case of $b^S \epsilon [\frac{n-3}{2n-1}, \frac{1}{2})$.[10]

Case 3: $p_E^B < 0$ and $p_E^S > 0$
Finally we have to determine a subsidy for $N = 1$ by satisfying $\pi_{I_1} < 1 + b^S$, i.e.

$$p_E^B < \frac{1}{2}(b^S - 1). \tag{20}$$

With $p_E^S = b^S$ the maximum profit will amount to $\frac{1}{2}(3b^S - 1)$, which will only be positive for $b^S > \frac{1}{3}$.
Going forward, we obtain for $\pi_{I_l} < 1$ a necessary subsidy of $p_E^B < -\frac{1}{2}$, which will never lead to a positive profit as sell-sides firms' surplus is less $\frac{1}{2}$.

From cases *2.2, 2.3* and *3* the new intermediary attained several strategies for making a positive profit within $b^S \epsilon (0, \frac{1}{2})$. The comparison of these options gives finally the rational choice of E.

Proposition 2 *In the case of a buy-side dominated industry a vertical marketplace can integrate different levels of production stages. Whenever the number of vertical stages is sufficiently small ($n \leq 4$), the entrant will run a full-integration for $b^S \epsilon (0, \frac{n-1}{4n-1})$, otherwise –for $b^S \epsilon (\frac{n-1}{4n-1}, \frac{1}{2})$– only firms from $N = 1$ will be attracted ('single-integration'). In a scenario of $n \geq 5$ the entrant has the choice between three profit-maximizing strategies: (1) for $b^S < \frac{1}{n}$*

[10] In a situation of three vertical production stages there exists only one case of a single-integration and we have to write the interval as $b^S \epsilon (\frac{n-3}{2n-1}, \frac{1}{2})$.

all firms will participate with E ('full-integration'), (2) for $b^S \epsilon [\frac{1}{n}, \frac{n-3}{2n-1})$ E will integrate firms from $N = 1, \ldots, n-1$ with the acceptance of the participation of sell-side firms from the last stage ('sub-integration') and whenever the demand-sided domination is quite small, i.e. $b^S \epsilon [\frac{n-3}{2n-1}, \frac{1}{2})$, only firms from the first stage will register with E ('single-integration').
In a case of a single integration E sets $p_E^S \lessapprox -\frac{1}{2}(1+b^S)$, $p_E^B = 1$ and earns $\pi_E \lessapprox \frac{1}{2}(1-b^S)$, for a sub-integration E's pricing scheme writes as $p_E^S \lessapprox -\frac{1}{2} - b^S$, $p_E^B = 1$ associated to a profit of $\pi_E = n(\frac{1}{2} - b^S) - 1$ and for a full-integration the entrant sets $p_E^S \lessapprox -\frac{1}{2} - b^S$, $p_E^B = b^B$, leading to $\pi_E = n(\frac{1}{2} - 2b^S)$.

The proof of proposition 2 is relegated to the appendix.

Finally figure 2 combines the results for both types of domination. It can be

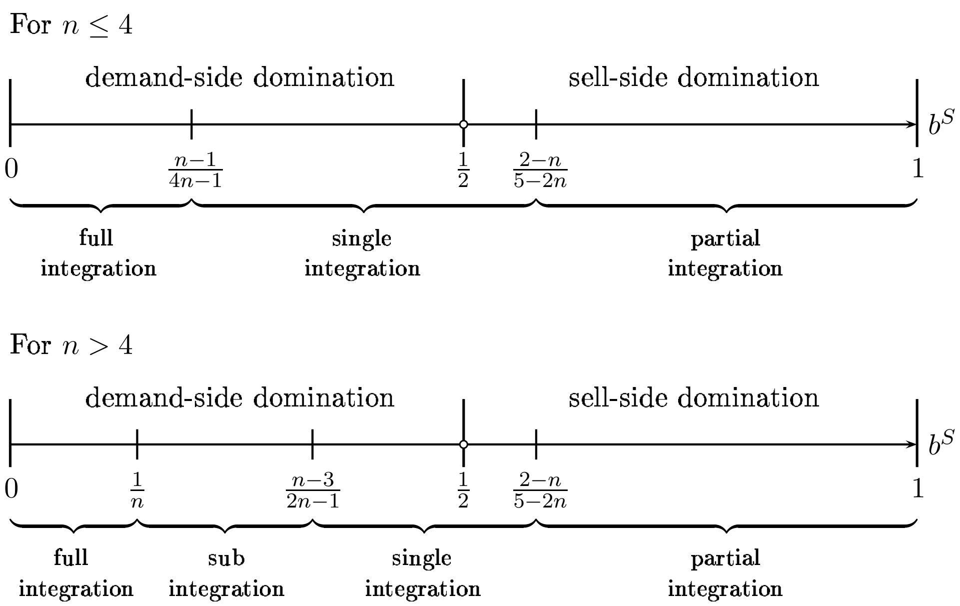


Figure 2: Optimal levels of integration

seen that horizontal marketplaces on lower stages, like platforms for MRO goods, can never defend their market-shares, as fighting will be relatively expensive. Moreover, the lower the one-sided market-power, the more difficult it becomes to integrate platforms for intermediate products. This general result holds symmetrically for both sides of domination, even a full-integration is only possible in a demand-side dominated branch.
As described before, an intermediary on $N = 1$ can always realize a profit of $1 + b^S$, which represents simultaneously the intermediary's opportunity costs

in the case of fighting. Consequently the expected profits from fighting have to be sufficiently high, which could never be fulfilled in our model. Therefore a vertical marketplace can always earn a positive profit by its entry, which is in a sharp contrast to recent literature (like Caillaud and Jullien, 2001) concerning access pricing schemes, where an entrant could not attract any trade in general. These results occurred as an incumbent had only an all-or-nothing decision between staying out of the market, related to a zero profit, or defending its market-share by access prices, intending to realize a positive profit. Meaning that opportunity costs became zero too, this made fighting very attractive and resulted in a credible strategy of entry deterrence. Our model could not create such a credible threat in general as an incumbent had only an all-or-partial decision. Most likely we yield a comparable result for the last stage, where an incumbent can only realize a relatively small profit. Even opportunity costs of b^B are still greater than a zero profit, this case illustrated the extreme difficulty for E to drive I_n out of the market, which would be only possible by a strong increase in subsidies, that would make fighting unattractive for I_n. But even if E can find prices that attract trade on the last stage, it will be rational for him to attract only the lower stages as the difference of buy-side and sell-side firms' share of trade decreases.
For the demand-side domination this can be explained as follows: first it is obvious, that subsidizing sell-side firms must be cheaper than subsidizing buy-side firms, as sell-side firms' surplus is relatively small. Consequently, this is the easiest way to attract sell-side firms as b^S is at a low level. Nevertheless, this is only one effect. The second effect, which is more difficult, occurs from the different levels of opportunity costs; if b^S adjusts to $\frac{1}{2}$ from the left side, $I_1's$ profits will increase, which makes it very cheap for E to attract firms from the first stage. Therefore an additional quantity effect by integrating firms from stages $1, \ldots, n$ cannot compensate the loss from the first stage. Otherwise, if b^S decreases, it is obvious that all opportunity costs adjust to 1. Consequently, an integration of the first stage becomes more expensive for E, which makes low-price strategies attractive, as the additional firms compensate the decreasing revenue per firm. As a full integration implies a buy-side price of $p_E^B \leq b^B$, the entrant has to decide between this boundary or a maximum price of 1, which can only be paid by buy-side firms from lower stages. On the other side, it could be shown, that $p_E^B = 1$ is always associated with a sell-side subsidy, which will even be captured by sell-side firms from the last stage. Hence, the entrant will only run such a strategy, if the number of stages is sufficiently great ($n > 4$). Otherwise, the loss on the last stage by this sub-integration would be greater than the loss of a lower price $p_E^B \leq b^B$, which will even attract buy-side firms from the last stage. But even for $n > 4$ there exists a boundary of $b^S = \frac{1}{n}$ where differences between incumbents' profits are sufficiently small. Symmetrically, this leads to a relatively high level of b^B, which induces only a small shift from 1 to b^B. Then the additional integration of buy-side firms on the last

stage compensates this loss and generates a higher profit. Concentrating on an increasing level of b^S within the interval $[\frac{1}{n}, \frac{n-3}{2n-1})$ demonstrates, that a single integration of $N = 1$ is not cheap enough. On the other side, the difference between a buy-side price of 1 and a buy-side price of b^B is to great to be compensated by the integration of firms from $N = n$. For $n \leq 4$ there does not exist such an interval, as the quantity effect of integrating the last stage will always overcompensate for the smaller revenue per buy-side firm. Consequently, we can summarize that the second effect, which explains the impact of different opportunity costs, induces different intervals of optimal behavior from $E's$ point of view. The first effect of decreasing subsidies at lower levels of b^S only strengthens the total effect. It will be seen, that this does not hold for a sell-side dominated branch. In such a case, the entrant will focus on a buy-side subsidy, as buy-side firms' surplus becomes smaller with a higher level of b^S. On the other side, there still exists the second effect, caused by the opportunity costs. As before, these opportunity costs increase with b^S, which makes it very cheap for E to attract firms from the first stage. Consequently, we could expect from this effect, that E will not be interested in attracting firms from upper stages, as the difference of opportunity costs between the first stage and all other stages increases. Nevertheless, this second effect only dominates for $b^S \leq \frac{2-n}{5-2n}$, in all other situations the first effect does. But even then the entrant will not be able to integrate the last stage, as $I_n's$ profit is falling, whereas $I_l's$ profits are constant at 1. Hence, the situation between E and the incumbent I_n resembles for a decreasing level of b^B more and more the basic model from Caillaud and Jullien, who have already shown that an entrant cannot attract trade by access prices. In consequence, if the first effect dominates, it will only lead to a partial integration of stages $1, \ldots, n-1$.

5 Conclusion

This paper analyzed the behavior of horizontal marketplaces whenever a new vertical marketplace tries to enter and monopolize one branch along the supply chain. It could be seen, that even with positive expectations towards the participation with incumbent platforms the entrant cannot be deterred at all stages by access prices. This result even occurred without changes in the network effects due to a different ownership structure. The main difference to recent analysis constitute opportunity costs, which can be softened in our model, as horizontal marketplaces have always the alternative on focussing the non-attracted industry.

Nevertheless, our approach made clear that industry specific marketplaces will not appear for all branches as it has often been predicted. A vertical integration in the sense of a full participation of all firms from one branch will only be rational in a strong buy-side dominated branch, moreover, the more

complicated a product becomes, inducing more production stages, the more this buy-side domination has to increase. On the other side, we observed that an entrant will never be deterred on the first stage, and so we can expect a strong competition for platforms on lower stages, like for MRO goods, where most platforms have a horizontal setup up to now.
In general, we can expect for a great number of stages within the supply chain a combination of branch solutions and non-industry specific horizontal platforms.
However, these results have to be examined under different conditions in future research. Therefore, this framework could be extended by a more diversified pricing scheme including transaction-fees. Additionally, a non-exclusive registration *('Multihoming')* could be investigated. In this context our model might even represent a framework for the adoption of different ex-ante structures –like exclusive marketplaces owned by demand-side firms on last stages– and give an approach for the explanation of solutions that apply under such circumstances.

References

Armstrong, M. (2005). Competition in Two-Sided Markets. Industrial Organization 0505009, EconWPA.

Belleflamme, P. and Toulemonde, E. (2004). B2B marketplaces: Emergence and entry. Core discussion paper no. 2004/78.

Bogaschewsky, R. and Mueller, H. (2002). *b2b Marktplatzführer*. Verlagsgruppe Handelsblatt.

Caillaud, B. and Jullien, B. (2001). Competing Cybermediaries. *European Economic Review*, 45: pp. 797–808.

——— (2003). Chicken & egg: competition among intermediation service providers. *RAND Journal of Economics*, 34(2): pp. 309–328.

Doganoglu, T. and Wright, J. (2004). Multihoming and compatibility. Departmental Working Papers wp0314, National University of Singapore, Department of Economics.

Economides, N. (1994). The Incentive for Vertical Integration. Working Papers 94-05, New York University, Leonard N. Stern School of Business, Department of Economics.

Gabszewicz, J.J. and Wauthy, X.Y. (2004). Two-sided markets and price competition with multi-homing. CORE Discussion paper 2004/30, Louvain-la-Neuve, Belgium.

Hagiu, A. (2004). Two-Sided Platforms: Pricing and Social Efficiency. Discussion papers 04035, Research Institute of Economy, Trade and Industry (RIETI), Tokyo and Princeton University.

Jullien, B. (2004). Two-Sided Markets and Electronic Intermediaries. CESifo Working Paper Series CESifo Working Paper No. 1345, CESifo GmbH.

Lucking-Reiley, D. and Spulber, D.F. (2001). Business-to-Business Electronic Commerce. *Journal of Economic Perspectives*, 15(1): pp. 55–68.

Milliou, C. and Petrakis, E. (2004). Business-To-Business Electronic Marketplaces: Joining a public or creating a private. *International Journal of Finance and Economics*, 9(2): pp. 99–112.

Popović, M. (2002). B2B e-Marketplaces. Mimeo, European Commission.

Rochet, J.C. and Tirole, J. (2003). Platform Competition in Two-Sided Markets. *Journal of the European Economic Association*, 1(4): pp. 990–1029.

——— (2004). Two-sided markets: An overview. *Mimeo, IDEI, Toulouse.*

Roland Berger Strategy Consultants (2001). *B2B Marktplätze: Trends und Strategien in der Network Economy.*

Roson, R. (2005). Two-Sided Markets: A Tentative Survey. *Review of Network Economics*, 4(2): pp. 142–160.

Suelzle, K. (2004). Duopolistic Competition between Independent and Collaborative Business-to-Business Marketplaces. Econometric Society 2004 Australasian Meetings 191, Econometric Society.

UNCTAD (2004). E-Commerce and Development Report 2004. Geneva.

Zhu, Z. and Lu, T. (2005). Pricing Strategies of Electronic B2B Marketplaces with Two-Sided Network Externalities. *ICEC.*

Appendix

A Proof of Proposition 2

In a buy-side dominated situation, we obtain from case *2.2* three intervals: $b^S \epsilon [\frac{1}{3}, \frac{1}{2})$ leading to $\pi_E = 0$ *(2.2.1)*, $b^S \epsilon [\frac{n-1}{4n-3}, \frac{1}{3})$ with $\pi_E = \frac{1}{2}(1 - 3b^S)$ *(2.2.2)* and $b^S \epsilon (0, \frac{n-1}{4n-3})$ associated to a profit of $\pi_E = n(\frac{1}{2} - 2b^S)$ *(2.2.3)*.

From the third subcase *2.3* we already know, that the entrant can realize for $b^S \epsilon [\frac{n-3}{2n-1}, \frac{1}{2})$ a profit of $\pi_E = \frac{1}{2}(1 - b^S)$ *(2.3.1)* and for $b^S \epsilon (0, \frac{n-3}{2n-1})$ a profit of $n(\frac{1}{2} - b^S) - 1$ *(2.3.2)*. Finally, the third case leads for $b^S \epsilon (\frac{1}{3}, \frac{1}{2})$ to $\frac{1}{2}(3b^S - 1)$ *(3.1)* and for $b^S \epsilon (0, \frac{1}{3}]$ to a zero profit $\pi_E = 0$ *(3.2)*.
In the following we will start with the comparison of the two subcases *2.2* and *2.3*. It can easily be seen, that $\frac{n-3}{2n-1}$ will only be smaller than $\frac{n-1}{4n-3}$ for $n \leq 5$. Therefore we we will concentrate on $n = 3$ first, so E has to compare the profit of *(2.2.3)*, *(2.2.2)* and *(2.2.1)* with the only alternative of *(2.3.1)*.[11] For $b^S \epsilon (0, \frac{n-1}{4n-3})$ we yield from *(2.2.3)* and *(2.3.1)* a boundary of $\frac{n-1}{4n-1}$, where the entrant will integrate all (three) stages for $b^S \epsilon (0, \frac{n-1}{4n-1})$ and for $b^S \epsilon [\frac{n-1}{4n-1}, \frac{n-1}{4n-3})$ only the first stage. Turning to $b^S \epsilon [\frac{n-1}{4n-3}, \frac{1}{3})$ we obtain from *(2.2.2)* and *(2.3.1)* the solution of a single integration along *(2.3.1)* either. In the range of $b^S \epsilon [\frac{1}{3}, \frac{1}{2})$ it becomes finally clear, that E will always decide for *(2.3.1)* as *(2.2.1)* offers only a zero profit. Hence we can summarize for $n = 3$ that E will decide for *(2.2.3)* in a situation of $b^S \epsilon (0, \frac{n-1}{4n-1})$ and for *(2.3.1)* whenever $b^S \epsilon [\frac{n-1}{4n-1}, \frac{1}{2})$.
In a scenario of $n \epsilon \{4, 5\}$ we attain from subcase *2.3* the two alternatives of *(2.3.1)* and *(2.3.2)* that we have to compare with *(2.2.3)*, *(2.2.2)* and *(2.2.1)*. For $b^S \epsilon (0, \frac{n-3}{2n-1})$ we yield from *(2.2.3)* and *(2.3.2)* $b^S < \frac{1}{n}$ as a condition for a full integration, following *(2.2.3)*. As $\frac{1}{n} > \frac{n-3}{2n-1}$ always holds for $n \leq 4$, the entrant will integrate all stages within $b^S \epsilon (0, \frac{n-3}{2n-1})$ for $n = 4$. For $n = 5$ a full integration takes only place for $b^S \epsilon (0, \frac{1}{n})$, in the interval of $b^S \epsilon [\frac{1}{n}, \frac{n-3}{2n-1})$ E will decide for a sub-integration along *(2.3.2)* instead. Continuing with $b^S \epsilon [\frac{n-3}{2n-1}, \frac{n-1}{4n-3})$ results for *(2.2.3)* and *(2.3.1)* in the same boundary of $\frac{n-1}{4n-1}$ as before, which will only be within $[\frac{n-3}{2n-1}, \frac{n-1}{4n-3})$ for $n = 4$. For $n = 5$ $\frac{n-1}{4n-1}$ will be smaller than $\frac{n-3}{2n-1}$ and so $E's$ rational choice will always be *(2.3.1)*, whereas the entrant will decide for *(2.2.3)* in the case of $b^S \epsilon [\frac{n-3}{2n-1}, \frac{n-1}{4n-1})$ and for *(2.3.1)* whenever $b^S \epsilon [\frac{n-1}{4n-1}, \frac{n-1}{4n-3})$. In the interval of $b^S \epsilon [\frac{n-1}{4n-3}, \frac{1}{3})$ we turn now to situations *(2.2.2)* and *(2.3.1)*, which show that a single integration along *(2.3.1)* will always be more profitable. Finally, for $b^S \epsilon [\frac{1}{3}, \frac{1}{2})$ E will even decide for *(2.3.1)*, as *(2.2.1)* offers only $\pi_E = 0$. Combining these solutions results for $n = 4$ in a full integration for $b^S \epsilon (0, \frac{n-1}{4n-1})$ and a single integration for $b^S \epsilon [\frac{n-1}{4n-1}, \frac{1}{2})$ along *(2.3.1)*, which is completely symmetrical to the scenario of $n = 3$. For $n = 5$ we yield a more diversified solution: for $b^S \epsilon (0, \frac{1}{n})$ E will full integrate *(2.2.3)*, for $b^S \epsilon [\frac{1}{n}, \frac{n-3}{2n-1})$ the entrant will decide for a sub integration *(2.3.2)* and in a scenario of $b^S \epsilon [\frac{n-3}{2n-1}, \frac{1}{2})$ for a single integration of $N = 1$ *(2.3.1)*.
In the next step we are extending the scenario to $n \epsilon \{6, 7, 8\}$, as $\frac{n-3}{2n-1}$ is not greater than $\frac{1}{3}$ for these numbers of stages. Hence, we have to compare *(2.2.3)* and *(2.3.2)* within $b^S \epsilon (0, \frac{n-1}{4n-3})$ first, which leads to a bound-

[11] As the situation of *(2.3.2)* does not exist for $n = 3$, we have to understand *(2.3.1)* as $b^S \epsilon (\frac{n-3}{2n-1}, \frac{1}{2})$.

ary of $\frac{1}{n}$ again, that will always be smaller than $\frac{n-1}{4n-3}$. Thus we can conclude that E will full integrate *(2.2.3)* for $b^S\epsilon(0, \frac{1}{n})$ and follow the strategy of a sub-integration *(2.3.2)* for $b^S\epsilon[\frac{1}{n}, \frac{n-1}{4n-3})$. Continuing in the range of $b^S\epsilon[\frac{n-1}{4n-3}, \frac{n-3}{2n-1})$ gives the entrant the opportunities of a single or a sub integration. As we yield from *(2.2.2)* and *(2.3.2)* a critical boundary of $\frac{n-3}{2n-3}$, which will be definitely greater than $\frac{n-3}{2n-1}$, E will always opt for a sub integration if $b^S\epsilon[\frac{n-1}{4n-3}, \frac{n-3}{2n-1})$ holds. In the interval of $b^S\epsilon[\frac{n-3}{2n-1}, \frac{1}{3})$ E can only choose between the two types of a single integration along *(2.2.2)* and *(2.3.1)*. Hence it becomes obvious that a profit of $\pi_E = \frac{1}{2}(1-b^S)$, related to *(2.3.1)*, will be greater than the alternative of $\pi_E = \frac{1}{2}(1-3b^S)$ and so the entrant will decide for *(2.3.1)*. Finally for $b^S\epsilon[\frac{1}{3}, \frac{1}{2})$ E will even choose *(2.3.1)* as *(2.2.1)* leads just to a profit of zero. Summarizing for $n\epsilon\{6, 7, 8\}$, shows that results will not differ from $n = 5$, i.e. for $b^S\epsilon(0, \frac{1}{n})$ the entrant will full integrate *(2.2.3)*, for $b^S\epsilon[\frac{1}{n}, \frac{n-3}{2n-1})$ $E's$ strategy becomes a sub integration *(2.3.2)* and for $b^S\epsilon[\frac{n-3}{2n-1}, \frac{1}{2})$ only the first stage will be integrated *(2.3.1)*.
Finally we have to examine situations of $n \geq 8$, where $\frac{n-3}{2n-1}$ becomes greater $\frac{1}{3}$. It can easily be seen that the first range of $b^S\epsilon(0, \frac{n-1}{4n-3})$ is absolutely identical to $n\epsilon\{6, 7, 8\}$, and so E opts for *(2.2.3)* in the case of $b^S\epsilon(0, \frac{1}{n})$ and for a sub integration level *(2.3.2)* whenever $b^S\epsilon[\frac{1}{n}, \frac{n-1}{4n-3})$ holds. Continuing with $b^S\epsilon(\frac{n-1}{4n-3}, \frac{1}{3})$ leads by the comparison of *(2.2.2)* and *(2.3.2)* to the the same boundary of $\frac{n-3}{2n-3}$ as before, which will even be greater than $\frac{1}{3}$, resulting in a sub-integration *(2.3.2)* for the whole interval of $b^S\epsilon(\frac{n-1}{4n-3}, \frac{1}{3})$. As there exist no alternatives to a zero profit along *(2.2.1)* the entrant will sub integrate *(2.3.2)* for $b^S\epsilon[\frac{1}{3}, \frac{n-3}{2n-1})$ either and determine a single integration as a rational strategy for $b^S\epsilon[\frac{n-3}{2n-1}, \frac{1}{2})$ *(2.3.1)*.
Combining these results for different numbers of stages leads to the following conclusion: For $3 \leq n \leq 4$ E will full integrate *(2.2.3)* for $b^S\epsilon(0, \frac{n-1}{4n-1})$ and single integrate *(2.3.1)* for $b^S\epsilon[\frac{n-1}{4n-1}, \frac{1}{2})$. For all other numbers of stages, namely $n \geq 5$, the entrant will run a full integration *(2.2.3)* only for $b^S\epsilon(0, \frac{1}{n})$, in a range of $b^S\epsilon[\frac{1}{n}, \frac{n-3}{2n-1})$ E will decide for a sub integration *(2.3.2)* and in a scenario of $b^S\epsilon[\frac{n-3}{2n-1}, \frac{1}{2})$ the only profit maximizing strategy will be a single integration, following *(2.3.1)*.
Last we have to include the alternatives *(3.1)* and *(3.2)* from the third case. For $n \leq 8$ we have only to compare *(3.1)* with *(2.3.1)*. It can easily be shown that a profit of $\frac{1}{2}(1 - b^S)$ from *(2.3.1)* will be greater than $\frac{1}{2}(3b^S - 1)$ for $b^S < \frac{1}{2}$, which will always be fulfilled in a demand-side dominated scenario. In the case of $n > 8$ there arise the two alternatives of a sub-integration *(2.3.2)* and a single integration *(2.3.1)*. Therefore we attain for $b^S\epsilon(\frac{1}{3}, \frac{n-3}{2n-1})$ a boundary of $\frac{n-1}{3+2n}$, which will be greater than $\frac{n-3}{2n-1}$. Consequently E will always decide for a sub-integration within $b^S\epsilon(\frac{1}{3}, \frac{n-3}{2n-1})$. In the range of $b^S\epsilon[\frac{n-3}{2n-1}, \frac{1}{2})$ the situation is absolutely symmetrical to $n \leq 8$, in which we

had already shown that a single integration along *(2.3.1)* will be more profitable than strategy *(3.1)* for $b^S < \frac{1}{2}$. Thus cases *(3.1)* and *(3.2)* will not change the results that arose from the comparison of the two subcases *2.2* and *2.3* and so we proofed proposition 2.