THE ROLE AND EXTENT OF ECONOMIC RENT IN DISTRIBUTION

CONTRACTS

by

Ho Fu Des Lo

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Business Administration)
in The University of Michigan
2008

Doctoral Committee:

Associate Professor Mrinal Ghosh, Co-Chair, University of Arizona
Professor Francine Lafontaine, Co-Chair
Professor Richard P. Bagozzi
Professor Stephen W. Salant
Professor Michel Wedel, University of Maryland

To Kit-Fu

Acknowledgements

I am grateful to my principal advisors Mrinal Ghosh, Francine Lafontaine, and Stephen Salant for their guidance and support throughout my doctoral study. I would also like to thank the other committee members, Richard Bagozzi and Michel Wedel, for their advice and comments. Most of all, I am indebted to Xiaohong Liu, whose love makes my life as a doctoral student a most enjoyable journey.

Table of Contents

List of Figures

List of Tables

List of Appendices

Abstract

This dissertation is composed of five chapters that investigate the extent and role of economic rent in distribution contracts between manufacturers and dealers. Manufacturers often devise contractual mechanisms that enable downstream dealers to earn economic rent. One such mechanism is the two-stage ordering process with quantity discounts used by MNCs and local enterprises operating in China and elsewhere. Chapter 2 shows how, in theory, this ordering process enables manufacturers to determine indirectly the outcomes of downstream competition to be either Bertrand or Cournot, which in turn affects the economic rent earned by their dealers.

In Chapter 3, I match the results of my theoretical model to the longitudinal data obtained from a leading Chinese manufacturer of a key computer accessory. I use the data to estimate unobserved final prices and thus the economic rent earned by each of its sixty dealers over a one-year period. I show empirically that the two-stage ordering process of this manufacturer leaves economic rent with its heterogeneous group of dealers.

Chapter 4 looks at the role of economic rent, in conjunction with manufacturer's supervisory effort, in enforcing desired yet non-contractible dealer marketing effort. Based on the institutional arrangements adopted by the computer accessory manufacturer, I find that the size of downstream economic rent and the manufacturer's supervision

intensity are used as complementary control instruments to induce non-contractible dealer

marketing effort.

Chapter 1

Introduction

Manufacturers are known to use multiple governance forms to manage their

distribution channels (e.g., Celly and Frazier 1996; Heide 1994; Weitz and Jap 1995)[1]. In

long-term relationships between a manufacturer and its dealers, the upstream firm often

uses both economic incentives and supervision as control mechanisms to coordinate

marketing activities (e.g. Murry and Heide 1998; Wathne and Heide 2000). The logic,

according to the self-enforcing contracts literature (e.g., Dutta, Bergen, and John 1994;

Kaufmann and Lafontaine 1994; Klein and Murphy 1988, 1997; Lafontaine and Raynaud

2002; Telser 1980; Wathne and Heide 2000) is that, when monitoring is costly, leaving

economic rent for the dealers, combined with occasional supervision, can serve as an

incentive that discourages shirking and encourages non-contractible promotional

activities by dealers.

To implement a self-enforcement based incentive mechanism, manufacturers

could rely on vertical restrictions e.g., territorial restrictions (e.g., Dutta, Heide, and

Bergen 1999), minimum resale price maintenance (e.g., Telser 1960), two-part tariffs

involving fixed fee transfers like franchise fees (e.g., Kaufmann and Lafontaine 1994), or

slotting allowances (e.g., Desai 2000; Shaffer 1991) to permit the dealers to earn supra-

---

[1] Henceforth, I refer to the upstream and downstream channel members as a manufacturer and a dealer respectively.

normal profits. At the same time, to ensure that dealers behave and perform in desired manners, manufacturers expend supervisory efforts, for example, to establish the extent of compliance by measuring output and behavior (e.g., Bello and Gilliland 1998; Heide 1994; Heide, Wathne, and Rokkan 2007; Stump and Heide 1996) and to direct dealer activities through assignments and instructions (Alchian and Demsetz 1972; Anderson and Oliver 1987).

By taking advantage of the institutional knowledge and transactional data obtained from Computec[2] – a leading local manufacturer of a key computer accessory sold in China – this dissertation examines explicitly the extent of economic rent and the role of such rent, in conjunction with supervision, in manufacturer-dealer relationships.

1.1. Institutional Context

I first consider the vertical arrangement that Computec relies upon. Computec uses a two-stage ordering process with quantity discounts. Hewlett-Packard, Toshiba, and other multinationals operating in China and elsewhere[3] also use a similar two-stage ordering process with quantity discounts. Computec chose a channel arrangement involving independent dealers, without any exclusive dealing clauses to sell its product. The most distinctive feature of Computec's channel is its sales and ordering process. The sales activities are organized into well-defined quarterly sales cycles which always consist of two distinct stages. In the first, or order-taking, stage, Computec announces a schedule of quantity discounts below the stated wholesale price. The dealers then pay in full for the quantities they "preorder" at a discount. In the second, or order-fulfillment,

---

[2] To preserve confidentiality, I use the pseudonym Computec to refer to the manufacturer who provided the context and data used in this paper.
[3] Certain companies and industries (e.g., publishing, media sales) in the U.S. also use similar arrangements.

stage, the manufacturer ships dealers' preorders according to their delivery requests. Dealers also have the option of ordering additional quantities, but must pay the full wholesale price for such units. As orders are fulfilled, dealers compete in price and also provide value-added services such as pre-sale education and trade credit to second-tier retailers. These services allow dealers to differentiate their offering. Dealers may not return any unsold units for refunds. In field interviews, the top management at Computec believed that this channel arrangement has provided both flexibility and a "satisfying" amount of profits to dealers.

At the same time, having compliant and focused dealers is critical for Computec to capitalize on the fast evolving Chinese economy. Computec supervises its dealers in an intensive manner to ensure desired behaviors and performance. For instance, Computec trains its dealer on product knowledge and directs and monitors dealers' sales effort. The manufacturer also helps the dealer to organize local promotions, trade shows, business meetings, and works with them to locate and recruit new customers. Through these interactions, Computec further gathers market intelligence on both intra- and inter- brand competition. It is important to notice that, according to Computec, its supervisory effort is often received with the most cooperative behaviors from those dealers who are making good profits. This observation suggests that economic rent and supervisory efforts may be used in synergy to induce desired dealer services.

1.2. Goals and Outline of Text

This dissertation has three specific goals. In Chapter 2, I formally model Computec's two-stage ordering process with quantity discounts and show how the

manufacturer's choice of quantity discount affects downstream outcomes. Specifically, I show how, in theory, the ordering process enables the manufacturer to endogenously determine the outcomes of downstream competition as Bertrand or Cournot, and thus affect profits earned by its dealers. Chapter 3 then estimates empirically the amount of economic rent that Computec actually leaves with each of its different dealers. To do this, I link the *specific* two-stage mechanism to the longitudinal data obtained from Computec and use econometric techniques along the lines of those used in the New Empirical Industrial Organization literature (e.g., Reiss and Wolak 2005) to estimate the unobserved final prices of the dealers. These estimated prices, together with the cost information I collected, enable me to calculate the economic profit that Computec actually leaves with each dealer. Chapter 4 empirically investigates the complementarity between the amount of downstream economic rent and manufacturer's supervision in enforcing non-contractible dealer marketing efforts. Chapter 5 presents limitations and directions for future research.

1.3. Potential Contributions

My research makes important empirical and substantive contributions. First, my dissertation addresses a serious gap between theory and empirical research in vertical settings. Specifically, several empirical studies have used econometric techniques to demonstrate positive downstream price-cost markups; however, except Chintagunta (2002), who shows side payments are a component of retail margins, other studies are not based on a specific vertical arrangement and instead focus on *inferring* the extent of competition and/or market structure from estimated parameters (e.g., Chen, John, and

Narasimhan 2006; Kadiyali, Chintagunta, and Vilcassim 2000; Villas-Boas and Zhao 2005; Villas-Boas 2007). As such, even when a positive markup is identified in some settings, its source remains unclear. My study, to the best of my knowledge, is the first to model analytically a specific channel arrangement and to link the features of this arrangement to field data for systematic empirical analyses on downstream markups.

Second, my analysis of the 2-stage ordering process extends the literature on capacity-constrained price games (e.g., Kreps and Scheinkman 1983; Maggi 1996) to show that manufacturer's production capacity constraint is not necessary for a two-stage game in which dealers choose their quantity orders and then price according to Bertrand to yield Cournot outcomes. I show that even without any production capacity commitment, the manufacturer can endogenously control the intensity of competition through an institutional arrangement.

Third, in order to estimate prices and thus calculate rents, my estimation problem is quite different from most New Empirical Industrial Organization work in the sense that only data on dealer's costs and quantities are available to me. Using longitudinal data, I show how the unobserved retail prices can be recovered. Specifically, to estimate the final retail prices, I begin with the demand side estimation using a fixed effect model in which the observed wholesale prices act as "proxy" for the final prices. Then, using the estimated slope of the demand function and the *a priori* inferred level of dealer-side competition from my analytic model and contract data, I specify a supply relation to calculate the final prices.

Fourth, the significantly positive downstream profits I estimate suggest that the ordering process is a workable mechanism for generating economic rent downstream.

Showing the existence of downstream rent in the context of a non-franchise, non-exclusive-territorial vertical channel also complements the evidence found in franchise chains (Kaufmann and Lafontaine 1994; Michael and Moore 1995). These findings are important since, according to self-enforcement theory, economic rent plays a vital role in contract enforcement.

Lastly, although both the self-enforcement literature and canonical efficiency wage theory presume that economic rent and supervision are substitutes in vertical agreements, the exact nature of the interdependence between the two control instruments has not been empirically established (e.g., Becker and Stigler 1972; Klein and Murphy 1988; Kaufmann and Lafontaine 1994; Shapiro and Stiglitz 1984; Wathne and Heide 2000). For these to be complements (substitutes) means that increasing the intensity of one raises (lowers) the return of using the other (Milgrom and Roberts 1990)[4]. By using recently developed econometric methods that have been applied in organizational design studies (e.g. Arora and Gambardella 1990, Athey and Stern 2003, Novak and Stern 2007) and the data I collected from Computec, I find that economic rent and supervision are complements, rather than substitutes as presumed by existing theories, in encouraging dealers' provision of marketing effort. To the best of my knowledge, my dissertation is the first empirical analysis to show the exact nature of the interdependence between economic rent and supervision and its effect on dealer's marketing effort. This finding has significant implications for theory as well as managerial practices.

---

[4] See Section 4.2 on technical definition and operationalization of complementarity.

Chapter 2

The Effect of a Two-Stage Ordering Process on the Intensity of Downstream

Competition

2.1. Introduction

In long-term relationships between a manufacturer and its dealers, the upstream

firm often uses economic incentives as a control mechanism (e.g. Heide 1994). The logic,

as argued in the literature on self-enforcing contracts (e.g., Dutta, Bergen, and John 1994;

Kaufmann and Lafontaine 1994; Klein and Murphy 1988) is that, when monitoring is

costly, leaving economic rent for the dealers can serve as an incentive that discourages

shirking and encourages non-contractible promotional activities by dealers. To implement

a self-enforcement incentive mechanism, manufacturers could rely on vertical restrictions,

e.g., exclusive territories (e.g., Dutta, Heide, and Bergen 1999), minimum resale price

maintenance (e.g., Telser 1960), or two-part tariffs involving fixed fee transfers like

franchise fees (e.g., Kaufmann and Lafontaine 1994) or slotting allowances (e.g., Desai

2000; Shaffer 1991) to permit the dealers to earn supra-normal profits.

However, these vertical restraints can be costly or infeasible to implement. In turn,

manufacturers wish to lower the intensity of downstream competition would look for

alternative mechanisms. One such alternative mechanism that is used by multinational

corporations like Hewlett-Packard and Toshiba in their distribution business in China, as

well as publishing and media sales sectors in the U.S., is the *two-stage ordering process*

with quantity discounts. Consider the specific arrangement of the two-stage ordering process deployed by Computec. Computec chose a channel arrangement involving independent dealers, without any exclusive dealing clauses to sell its product. The most distinctive feature of Computec's channel is its sales and ordering process. The sales activities are organized into well-defined *quarterly* sales cycles which always consist of two distinct stages. The first week of each quarterly sales cycle constitutes the *order-taking* stage. Computec announces a schedule of quantity discounts below the given wholesale price and its 60 dealers pay in full for the quantities they want to "preorder" at a discount. Figure 1 shows the time line of the ordering process. The second, or *order-fulfillment*, stage immediately follows the order-taking stage and last approximately three months. The manufacturer ships the scheduled preorders during this phase and dealers can order additional quantities. As orders are fulfilled, dealers compete in price and also provide other value-added services such as pre-sale education and trade credit to second-tier retailers to differentiate their offering. In field interviews, the top management at Computec believed that this channel arrangement has provided both flexibility and a "satisfying" amount of profits to dealers which engage in non-contractible marketing efforts.

<center><insert Figure 1 about here></center>

This chapter formally models Computec's two-stage ordering process with quantity discounts and shows how the manufacturer's choice of quantity discount affects downstream outcomes. Specifically, I show how in theory the ordering process should enable the manufacturer to determine the intensity of downstream competition as Bertrand and Cournot and thus affect the profits earned by the dealers. The results

derived from this model will be linked to the longitudinal data obtained from Computec

to estimate the unobserved final retail prices of the dealers in Chapter 3.[5]

The chapter proceeds as follows. Section 2.2. reviews related research. I then

formulate and solve the model of the two-stage ordering process with quantity discounts

in Section 2.3. Section 2.4 concludes.

2.2. Related Research

Although neither Computec nor its dealers is capacity constrained, my analysis of

the two-stage ordering process complements the literature on capacity-constrained price

games initiated by Kreps and Scheinkman (1983). Kreps and Scheinkman (1983) show

that when firms compete in prices after a prior stage of capacity building, the price and

quantities arising in the subgame-perfect equilibrium can coincide, under specified

circumstances, with one-shot Cournot competition. Maggi (1996) extends their work to

the case of differentiated products and allows expansion of production capacity in the

second stage.

My analysis shows that manufacturer's production capacity constraint is *not*

necessary for a two-stage game in which dealers choose their quantity orders and then

price according to Bertrand to yield Cournot outcomes. In particular I show that under the

2-stage ordering process, if the manufacturer offers no quantity discount the downstream

competition would be equivalent to that of a one-shot Bertrand game; in contrast, if the

---

[5] In many sale-resale contexts (e.g., business-to-business sales), manufacturers do not know the actual downstream prices. Lack of appropriate tracking techniques or strategic unwillingness by the dealer to reveal prices are two potential reasons.

manufacturer offers a strictly positive discount the downstream competition would be equivalent to that of a one-shot Cournot game.

2.3. A Model of the Two-Stage Ordering Process with Quantity Discounts

Model Assumptions

Consider a monopolistic manufacturer which sells its product to consumers through two competing but symmetric dealers. The manufacturer sets the quantity discount schedule in stage 0. In stage 1 – the order-taking stage – the dealers independently and simultaneously place their orders taking into consideration the wholesale price and the discount schedule. In stage 2 – the order-fulfillment stage, the manufacturer delivers the products to the dealers. Each dealer observes both amounts delivered and simultaneously sets his price. If demand for his product exceeds the preordered amount, the dealer must order more from the manufacturer at the undiscounted wholesale price. If demand falls short of the preordered amount, the dealer may not return the excess to the manufacturer for a refund; for simplicity, I assume that the dealers cannot store merchandise for sale in a subsequent cycle. Figure 2 describes the information structure and the decision sequence. I assume that there is no uncertainty in demand,[6] that demand is common knowledge, and that both manufacturer and dealers maximize profits. I show how the two-stage ordering process can be summarized in reduced form by a static Cournot or Bertrand game, and I use this insight to show how the manufacturer can vary the intensity of downstream competition in the three-stage game by varying the discounts offered in stage 0.

---

[6] Neither Computec nor the dealers I interviewed seem concerned about demand uncertainty. According to them, economic growth in the system is fast and predictable, and there are few demand shocks.

<insert Figure 2 about here>

Let k_i be the quantity ordered by dealer i in stage 1 ("preorders"). Assume that he must pay $(w - d\, k_i)$ per unit preordered, where w and d are wholesale price and dollar discount per unit respectively[7] This discount schedule which declines linearly with the amount preordered approximates Computec's actual discount schedule.[8]

Common business practice keeps the list price (w) constant over a rather long period of time and I treat it as fixed in my analysis. I further assume that each dealer has a constant marginal cost of selling which is assumed to be zero. The manufacturer's total cost of production is $m \cdot (k_1 + k_2)$. All fixed costs are assumed to be zero.

If dealer i sells q_i units in stage 2, his "short-run" marginal cost of sales (q_i for i = 1, 2) then is:

$$
\begin{aligned}
MC_i &= 0 && \text{for } q_i < k_i \\
&= w && \text{for } q_i > k_i.
\end{aligned}
$$

Since the total cost to dealer i of selling q_i units in stage 2 is kinked at $q_i = k_i$, the marginal cost is undefined there (the left and right marginal cost are 0 and w, respectively). At the beginning of stage 1, the total cost of preordering k_i units is $(w - d\, k_i)$ k_i; and hence $(w - 2\, d\, k_i)$ is the "long-run" marginal cost. To simplify, I assume dealer i's demand function to be:

$$
D_i(p_i, p_j) \equiv q_i = a - p_i + b\, p_j
$$

---

[7] I assume that the manufacturer does not entertain orders so large that the net wholesale price drops to zero. Moreover, I assume that d is small enough to assure positive equilibrium prices. In fact, the upper bound of d is implicitly defined in the equilibrium Cournot price (See Appendix A).

[8] The linear discount schedule has been adopted by previous studies (e.g., Ingene and Parry 1995; 2004). It can be regarded here as an approximation of the multi-tier, all-quantity discounts that Computec uses. All unit-discount contracts are pricing arrangements in which the wholesale price on every unit purchased is lower when the purchase quantity is equal to or above some threshold (Kolay, Shaffer, and Ordover 2004). Multiple-tier discounts have multiple, rather than just one, levels of quantity thresholds that correspond to different wholesale prices. See Banerji (1990) and Kolay, Shaffer, and Ordover (2004) for models that involves single-tier all-unit discounts.

with $0 \leq b < 1$, $i = 1, 2$, and $i \neq j$. b is the substitutability between the two dealers.[9]

Stage 2: Dealers' Pricing Decisions.

I determine the subgame-perfect Nash equilibrium by backward induction, beginning with stage 2 in Figure 2 and working backward through stage 0.

In stage 2, the two dealers observe the amounts preordered (k_1, k_2) and engage in Bertrand competition. Each dealer chooses his own price given the inherited preorders and his conjecture about the price set by his rival. The situation from firm i's perspective is depicted in Figure 3:

<insert Figure 3 about here>

Given dealer j's price, dealer i faces a linear demand curve and consequently has a linear marginal revenue curve which declines at twice the rate. His marginal cost of selling less than he preordered is zero. His marginal cost of selling strictly more than he preordered is the undiscounted wholesale price (w). The profit-maximizing amount to sell (q_i) occurs where marginal revenue and marginal cost are equal.

The reaction function of dealer i represents his profit-maximizing price given the price set by his competitor. Dealer i's best price response, $p_i = R_i(p_j, k_i)$, is continuous and depends on i's preorder but is independent of the preorder of dealer j. The best reply consists of three linear segments (in bold in Figure 4).

<insert Figure 4 about here>

Part 1: When dealer j sells at a low price, the demand for dealer i's merchandise is weak and selling less than he preordered is profit-maximizing for him. This occurs if the

---

[9] A similar demand system is utilized in Ingene and Parry (1995).

marginal revenue curve of dealer *i* crosses his marginal cost curve to the left of k_i in

Figure 3. In this case, his best response to p_i is:

(1)
$$r^i(p_j) = \frac{a + b\,p_j}{2}.$$

Part 2: When dealer j sets an intermediate price, the demand for dealer i's

merchandise is further to the right and selling exactly what he preordered becomes profit-

maximizing. This happens when the marginal revenue curve crosses the vertical segment

of the marginal cost curve at $q_i = k_i$. Define $p_i \equiv s^i(p_{j,}\ k_i)$. Thus, the optimal price the

dealer i charged clears the quantity demanded q_i exactly at k_i, which can be derived

directly from the dealer's demand function:

(2)
$$s^i(p_j; k_i) = a + b\,p_j - k_i.$$

Part 3: When dealer j sets a high price, the demand for dealer i's merchandise is

so large that it is profit-maximizing for him to supplement his preorder even though

Computec charges him the undiscounted wholesale price for the additional amount. This

happens when his marginal revenue curve intersects the marginal cost curve to the right

of k_i. His best response to p_i can be determined by maximizing his profit

$\max\limits_{p_i} \pi_i = p_i \cdot k_i + (p_i - w) \cdot (q_i - k_i)$, where in calculating the quantity demanded dealer i

anticipates that p_j is fixed. In this range, his best reply is:

(3)
$$r^i(p_j; w) = \frac{a + b\,p_j}{2} + \frac{w}{2}.$$

Any intersection of the two best replies constitutes a pure-strategy Nash

equilibrium in the subgame indexed by the inherited preorder pair (k_1, k_2). Since the two

best replies intersect exactly once, each of these subgames has a unique Nash equilibrium.

To verify that the best replies intersect once, note that, for each preorder pair, the best

reply of dealer 1 in Figure 4 has a slope which is always strictly larger than 1 while the best reply of dealer 2 has a slope which is always strictly smaller than 1.[10] Since the best reply of dealer 1 starts out below that of dealer 2, the former best reply will eventually overtake the latter best reply and will never cross it again.

This unique intersection can, however, occur on any of the three segments of each reaction function. Hence, depending on the preorder pair (k_1, k_2) inherited from the prior stage, nine qualitatively distinct types of behavior can arise in the Nash equilibrium in a price subgame: the best response of dealer 1 may be to sell (1) strictly less than, (2) strictly more than, or (3) exactly what he preordered and, at the same time, dealer 2 himself may find any of these behaviors to be profit maximizing.

Stage 1: Dealers' Preorder Decisions

As we have seen, the prices and sales in stage 2 depend on preorders in stage 1. It is straightforward to verify that, for any d > 0, no dealer will preorder so little in stage 1 that purchasing more in stage 2 will be profit-maximizing; nor will either dealer preorder so much in stage 1 that leaving goods unsold in the stage 2 becomes profit-maximizing. Hence, although for *arbitrary* preorder pairs nine qualitatively distinct kinds of behavior may occur, for *profit-maximizing* preordering, only one type of behavior occurs in any subgame-perfect equilibrium: each dealer sells everything it preorders and nothing more.

To prove that no firm will preorder *less* in the first stage than it sells in the second stage, assume the contrary. That is, assume one of the dealers, dealer 1 for concreteness, preordered in the first stage less than he sells in the second stage. Then suppose in stage 1 he marginally increased his preorder unilaterally by one unit. This would have no effect

---

[10] In particular, the slope of the three segments for player 1 are 2/b, 1/b, and 2/b for b < 1 while the slope of the three segments for player 2 are b/2, b/1, and b/2.

14

on the price either dealer would charge in the second stage. Intuitively, dealer 2's price is still best given dealer 1's price since his marginal revenue and marginal cost curves in Figure 3 have not shifted. And dealer 1's price remains best given dealer 2's price since the only change involves an inframarginal shift to the right of the vertical segment of his marginal-cost curve – by assumption, to the left of the intersection point of the marginal revenue and marginal-cost curve. In terms of the reaction functions of Figure 4, dealer 2's best reply would not shift. And the only part of firm 1's best reply which would shift marginally is its middle segment. Since the intersection point, by assumption, is not on this middle segment but on the outer segment, the intersection point would not change. Since the two dealers will set the same prices even though dealer 1 marginally increased his preorder, dealer 1 would reduce the supplemental purchases by an offsetting amount. But this unilateral deviation is then always profitable for dealer 1 since he earns the same revenue but acquires the last unit at the discounted wholesale price instead of the undiscounted price. A parallel argument establishes that in any subgame-perfect equilibrium dealer 2 will never preorder so little in stage 1 that he would want to augment it in stage 2.

It is equally straightforward to show that in an equilibrium no dealer will preorder *more* in the first stage than he sells in the second stage. For, assume the contrary. That is, assume that one of the dealers, dealer 1 for concreteness, preordered in the first stage more than he sold in the second stage. Consider a unilateral deviation where player 1 preorders marginally less. This would not affect the pair of prices chosen in the second stage. To verify this, note that given p_1, dealer 2's marginal revenue and marginal cost in Figure 3 are unchanged and hence his behavior would be unchanged. Given p_2, dealer 1's

15

marginal revenue curve would also be unchanged and it would continue to cross the marginal cost curve to the left of the vertical segment at k_1, which shifts locally to the left. In Figure 4, the best reply of player 2 would be unaffected and the only segment of player 1's best reply which changes is not where the two curves intersect. Hence, the unique intersection point would not change. By deviating, therefore, dealer 1 would sell as much as before and would earn the same revenue. However, his costs would fall since he would preorder less merchandise. A parallel argument establishes that dealer 2 will never preorder more in stage 1 than he sells in stage 2. It follows that in any subgame-perfect Nash equilibrium the intersection of the two reaction functions in Figure 4 *always* occurs in their middle segments. For future reference, I summarize these results in the following lemma:

Lemma 1. In any subgame-perfect equilibrium, if $d > 0$, $k_i = q_i = D_i\,(p_i,\,p_j)$, $i = 1$, 2.[11]

We have seen that neither dealer orders so much in the first stage that he cannot sell it in the subsequent stage nor so little that he will have to supplement his preorder in the subsequent stage. I now ask, for a given discount schedule, how the amount each dealer will preorder in stage 1 is determined. Each dealer will preorder simultaneously and each will have a conjecture about his rival's preorder. Given k_j, dealer i, i = 1, 2, knows that if he preorders any amount less than some threshold, k_i^{min} he will be expected to supplement his preorder so the amount sold is unchanged. Hence, for any preorders below this threshold the second-stage prices are not expected to change. Similarly, dealer

---

[11] Notice that at $d = 0$, preorders are indeterminate since both dealers are indifferent to preordering any quantity between 0 and q_i.

i knows that if he preorders any amount more than some larger threshold, k_i^{max} ($\geq k_i^{min}$),

he will be expected to sell an unchanged amount and to leave the remainder of the

preorder unsold. Hence, for preorders above the larger threshold, the subsequent price

will be unaffected. Given k_j, dealer i's smallest credible quantity k_i^{min} and the associated

maximal price p_i^{max} (for i=1,2) can be determined, along with dealer j's price, by solving

three equations: the two demand curves (with $D_j(p_i^{max}, p_j) = k_j$ and $D_i(p_i^{max}, p_j) = k_i^{min}$)

and the best reply of dealer i ($p_i^{max} = \dfrac{a + b\,p_j}{2} + \dfrac{w}{2}$) assuming that he acts as a Bertrand

competitor with marginal cost w. Dealer i's largest credible quantity, k_i^{max} and minimal

price p_i^{min} (for i = 1, 2) can be determined in a similar way. Given k_j, dealer i's largest

credible quantity k_i^{max} and the associated minimal price p_i^{min} (for i = 1, 2) can be

determined, along with dealer j's price, by solving three equations: the two demand

curves (with $D_j(p_i^{min}, p_j) = k_j$ and $D_i(p_i^{min}, p_j) = k_i^{max}$) and the best reply of dealer i

assuming that he acts as a Bertrand competitor with zero marginal cost marginal

($p_i^{min} = \dfrac{a + b\,p_j}{2}$). Given any $k_j \in [k_j^{min}, k_j^{max}]$, larger preorders by dealer i will result in a

lower price when $k_i \in [k_i^{min}, k_i^{max}]$. The resulting price ($p_i$) can then be determined by

setting the two demand functions respectively to dealer i's chosen preorder (at k_i) and to

the his conjecture about the preorder of dealer j.

The situation confronting dealer i can be depicted graphically as follows:

<insert Figure 5 here>

17

If the marginal-cost curve has a shallow slope (MC'), then dealer i's optimal preorder is

k_i^{min}. If the marginal- cost curve has a steep slope (MC), then his optimal preorder is

$k_i (< k_i^{max})$ and occurs where the marginal-revenue curve intersects the marginal-cost

curve. In the latter case, his optimal preorder is larger when the discount (d) is larger.

For any d > 0, there exists a unique pair of preorders in the first stage, each of

which is optimal given the other. Suppose d induces each dealer to preorder an amount

much larger than his minimal preorder. If Computec had a smaller discount (d), each

dealer would reduce his preorder and hence each would charge a higher price in the

second stage. Eventually d can be reduced to the point where each dealer is preordering

its minimal amount (respectively, k_i^{min} and k_2^{min}). If Computec reduced the discount any

further, its dealers would each recognize that preordering even less would leave prices in

the last stage unchanged. Hence, each dealer would continue to preorder his minimum

amount.

Hence, as d is reduced exogenously, the equilibrium price pair in Figure 6 moves

up until it reaches point B. At that point, each dealer is preordering the minimum amount

and further reductions in d do not alter the equilibrium.

As we will see, both the Bertrand and Cournot prices play important roles as

benchmarks in the characterization of the subgame-perfect equilibrium of the three-stage

game. The Bertrand price pair, denoted as ($p_1^B(w), p_2^B(w)$), i.e. point B in Figure 6, is

obtained by solving $r_1^B(p_2; w)$ and $r_2^B(p_1; w)$. Appendix A reports the closed-form

solutions of the Bertrand outcomes, as well as other solutions derived in the remaining of

this subsection.

The Cournot price for dealer i is the price that corresponds to the quantity that solves the maximization problem for the dealer given his rival j's quantity. Assuming the rival's quantity to be fixed at k_j, the corresponding Cournot price response function, $r_i^C(k_j; w - 2d\,k_i)$, for dealer i is given by the solution to the following constrained maximization problem:

(4) $\max\limits_{p_i} \pi_i = (p_i - (w - d\ (a - p_i + b\,p_j)))(a - p_i + b\,p_j)$, subject to

$$k_j = a - p_j + b\,p_i.$$

The intersection of $r_i^C(k_j; w - 2d\,k_i)$ and $r_j^C(k_i; w - 2d\,k_j)$ provides the Cournot price pair denoted by $(p_1^C(w - 2d\,k_i), p_2^C(w - 2d\,k_i))$, or point C in Figure 6.

For d above some threshold, the equilibrium remains at A (which itself is a Cournot price pair). For d smaller than the threshold but not too small, the equilibrium price pair lies on the diagonal line AB. C is such a point. As d decreases from that threshold, the average net wholesale price to the dealer increases and hence amounts of preorders decrease. In Figure 6, this implies s^1 shifts downwards and s^2 upwards. As a result, C moves towards B along the diagonal line in the center parallelogram until it reaches B. I call the largest d inducing the price pair at B the critical discount and denote it as δ. δ is implicitly defined in $p_i^C(w - 2\,\delta\,k_i) = p_i^B(w)$. The uniquely feasible critical discount is given by $\delta = \dfrac{b^2}{2(1 - b^2)}$ (see Appendix A for proof). This is where the price outcomes shift from Cournot to Bertrand. At $d = 0$, preorders at the first stage are indeterminate but the sales quantities and prices in the second stage are determinate. The following lemma formally states this result. A proof is included in Appendix B.

Lemma 2: The price, quantity, and profit for the dealers in the quantity subgame depends on the quantity discount chosen by the manufacturer. If the manufacturer offers a low quantity discount, i.e. $0 < d \leq \delta = \dfrac{b^2}{2(1-b^2)}$, then the subgame-perfect prices, quantities, and profits for the dealers are given by:

Prices: $p_1^B(w) = p_2^B(w) = \dfrac{a+w}{2-b}$

Quantities: $k_1^B = k_2^B = q_1^B(w) = q_2^B(w) = \dfrac{a(1-b)w}{2-b}$

Profits: $\pi_i^B(w - 2d\, k_i) = \dfrac{(1-d)(a-(1-b)w)^2}{(2-b+2d-2b\,d)^2}, i = 1,2.$

If the manufacturer offers a steep quantity discount, i.e. $d > \delta = \dfrac{b^2}{2(1-b^2)}$, then the subgame perfect prices, quantities, and profits for the dealers are given by:

Prices: $p_1^C(w - 2d\, k_1) = p_2^C(w - 2d\, k_2) = \dfrac{a(1-2(1-b^2)d)+(1-b^2)w}{(1-b)(2+b-2(1-b^2)d)}$

Quantities: $k_1^C = k_2^C = q_1^C(w - 2d\, k_1) = q_2^C(w - 2d\, k_2)) = \dfrac{(1+b)(a-(1-b)w)}{(2+b-2(1-b^2)d)}$

Profits: $\pi_1^C(w - 2d\, k_1) = \pi_2^C(w - 2d\, k_2) = \dfrac{(1+b)(1-(1-b^2)d)(a-(1-b)w)^2}{(1-b)\,(2+b-2d(1-b^2))^2}.$

If the manufacturer offers zero quantity discount, i.e. $d = 0$, then the subgame perfect prices, quantities, and profits for the dealers are given by:

Prices: $p_1^B(w) = p_2^B(w) = \dfrac{a+w}{2-b}$

Quantities: $k_1^B = k_2^B = q_1^B(w) = q_2^B(w) = \dfrac{a(1-b)w}{2-b}$

Profits: $\pi_1^B(w) = \pi_2^B(w) = \dfrac{(a-(1-b)w)^2}{(2-b)^2}$.

The intuition for the results is as follows. In this game, the size of the preorders fundamentally determines the outcomes of competition. If the preorders are small, each dealer will realize that the rival will place additional orders in stage 2. In this circumstance, the threat to sell only the preordered quantity is not credible. Consequently, the equilibrium price and quantity of the two-stage game would be the same whether or not dealers could observe the quantity preordered by the rival in stage 1. Hence, the price-quantity pair arising in the equilibrium of the two-stage game must coincide with that of a one-stage game where prices are chosen simultaneously by firms with marginal cost w. I refer to this as the "Bertrand regime".

In contrast, if the preorders are larger, each dealer realizes that the rival has no incentive to supplement his preorder. Here, the threat to sell no more than the preordered quantity is credible and the price-quantity pair arising in the equilibrium of the two-stage game must coincide with that of a one-stage game where preordered quantities are chosen simultaneously by firms with decreasing marginal costs $(w - 2d\, k_i)$. I refer to this as the "Cournot regime"[12]. Whether preorders are large or small depends on the magnitude of the manufacturer's discount. If it is very small, the amount preordered is sufficiently small so that Bertrand outcomes ensue; if it is sufficiently large, the amount preordered is sufficiently large so that Cournot outcomes ensue.

---

[12] Baye and Ueng (1998) show that in an alternating-moving price game with differentiated products, the steady-state Markov equilibrium prices are strictly higher than one-shot Bertrand prices. This commitment effect is true even for an infinite number of periods.

Stage 0: Manufacturer's Choice of Discount

The manufacturer's problem in stage 0 is to choose an optimal quantity discount such that

its profit is maximized:

$$\max_{d \geq 0} \pi_m = (w - m - d \, k_1)k_1 + (w - m - d \, k_2)k_2 .$$

As I show below, the discount that maximizes the manufacturer's profit, namely the

optimal discount d*, is *either zero or strictly larger than the critical discount*, δ. For $0 \leq d$

$< \delta$, the highest profit for the manufacturer is always at d = 0 (which generates Bertrand

profit for the manufacturer), since in this regime dealers will not reduce preorders as the

discount is lowered. I denote the corresponding quantity discount and manufacturer's

profit as d_B^* and π_m^B respectively. For $d > \delta$, the equilibrium outcomes are Cournot. I

denote the Cournot optimal discount and profit for the manufacturer as d_C^* and π_m^C. The

manufacturer compares its Bertrand profit π_m^B and the Cournot profit π_m^C and chooses the

discount, i.e. either at zero or at d_C^*, that gives it a higher profit. The corresponding

discount is the optimal discount, d*. Table 1 summarizes the algebraic expressions of

these solutions. Therefore, in the two-stage ordering process, I have established the

following lemma:

    Lemma 3: In the two-stage ordering process, (1) if the manufacturer chooses d* =

0, then downstream competition is in the Bertrand regime and the manufacturer's profit

is $\pi_m^B = \dfrac{2(w - m)(a - w(1 - b))}{2 - b}$; (2) if the manufacturer chooses d* = d_C^* in stage 0 such

that $d_C^* > \delta$, then downstream competition is in the Cournot regime and the

manufacturer's profit is $\pi_m^C = \dfrac{(1 + b)(a - m(1 - b))^2}{4(2 - b - b^2)}$.

2.4. Conclusions

In this chapter, I modeled the two-stage ordering process adopted by various manufacturers and industry sectors. In this game theoretic model, the manufacturer offers quantity discounts to induce downstream dealers to preorder in the first stage and then the dealers compete in price in the second stage. As I have shown, the two-stage ordering process enables the upstream firm to control the intensity of downstream competition and thus affect the profits earned by its dealers. Specifically, under such arrangements, if the profit-maximizing manufacturer chooses a strictly positive discount, the downstream market will have Cournot outcomes even though dealers price by Bertrand in the second stage. If the manufacturer offers a zero discount, then the outcomes of downstream competition must be Bertrand.

With these analytical results on hand, I can link them to the data collected from Computec. The linkage enables me to estimate unobserved final prices and thus calculate the amount of economic rent earned by its dealers. Chapter 3 illustrates the econometric technique and estimates the amount of downstream economic rent left by the manufacturer. As we will see, the two-stage ordering process is an effective and workable mechanism to leave rent at the downstream.

Chapter 3

Estimating the Extent of Economic Rent under the Two-Stage Ordering

Process

3.1. Introduction

In this chapter, I estimate the economic rent that Computec actually leaves with

its heterogeneous group of dealers. To do this, I link the *specific* two-stage mechanism to

the longitudinal data obtained from Computec and use econometric techniques along the

lines of those used in the New Empirical Industrial Organization literature (e.g., Reiss

and Wolak 2005) to estimate the unobserved final retail prices of the dealers. However,

my estimation problem is quite different from most New Empirical Industrial

Organization work in the sense that final prices are not observed, but only data on

dealer's costs and quantities are available to me[13]. Using longitudinal data, I show how

these unobserved retail prices can be recovered. Specifically, to estimate the final retail

prices, I begin with the demand side estimation using a fixed effect model in which the

observed wholesale prices act as "proxy" for the final prices. Then, using the estimated

slope of the demand function and the *a priori* inferred level of dealer-side competition

---

[13] In many sale-resale contexts (e.g., business-to-business sales), manufacturers do not know the actual
downstream prices. Lack of appropriate tracking techniques or strategic unwillingness by the dealer to
reveal prices are two potential reasons.

from my analytic model and actual contractual data, I specify a supply relation to calculate the final prices.

By linking the two-stage ordering process to Computec's data, I addresses a serious gap between theory and empirical research in vertical settings. Specifically, several empirical studies have used econometric techniques to demonstrate positive downstream price-cost markups; however, these studies are not based on a specific vertical arrangement and instead focus on *inferring* the extent of competition and/or market structure from estimated parameters[14]. As such, even when a positive markup is identified in some settings, its *source* remains unclear. Differently, my study models analytically a specific channel arrangement and links this arrangement to assembled field data for systematic empirical analyses on downstream markups. Moreover, the positive downstream profits I estimate suggest that the ordering process is a workable mechanism for leaving economic rent downstream. Finally, empirically showing the existence of downstream rent in the context of a non-franchise, non-exclusive-territorial vertical channel complements the evidence found in the franchising literature (Kaufmann and Lafontaine 1994; Michael and Moore 1995).

This chapter is organized as follows. Section 3.2 links the analytical results derived in Chapter 2 to Computec. Section 3.3 presents the data. Estimation methods are presented in Section 3.4. Section 3.5 summarizes results. Finally, Section 3.6 concludes.

---

[14] An exception is Chintagunta (2002), who shows side payments are a component of retail margins.

3.2. Linking Computec and the Two-Stage Ordering Game

As we can see from Figures 1 and 2, Computec's channel arrangement essentially mirrors the two-stage ordering game. This close resemblance between theory and institution enables me to test for consistency between some observable implications from the theory model and corresponding facts from Computec's channel. In particular, I observe a match on two critical aspects that enable me to deduce the type of downstream competition between the dealers.

Specifically, Lemma 3 suggests that under the 2-stage game, the manufacturer should either offer zero or positive discounts, and if they offer positive discounts the downstream competition would be Cournot. Lemma 1, in turn, suggests that whenever discounts are positive neither dealer will order additional units in stage 2; in essence they would set prices so demand equals the amounts preordered. The data obtained from Computec (details in next section) shows support for both propositions. First, Computec *always* offers positive discounts to its dealers using the 2-stage ordering process. Second, throughout my longitudinal data over four sales cycles, *none* of the 60 dealers supplemented its order in stage 2 at the undiscounted wholesale list price. This suggests that dealer preorders constitute a credible commitment not to order more. Based on this match between theory and observation I *infer* that the downstream competition between dealers is most likely in the Cournot regime.

Why does this inference matter? I use this inference on the outcomes of game being played by the dealers (Cournot) to *a priori* setup my econometric specification that estimates the unobserved retail prices, the price-cost markups and economic profits earned by the dealers. My approach contrasts and complements with the NEIO-based

work on this topic. Specifically, existing studies estimate a "conduct parameter" from data and use it to infer *ex post* the type of competition and/or vertical game being played. As Reiss and Wolak (2005, pp.49-52) argue, however, even when positive markups are identified using this approach, they typically cannot be tied back to a specific rent-generating arrangement or market structure. In contrast, rather than estimate the conduct parameter from data, I use my theoretical analysis of the observed institutional structure to *set* the conduct parameter *a priori* and then estimate the markups. This approach enables me to tie the estimated markups to the specific vertical arrangement set by the manufacturer. I turn to this task below.

3.3. Data

The proprietary data were collected onsite at Computec's headquarters in China. The relevant period of the data is from December 2004 to November 2005, covering a period of twelve months. The data contain transactional details such as quantity discount schedules, wholesale prices, quantities, and marketing expenses. In the twelve month period of my data, there were four quarterly sales cycles. The data on quantity discounts and wholesale prices are quarterly whereas those on quantities and marketing expenses are monthly. Those monthly data allow me to exploit the variations arising from seasonality. I also secured data on Computec's marketing expenses on advertising, public relations, and other promotional activities. This data is available at the national, regional, and individual dealer levels. I could not get data on marketing expenses spent by dealers themselves, but company officials believed such amounts were minimal. I conducted personal interviews that provided background information on the industry, business

practices, and distributional and contractual arrangements[15]. Tables 2 and 3 provide the descriptive statistics and pairwise correlations, respectively.

<Insert Table 2 about here>

Note that for confidentiality purposes, all prices, costs/expenses, and quantities have been re-scaled. A fictitious monetary unit, Y$, is created as a result of the rescale. The following is the descriptions of the variables:

- Monthly quantity: monthly quantity delivered to the dealer.

- Wholesale price: dealer's wholesale price transacted with Computec, net of quantity discounts.

- Net wholesale market prices of competing manufacturers: selling prices of 3 direct competing manufacturers' products in the wholesale market in Beijing. These are monthly prices. Beijing is the largest wholesale market of computer related products in China and has the lowest wholesale market prices in the nation. A total of twelve observations, which are dealer-invariant, were obtained.

- Advertising expenses at national level: Computec's monthly advertising expenses in national media. There are twelve data points which are also dealer invariant.

- Public relations (PR) expenses at national level: Computec's monthly expenses on public relation activities such as press conference, exhibitions, and media relations. Twelve dealer-invariant observations were collected.

- Marketing expenses at regional level: marketing expenses such as outdoor displays, dealer conferences, display materials for retail outlets, and other

---

[15] To obtain a more comprehensive and independent view on the industry in China, I also interviewed two industry observers during the data collection period.

promotional activities that Computec spends in a specific region. Multiplying

eight regions by twelve months gives us 96 possible observations.

- Manufacturer's subsidy at dealer level: marketing dollars allocated to the dealer,

    i.e., the amount of expenses that Computec spends on a particular dealer on

    marketing activities such as outdoor displays, dealer conferences, display

    materials for retail outlets, and other promotional activities[16].

<Insert Table 3 about here>

3.4. Estimation Technique

To calculate the amounts of economic rent earned by Computec's dealers, I need

information on prices, costs, and quantities. When company data are available, this

economic rent can be calculated directly (e.g., Kaufmann and Lafontaine 1994). In the

case of Computec, I do not have data on final prices; only dealer's costs and quantities,

where final price refers to the price at which Computec's dealer sells the product to

second-tier retailers and/or consumers. As a result, my estimation problem is quite

different from that observed in most New Empirical Industrial Organization work in

which information on marginal cost, not final price, is usually unknown. Hence, I have to

develop a procedure to recover these unobserved retail prices. Specifically, to estimate

final retail prices, I begin with demand estimation using a fixed effect model in which the

observed wholesale prices act as a "proxy" for the final prices. Then, using the estimated

slope of the demand function and the *a priori* inferred type of dealer-side competition

---

[16] Nonetheless, Computec often overcompensates dealers on these marketing activities. Unfortunately, I could not obtain any estimates from the company on the overcompensated amounts. As a result, any positive effect of such subsidy on dealer sales would be overestimated. See also Section 4.4 and 4.5.

from my analytic model and actual contract data, I specify a supply relation to calculate the final prices.

To estimate the unobserved final prices, I use a linear demand specification that is frequently used in estimating structural models (e.g., Dube and Manchanda 2005; Kadiyali 1996; Roy, Hanssen, and Raju 1994). Specifically, the linear demand function for the product sold by dealer i at time t is taken to be:

$$(5) \quad q_{it} = \alpha_0 + \alpha_1 p_{it} + \alpha_2 p_{-i,t} + \sum_{r=1}^{3} \alpha_{r+2} \, p_{it}^r + \alpha_6 X_{it} + \sum_{m=1}^{3} \alpha_{m+6} X_t^m + \alpha_{10} X_i + \varepsilon_{it}, \ i \neq j,$$

where q_{it} is quantity demanded, p_{it} is own final price, $p_{-i,t}$ is the average final price of i's rival dealers located in the same region, p_{it}^r is a vector of final prices for the three competing brands sold by dealer i, X_{it} is Computec's subsidy on dealer i, X_t^m is a vector of Computec's national-level advertising and public relations expenses and regional-level marketing expenses, X_i is a vector of dealer time invariant characteristics such as the number of retail outlets and dealership tenure, α's are demand parameters to be estimated, and ε_{it} is the error term[17]. The coefficients of p_{it} and the $p_{-i,t}$ represent own-price effect and peer- (or intra-brand price-) effect respectively on quantity demand. Peer-effect is

defined as: $p_{-i,t} = \dfrac{1}{N_g - 1} \sum_{-i=1}^{N_.-1} p_{-i,t}$, where N_g is the number of dealers located in region g

(Bresnahan 1987, p.1046; Wooldridge 2002, p.331).

Since p_{it}, $p_{-i,t}$ and the p_{it}^r 's are unobserved, I cannot directly estimate (5). To solve this problem, I take advantage of the longitudinal nature of my data and use a fixed-effect

---

[17] Like previous studies (e.g., Chintagunta and Desiraju 2005, Sudhir 2001), I lack data on the full set of marketing expenses; hence I assume that the marketing expenses of the competing brands are absorbed by dealer- specific, time-invariant characteristics. Nevertheless, the inclusion of the marketing expenses by the focal brand (Computec) in my specifications improves my estimation by significantly reducing the (own) price endogeneity problem (Chintagunta 2002, Lal and Narasimhan 1996).

model along with the following assumptions on individual dealers' mark-ups. First, for competing manufacturers' products, I assume that each dealer adds a dealer-specific markup, θ_i, to the observed wholesale market prices, p_t^r, as his final retail price, i.e. $p_{it}^r = p_t^r + \theta_i^r$. Second, I write the unobserved own price as a function of wholesale price and its associated dealer-specific markup, δ_i: $p_{it} = \omega_{it} + \delta_i$, where ω_{it} is the after-discount or net wholesale price. This additive, rather than multiplicative, specification of dealer markups has been used previously (e.g., Kadiyali et al 2000) and more crucially for me, fits the pricing rules used by dealers. Indeed, my field interviews revealed that the dealers markup their costs by a fixed amount, and not by a percentage. Using the additive pricing rule on own price, I can express peer-effect as

$$p_{-i,t} = \frac{1}{N_g - 1} \sum_{-i=1}^{N_*-1} p_{-i,t} = \frac{1}{N_g - 1} \sum_{-i=1}^{N_*-1} (\omega_{-i,t} + \delta_{-i}) = \overline{\omega}_{-i,t} + \overline{\delta}_{-i}.$$

Second, the markups, which can be viewed as a measure of a dealer's pricing power, are also time invariant. Again, I believe this is reasonable because my field interviews revealed that the number of dealerships used by the leading manufacturers is fairly stable. I do not restrict the relative magnitude of θ_i^r's and δ_i; this allows the dealers to add different markups for different brands. Substituting the three expressions of final prices into (5), mean-differencing the transformed question to remove the markup terms and other time-invariant variables, and adding a sales cycle intercept, τ, to capture any time-trend effects gives:

$$q_{it} - \overline{q}_i = \tau + \alpha_1 (\omega_{it} - \overline{\omega}_i) + \alpha_2 (\overline{\omega}_{-i,t} - \overline{\overline{\omega}}_{-i}) + \sum_{r=1}^{3} \alpha_{r+2} (p_t^r - \overline{p}^r) + \alpha_6 (X_{it} - \overline{X}_i)$$

$$+ \sum_{m=1}^{3} \alpha_{m+6} (X_t^m - \overline{X}_i^m) + (\varepsilon_{it} - \overline{\varepsilon}_i).$$

Note that this specification removes any potential omitted variable bias caused by unobserved markups which are correlated with prices and marketing activities (e.g., Lal and Narasimhan 1996). Renaming the transformed variables, I then estimate:

$$(5') \qquad \ddot{q}_{it} = \tau + \alpha_1 \ddot{\omega}_{it} + \alpha_2 \ddot{\omega}_{-i,t} + \sum_{r=1}^{3} \alpha_{r+2} \ddot{p}_t^r + \alpha_6 \ddot{X}_{it} + \sum_{m=1}^{3} \alpha_{m+6} \ddot{X}_t^m + \ddot{\varepsilon}_{it}.$$

Note that the mean-centered wholesale prices, $\ddot{\omega}_{it}$, are uncorrelated with the demand errors, $\ddot{\varepsilon}_{it}$ (Berry 1994), which is further supported by the results of endogeneity tests. I also tried semi-log and log-log demand specifications and found similar fit to data relative to the linear specification in (5'). To take into account of regional differences, I incorporate an interaction of $\ddot{\omega}_{it}$ with the regional dummies to obtain estimates of region-specific dealer-level slopes of demand, namely $\hat{\alpha}_{1g}$. Region-specific estimates of peer-effect and Computec's subsidy on a specific dealer are obtained similarly. Nevertheless, I do *not* use regional dummies to interact with cross-brand prices and regional- and national-level marketing expenses because of their limited numbers of observations (see Table 2)[18]. The estimated region-specific slopes of the demand function, $\hat{\alpha}_{1g}$'s, are used in the supply side formulation to compute the unobserved final prices.

First-order condition of dealer's profit maximization yields the following price-cost markup relation:

$$(6) \qquad p_{it} = MC(q_{it}) - \lambda_{it} \frac{\partial p_{it}}{\partial q(p_{it}, p_{-i,t}, p_{it}^r)} q_{it}(p_{it}, p_{-i,t}, p_{it}^r),$$

---

[18] Although there are a total of ninety-six possible observations for regional-level marketing, Computec does not have any regional expenses in most of the months, which makes the "effectual" number of observations quite small.

where MC($\cdot$) is the marginal cost function, q($\cdot$) is the dealer's demand function which takes both intra- and inter-brand competition into account, and λ_{it} is the conduct parameter for intra-brand competition. The partial derivative with respect to own quantity on the right hand side of (6) is the inverse of the slope of the individual dealer's demand curve. However, because of my short-panel, I cannot estimate dealer-specific slope of demand, but only region-specific slope of demand for a representative dealer located in that region. I account for such limitation in calculating individual dealers' final prices by assuming a dealer's markup equals to the markup of the representative dealer located in the same region (e.g. Reiss and Wolak 2006). With downstream Cournot outcomes, i.e. $\lambda_{it} = 1$ for all i's and t's (Bresnahan 1989), assuming the discounted wholesale price, ω_{it} to be the only marginal cost, and *approximating* an individual dealer's markup with the average markup corresponding to his located region, I can *calculate* the final price, $\hat{p}_{it}$, for all dealer i's in region g, as:

$$(7) \qquad\qquad \hat{p}_{it} = \omega_{it} - \frac{1}{N_g \cdot \hat{\alpha}_{1g}} Q_{gt},$$

where $\hat{\alpha}_{1g}$ is the slope of the demand function in region g, N_g the number of dealers in region g, and Q_{gt} is the aggregate regional quantity in month t. This formulation of final prices results in a pattern of regional-level price dispersion that is equivalent (to be precise, affine-transformed) to that of dealers' net wholesale prices, which clearly requires an assumption about the nature of intra-brand competition in that region. That is, large dealers sell at lower prices than smaller ones because the former has lower average wholesale prices while the latter has higher average wholesale prices. This can be

justified by the institutional fact that these two types of dealers focus on different customer segments: wholesale for the large dealers versus retail for the small dealers.

On the other hand, note that my measure of marginal cost in (7) follows a more precise definition per economic theory and excludes costs that do not vary with each additional unit sale (e.g., Pindyck and Rubinfeld 2001). As such, I assume that employees' wages are short-run fixed costs and thus, the marginal selling cost is negligible. My field interviews revealed that almost all the sales people hired by dealers are paid by either pure salary or a combination of fixed salary and semi-annual or annual bonuses based on company-wide profitability; hence, a sales person's incentives are not set at the unit margin. Moreover, dealers usually do not offer overtime pay even if their sales people work overtime occasionally; instead such overtime work effort by sales people is taken into account for the bonus considerations.

Finally, I calculate the gross and net economic profit earned by dealer i over the 12 months of data as

$$(8) \qquad \Pi_i^G = \sum_{t=1}^{12} (\hat{p}_{it} - \omega_{it}) \cdot q_{it} \text{ and } \Pi_i^N = \sum_{t=1}^{12} (\hat{p}_{it} - \omega_{it}) \cdot q_{it} - F_i$$

respectively, where F_i includes employee salary/wages, the entrepreneur's opportunity cost of time (proxied by their second-best job), and the office/outlet rental charges. The first two items may be categorized as short-run fixed costs; and as discussed above, not part of the marginal cost. According to company officials, other expenses such as utility bills are negligible. I exclude tax- and interests- based expenses in (8); hence, the Π_i's can be thought as pre-tax and pre-interests economic rents. Specifically, information on wages of computer engineers and those of wholesale/retail workers were collected from

China Provincial Statistical Yearbooks (2005, 2006)[19] while dealers' rental fees were

provided by regional managers. I assume that the opportunity cost of the entrepreneur's

time equals a computer engineer's wage in that corresponding city because computer

engineers were among the highest paid jobs across all the occupations that were surveyed

by the Statistical Yearbooks. Since the employees of Computec's dealers engage in

wholesale and/or retail business in the computer industry, I assume that their

compensation is equal to the mean wage of the computer engineers and wholesale/retail

workers. The total employee wage expense of a dealer is then calculated by multiplying

this wage by the number of sales people and technical support staff he hires. The sum of

the entrepreneur's opportunity cost, employee wages, and rental fees is lastly weighted by

the share of dealer's total business that is Computec's sales to obtain the dealer's fixed

costs incurred for selling Computec's product.

3.5. Empirical Results

Table 4 summarizes the results from the pooled demand estimation. In order to

control for intra-brand competition or peer effects, in column 2 I include the average

own-brand price of competing dealers that are co-located in the same region as dealer i.

As expected, the demand function is negatively sloped, and intra-brand and inter-brand

competition show positive substitution patterns. National and regional marketing

campaigns and activities and manufacturer's subsidy are all effective. The two sets of

estimates on the own price coefficient are almost identical.

<Insert Table 4 about here>

---

[19] China Statistics Press (2005, 2006), Provincial Statistical Yearbooks.

Table 5 provides the regional estimates. Note that dealers in Beijing, the East, and the South – the three most developed regions in the country – have significantly larger coefficient estimates on price, i.e. higher price sensitivity, than those of the five less developed regions. The more competitiveness in these regions is also evident from the significant, positive, and large estimates of peer-effect in these three regions. National-level advertising and public relations campaigns and regional-level marketing are effective in generating demand. Finally, the marketing resources Computec spends on individual dealers seem to be effective in four out of the eight regions.

<Insert Table 5 about here>

Table 6 shows the estimated average final prices by region. According to company officials, these estimates seem to be a little (approximately 5-10%) higher than their expectation based on anecdotal evidence on the average purchased prices obtained from the second-tier retail shops. For example, such purchased prices in Beijing were around Y$1400-1500, which is only slightly lower than my estimates of Y$1512. This makes sense since my final dealer price estimates should be taken as the average of the wholesale price to second-tier retail shops and retail prices to end-consumers.

<Insert Table 6 about here>

Based on my estimates of the final prices and individual quantities at each dealer, I use equations (8) to calculate the economic rent earned by each dealer in the fiscal year 2004-2005. The first two columns in Table 7 show the estimated gross rent, before accounting for the entrepreneur's opportunity costs, employee wages, and office/store rental charges while the last two columns summarize these results by region. My results show that the average net economic rent of a typical dealer is Y$4.48 million, or

approximately $30,000, for the one-year data period, which shows the effectiveness of

the profit-generating purpose of the two-stage ordering process. Since Computec does not

use any transfer mechanism to extract such profits from the dealers, *ex ante* rent equals *ex

post* rent[20]. The existence of *ex ante* rent is circumstantially supported by the observation

that there is always a "queue" of potential dealers hoping to land a dealership from

Computec (e.g., Mathewson and Winter 1985, Kaufmann and Lafontaine 1994).

<Insert Table 7 about here>

3.6. An Assessment of the Effectiveness of the Two-Stage Ordering Mechanism

Computec's two-stage ordering process creates economic incentives for its

independent dealers. Anecdotal evidence from both internal and external sources

provides support to the effectiveness of this arrangement. Interviews with company

officials revealed that before the deployment of the current two-stage ordering process,

dealers' markups were much thinner than what I estimated. I further compare the

profitability of Computec's dealers to that of other information-technology (IT)

distributors in China. By Tables 1 and 4, the net profit margin of an average Computec is

6.52%. I use the two largest IT distributors in China – Digital China and PCI – as

benchmarks. According to their company reports, the operating margins, i.e. profit

margins before interest and taxes but *excluding* opportunity cost of entrepreneur labor,

are 1.89% (fiscal year 2005-6) and 1.35% (first 3 quarters of 2006) for Digital China and

---

[20] *Ex post* rent is the stream of positive profits earned by dealers *after* they commence marketing the product while *ex ante* rent are the economic profit earned by dealers *before* they commence marketing. For example, a two-part tariff where the manufacturer extracts *all* the profits through a fixed fee involves *ex post* rent rather than *ex ante* rent.

PCI respectively[21], which are indeed significantly lower than that of an average

Computec's dealer.

3.7. Conclusions

In this chapter, I match the decision structure and results of the model with actual

contractual arrangements and novel data obtained from Computec to estimate the

unobserved final prices and hence the economic profit earned by each dealer over a one-

year period. I find that the manufacturer leaves rent with a heterogeneous group of

dealers. Complementing what have found in the franchising context (Kaufmann and

Lafontaine 1994; Michael and Moore 1995), this is a new evidence showing the existence

of downstream rent in a non-franchising and non-exclusive distribution arrangement.

By embedding observable data into the specific institutional context is important

for model-building and subsequent interpretation of data (Coughlan and Wernerfelt 1989).

Manufacturers often offer quantity discounts and induce downstream dealers to preorder.

Using the analytical results from Chapter 2, I show that under the two-stage ordering

process adopted by Computec, an observed positive discount could result in Cournot

outcomes rather than Bertrand outcomes in the downstream market even though its

dealers compete in price; hence, quantity rather than price would be the appropriate

choice variable in formulating the supply relation in both theory and empirical analyses.

Without taking account of the details of the ordering process, a researcher would not

know whether to summarize industry supply as the result of price or quantity competition.

---

[21] See www.digiticalchina.com.hk and www.ecs.com.sg. Assessed on December 5, 2007. ECS Singapore is
a major shareholder of PCI China. The companies use the accounting term "operating margin" or
"operating profit" in their financial statements.

My findings also have important managerial implications. First, in many contexts, downstream rent-generating mechanisms like resale price maintenance, territorial restrictions, and fixed fee transfers might not be feasible. By showing the existence of downstream rent in Computec's distribution channel, I showed that a combination of the two-stage ordering process with its quantity discounts is an effective mechanism to soften downstream competition and thus to leave economic rent. In this sense, my study identified an alternative mechanism in widespread use which creates economic profits downstream. Second, in many contexts (e.g., business-to-business sales), downstream members might be reluctant to reveal their pricing information because of strategic considerations (for instance revealing one's profit margin is likely to weaken one's bargaining position in vertical relationships). My estimation method should help manufacturers recover the unobserved downstream selling prices. My method requires information on contractual arrangements, wholesale prices, quantities, and number of assigned dealers; such information is likely to be readily available in company records. Therefore, my model should appeal to those manufacturers which want to adopt a more structural way to alleviate the asymmetric information problem.

According to the self-enforcement theory, economic rent, combined with supervision, is a useful instrument to induce downstream marketing effort. In the next chapter, using the estimated amounts of dealer profits and other data, I look at the interdependence of rent and supervision and its role in encouraging the provision of desired dealer effort.

Chapter 4

Inducing Dealer Effort: The Role of Economic Rent and Supervision

4.1. Introduction

In long-term relationships between a manufacturer and its dealers, the upstream firm often uses both economic incentives and supervision as control mechanisms to coordinate downstream marketing activities (e.g., Weitz and Jap 1995). The logic, according to the self-enforcing contracts literature (e.g., Dutta, Bergen, and John 1994; Heide 1994; Kaufmann and Lafontaine 1994; Klein and Murphy 1988, 1997; Lafontaine and Raynaud 2002; Murry and Heide 1998; Telser 1980; Wathne and Heide 2000) is that that, when monitoring is costly, combining economic rent for the dealers with the manufacturer's supervisory effort can serve as an incentive that discourages shirking and encourages non-contractible promotional activities by dealers.

Both theory and empirical work find economic incentives co-exist with supervision in bilateral agreements. The self-enforcement perspective offers a framework to analyze the nature of such vertical agreements. In that framework, economic rent, supervision, and the authority to terminate are the three required elements to make a vertical agreement self-enforcing within a dyad (e.g., Kaufmann and Lafontaine 1994; Klein and Murphy 1988, 1997; Klein 1999). Given the right to terminate non-performing dealers, downstream economic rent in the form of a profit stream provided by the

manufacturer combined with supervision in the form of directing dealer behavior and monitoring their performance incentivize dealers to provide desired promotional services.

The self-enforcement framework (e.g., Klein 1980, p.360), together with classical efficiency wage theory (e.g., Becker and Stigler 1974; Shapiro and Stiglitz 1984) and some recent work on the theory of the firm (e.g., Roberts 2004, p.35), presumes that manufacturer's supervision and economic rents act as substitutes in their ability to reduce opportunism[22] in relational exchanges. The rationale is that the more capable the manufacturer is in observing dealers' compliance through supervision, the less the marginal value of profit premium to enforce desired behavior. This implies that to induce a desired level of compliance, the manufacturer can trade off between the amount of downstream rent and its supervisory intensity.

However, the exact nature of their interdependence, i.e. whether the *amount* of economic rent left downstream and the *intensity* of manufacturer's supervision are substitute or complementary control instruments, has not been empirically established. In fact, institutional details about Computec's relationship with its dealers suggest that the intensities of supervision and downstream rent are used as *complementary*, rather than substitute, control instruments. As I showed in previous chapters, the manufacturer mainly uses a two-stage ordering process to leave rent. At the same time, Computec's sales and marketing personnel supervises its dealers by directing and monitoring their activities. According to field interviews, regional managers at Computec revealed that their supervisory effort often received with the most cooperative behavior, and thus led to

---

[22] Notwithstanding, recent analytical models (e.g., Allugin and Ellingsen 2002) and empirical work (e.g., Rebitzer 1995) show the substitutability prediction between supervision and wage premium can be tedious. See also Prendergast (1999).

most productive results, from the dealers who were highly profitable. This observation implies that supervision and rent are complements.

Given the presumably important role of economic rent and supervision in vertical agreements, it is surprising that there is very little empirical work on their interdependence and its performance or outcome effects. The purpose of this chapter is to empirically assess whether evidence in Computec's context supports the field observation that rent and supervision are complements and, if so, the effect of such complementarity on inducing non-contractible dealer marketing efforts. Complementarity carries a precise meaning in this dissertation: two instruments are said to be complements (substitutes) if increasing usage of one increases (lowers) the returns of using the other (Milgrom and Roberts 1990; 1995)[23]. According to this definition, merely observing the joint-adoption or co-existence of the two instruments is necessary but not sufficient to conclude that they are complements (e.g., Wathne and Heide 2000).

Fit among governance forms is essential to achieve efficient outcomes in bilateral relationships (e.g., Ghosh and John 1999, 2005). Complementarity is a useful idea to analyze such organizational design issues since it offers a concrete concept to study synergistic effects and provides some basis to interpret the effects of fit among marketing strategies, organization structures, or managerial processes (Milgrom and Roberts 1995). By studying complementarity between rent and supervision, this essay makes three primary contributions to the research of vertical agreements. First, in many organizational design contexts, multiple practices are adopted in a complementary manner to create synergistic effects on intended outcomes. Therefore, investigating complementarity among various control mechanisms has important implications to the study of governance

---

[23] See next section on the technical definition and operationalization of complementarity.

issues since an incoherent system would lead to inefficiency (e.g., Athey and Stern 2002; Ghosh and John 2005). This essay responds to this call by demonstrating, in the context of self-enforcing vertical agreements, the existence of complementarity between downstream rent and supervision and its effect on the supply of dealer marketing effort.

Second, my empirical analysis below confirms the field observation that rent and supervision are complements. In other words, in Computec's case, expending more supervisory effort increases the returns to leaving a profit premium when it comes to inducing the provision of downstream promotional effort. This evidence is contrary to the presumptions from classical efficiency-wage and self-enforcement theories; thus, the intensity of rent and supervision need not to be negatively related as per conventional wisdom. My results also suggest that the amount of economic rent and/or supervisory effort affects the intensity, and not just the existence, or not, of downstream marketing effort. These new findings call for extensions of the aforementioned theoretical frameworks (e.g., Allgulin and Ellingsen 2002).

Third, in the process of exploring the complementarity issue, I introduce recently developed methods in the organizational design literature to the testing of complementarity in the context of distribution channels. While reduced forms test statistical associations to determine complementarity (e.g., Arora and Gambardella 1990; Novak and Stern 2007), the more structural productivity (or outcome) approach posits that desired outcomes are a function of control instruments (e.g., Athey and Stern 2003). These methods are appealing since price or cost information on the use of control instruments is not required. Note that although market prices are readily available for

many consumer products, prices of institutional choices would be very difficult to measure or observe.

The chapter proceeds as follows. Section 4.2 defines complementarity. Section 4.3 reviews the literature on self-enforcing agreements. Institutional arrangements are described in Section 4.4. Sections 4.5 and 4.6 describe data and empirical methods, respectively. Section 4.7 presents empirical findings. Section 4.8 concludes.

4.2. Complementarity: A Definition

In the organizational design literature, the notion of complementarity is directly related to supermodular functions in lattice theory. Specifically, function f: $R^2 \rightarrow R$ is supermodular if for all a, b in the 2-dimenational x-y space

(9) $f(max(a, b)) - f(a) \geq f(a) - f(min(a, b))$,

where max(a, b) is the coordinate-wise maximum of a and b, i.e. $(max(x_1, y_1), max(x_2, y_2))$ and min(a, b) is the coordinate-wise minimum, i.e. $(min(x_1, y_1), min(x_2, y_2))$. In (9) the two activities x and y are said to be complements[24]. Moreover, f is submodular and its arguments are substitutes if function (–f) is supermodular; or, the inequality sign in (9) becomes "<". Thus x and y are complements (substitutes) if increasing one variable raises (reduces) the return of using the other, or if increasing both x and y together yields a higher (lower) return than the sum of just increasing x or y separately[25].

It can be shown that for a twice-differentiable function f, its arguments x and y are complementary if and only if the second-order cross derivative between x and y, $\partial^2 f$ /

---

[24] Following the literature on organizational design, I use weak inequality in (9) to define supermodality and thus when equality holds for (9), x and y are (weakly) complements as well. See also Milgrom and Roberts (1990; 1995) for a definition of supermodular functions with $R^n \rightarrow R$.

[25] Notice that (9) can be rewritten as $f(max(a, b)) - f(min(a, b)) \geq [f(a) - f(min(a, b))] + [f(b) - f(min(a, b))]$.

$\partial x \partial y \equiv f_{xy} \geq 0$ (Topkis 1994). This expression is identical to the definition of

interdependence in productivity analysis (Beattie and Taylor 1985; Coelli, Rao, and

Battese 1998). In productivity analysis, x and y are said to be complementary (substitutes)

if the cross derivative is positive (negative)[26, 27]. Therefore, one way to empirically infer

whether the two instruments are complements is to look at the sign of the interaction term

between x and y in a regression where the dependent variable is productivity or desired

outcome. Notice that this operationalization of complementarity does not require the

knowledge of the cost of adopting a control instrument. This is appealing since in many

contexts of organizational design, it would be difficult to obtain information on the cost

of various institutional choices.

4.3. Control Mechanisms in Self-Enforcing Agreements

Marketing researchers have long pointed out the importance of channel control

(e.g., Bucklin 1973). A control system is defined as the set of procedures adopted by an

upstream firm for the purpose of monitoring, directing, evaluating, and compensating its

agents (Anderson and Oliver 1987). This notion of control, which includes information

provision and gathering on the one hand, and reinforcement through incentives on the

other, is very similar to the ideas developed in the self-enforcement framework. Among

---

[26] This is also known as Edgeworth complements (Milgrom and Roberts 1995). In the economics of production literature, this relationship is called factor interdependence which is a different concept from factor substitutability. The latter assumes constant output while the former does not. See Beattie and Taylor (1985, p.34). This chapter follows other organizational design studies by focusing on the interdependence, rather than the substitutability, between institutional choices.

[27] Separately, the marketing literature has almost exclusively used cross-price effects on consumer goods to examine consumption complementarity (e.g., Chintagunta and Halder 1998; Duvvuri, Ansari, and Gupta 2008; Manchanda, Ansari, and Gupta 1999; Song and Chintagunta 2007). These studies test complementarity between consumer products by estimating cross price effects on quantity demanded. If the quantity demanded for product y is increasing in the price of x, i.e. $\partial y / \partial p_x \geq 0$ (<0), then x and y are said to be complements (substitutes).

various theoretical perspectives[28], the institutional details of Computec's distribution arrangements are best aligned to this framework. As a result, for the remainder of this section, I will discuss the theory and its main elements in detail.

Self-enforcing agreements in vertical settings refer to manufacturer-dealer agreements that are enforced within the dyad without any intervention of third parties. These agreements are self-enforceable because dealers get a benefit from the vertical relationship that is at risk if they do not behave or perform as requested by the manufacturer (Lafontaine and Raynaud 2002). To promote its product, the manufacturer often request dealers to engage in marketing services and promotional efforts such as presale education, product display, quality assurance, and customer recruitment. However, these marketing services can be costly for dealers to perform and competing dealers can free ride (Telser 1960; Blair and Lafontaine 2005). In addition, from the manufacturer's perspective, dealer effort level might be too low in many contexts. This is because the gross profit margin is usually much smaller downstream than upstream and the bulk of benefits of selling an additional unit do not go to the dealers (Blair and Kaserman 1983; Klein 1999; Klein and Murphy 1997)[29]. Together, these vertical externalities can result in sub-optimal dealer effort.

---

[28] Alternative theories would be property rights theory, agency theory, and transaction cost analysis. However, because (1) there is no ownership decision to be made on specific physical investments between Computec and its dealers, (2) uncertainty and risk sharing do not seem to be important factors in their relationship, and (3) neither side makes noticeable specific investments, these theories would be less applicable in my context. Notice that the original self-enforcement theory (Klein and Leffler 1981, Klein and Murphy 1988) is based on the notion of choosing the optimal self-enforcing range by balancing flexibility to adapt and possible hold-up ex post. Nevertheless, hold-up due to specific investments is not necessary for self-enforcement arguments to be applicable. Minimizing bargaining cost ex post (Barzel 1982; Masten 2007) or the mere existence of ex post rent (Klein 1995) can lead to hold-ups.
[29] Manufacturers usually incur large fixed costs and therefore need to have a large gross margin in equilibrium to recover those investments in, for example, R&D and branding.

When dealer inputs are easy to measure or outputs are good indicators of marketing effort, the manufacturer can compensate the dealers through trade deals such as sales drives, display allowances, and off-invoices (Blattberg and Neslin 1990; Coughlan, Anderson, Stern, and El-Ansary 2006). However, marketing efforts and their outcomes can be difficult to measure and verify due to uncertainty, complexity, and a lack of perfect monitoring; hence direct compensation through high-power incentives may not be infeasible (e.g. Celly and Frazier 1996; Raynaud and Lafontaine 2002; Klein and Murphy 1988, p.285; Wathne and Heide 2000, 2004). Moreover, even when the dealers have the best intention and faith to sell, they may not have the necessary product knowledge or marketing skills to make the best use of their effort. To induce desired yet non-contractible dealer services under these circumstances, the manufacturer needs to *both* generate "benefits" in the form of a downstream profit stream *and* supervise its dealers. Finally, to constrain downstream opportunism and discipline non-performing dealers, the manufacturer ought to reserve termination rights. Evidence has shown that these rights economize enforcement costs in vertical contracts (Brickley, Dark, and Weisbach 1991; Klick, Kobayashi, and Ribstein 2008).

Economic Rent

Economic rent refers to the part of dealer revenue that is above economic costs, including opportunity costs of the dealership. As I have argued, when marketing efforts are non-contractible, high-power incentives that tie to specific actions or outcomes are not available and thus economic rent becomes an appropriate incentive instrument. It is important to note that using economic rent as an incentive mechanism, and thus a self-enforcement framework, applies most appropriately when desired dealer actions are

difficult to verify and directly contract for (Cheung 2001; Rebitzer 1995). Economic rent

can be created through restrictive distribution arrangements such as resale price

maintenance (e.g. Klein and Murphy 1988; Telser 1960), exclusive territories (e.g. Dutta,

Bergen, and John 1994; Dutta, Heide, and Bergen 1999), or upfront fixed fees (e.g.,

Kaufmann and Lafontaine 1994) and as I showed in previous chapters, ordering

processes. Using economic rent as a control instrument achieves two functions. First, the

manufacturer compensates desired yet non-contractible dealer services (Telser 1960;

Marvel 1982). Second and foremost, economic rent acts an enforcement mechanism for

dealers to adhere to, rather than to violate, requested behaviors (Klein 1996; Klein and

Murphy 1988, 1997; Telser 1980). When the manufacturer leaves a large enough rent, the

dealer would find its gain from performing as requested is larger than the expected gain

from non-performing, and thus will choose to behave as desired by the manufacturer.

Formally[30], the dealer compares the expected gain from compliance, B_c, and the

additional short-run gain from deviating from requested behavior, B_d, and then decides

whether to supply the desired level of marketing effort. B_d can be expressed as

(10) $$B_d = \pi_t(m_L) - \pi_t(m_H),$$

where t is the amount of time it takes the manufacturer to detect non-compliance. $\pi_t(m_H)$

and $\pi_t(m_L)$ are dealer profit under high marketing effort and low marketing effort

respectively. B_c, on the other hand, is the present discounted value of the future profit

stream, or economic rent, that can be earned in the dealership as long as the dealer is

performing as desired by the manufacturer:

---

[30] This discussion is adapted from Klein and Murphy (1997). Other papers have discussed this in a similar manner as well. See, e.g., Klein and Murphy (1988), Klein (1996), Lafontaine and Raynaud (2002).

$$B_c = \sum_t \frac{\pi_t(m_H)}{(1+r)^t},$$

where r is the discount factor. This profit stream is lost if the dealer is found to have underprovided effort. Then in a self-enforcing agreement, the dealer will perform as requested if and only if $B_c \geq B_d$ at every point in time.

Supervision

While economic rent functions as reinforcement for desired behavior in a control system, the manufacturer also guides and instructs dealer's activities (Alchian and Demsetz 1972[31]; Blair and Lafontaine 2005; Lafontaine and Raynaud 2002; Klein and Murphy 1988). The supervisory effort helps to direct, as well as establish the extent of, dealer compliance and performance. In this dissertation, supervision connotes a broader meaning than monitoring. In the marketing literature, monitoring often refers to efforts that reduce information asymmetry through the measurement of output and behavior (e.g., Anderson and Oliver 1987; Heide 1994; Heide, Wathne, and Rokkan 2007). And the term supervision is *further* inclusive of efforts that correspond to active information provision and guidance (Alchian and Demesetz 1972).

Monitoring has been widely studied as a control instrument in the marketing literature. Many have looked at intra-firm monitoring and its effect on individual employees[32]. For example, Joworski (1988) looks at the antecedents of adopting formal (input/process/output) versus informal (self/social/cultural) monitoring mechanisms and

---

[31]Specifically, Alchian and Demestz (1972, p.782) use the term monitor to "connote measuring output performance, appropriating rewards, observing the input behavior of inputs as means of detecting or estimating their marginal productivity and giving assignments and instructions as in what to do and how to do it". I follow this definition but choose to use the term supervision in this dissertation.
[32] See Anderson and Oliver (1987) and Jorworski (1988) for reviews. See also Oliver and Anderson (1994) and Jaworski, Stathakopoulos, and Krishnan (1993).

their consequences on marketing personnel and their unit[33]. Anderson and Oliver (1987) distinguish between outcome-based and behavior-based monitoring and hypothesize their impacts on sales people's performance. On the other hand, research on governance forms has examined inter-firm monitoring mechanisms. Stump and Heide (1996) look at the relationship among different control mechanisms and buyer monitoring of suppliers' outputs is one of them. Lafontaine and Slade (1996) and Heide et al (2007) examine the actual effects of output- versus behavior-monitoring on partner's opportunistic behaviors. Bello and Gilliland (1998) investigate, among other coordinative mechanisms[34], the determinants and effects of output and process monitoring on sales and profitability of export channels. In generally, monitoring, being one type of supervisory efforts, is found to safeguard against opportunistic behavior, especially when manufacturer's monitoring activities are viewed as legitimate from the dealer's perspective (e.g., Heide et al 2007).

Complementarity between Economic Rent and Supervision

Based on self-enforcement arguments, Murry and Heide (1998) look at the impact of incentive premium and supervision on dealer's compliance to promotion agreements[35] and find that stores' compliance to promotion agreements is increasing in incentive premiums but not affected by monitoring; unfortunately, their paper does not explore if complementarity exists between the two. In fact, neither explicit discussion nor empirical

---

[33] Interestingly, the author also raises the issue of synergy and complementarity between different control mechanisms; but they do not offer a formal test.
[34] Flexibility is the third coordinative mechanism in their theoretical framework. See also Celly and Frazier (1996) which investigate the antecedents of using outcome-based and behavior-based communication strategies by supplier personnel to their distributors.
[35] Interpersonal attachment between boundary personnel is also included in their model as another determinants of compliance.

testing of the complementarity issue is common in the self-enforcement literature[36], in spite of the frequently mentioned co-existence of rent and supervision (e.g., Klein and Murphy 1988; Murry and Heide 1998). But as we saw, although co-existence is necessary, it is not sufficient to infer complementarity.

As discussed earlier, assuming detection of cheating leads to termination, the dealer would rather supply the desired high-level marketing effort and not deviate if the additional gain from deviation is smaller than the expected value of the profit stream earned by performing; that is:

$$(11) \qquad\qquad B_d = \pi_t(m_L) - \pi_t(m_H) \le B_c.$$

Now suppose that the manufacturer increases its per-period profit premium for supplying the high marketing effort to $\pi_t'(m_H)$ ($> \pi_t(m_H)$). Given that the short-run gain to the dealer from shirking, $\pi_t(m_L)$, is unchanged, the incentive to deviate is lower as B_d is decreased. As a result, the manufacturer can reduce its supervisory effort, say from S_H to S_L, to detect non-compliance. I call the change from S_L to S_H the substitution effect on supervision. In this scenario, consistent with the assumption in classical efficiency wage models (e.g., Becker and Stigler 1972; Shapiro and Stiglitz 1984) economic rent and supervision are considered as substitute instruments.

However, being substitutes is not a necessary consequence of the increased rent. Instead of fixing the desired effort level, I allow it to be affected by the amount of downstream rent and thus the desired level can be varied continuously above m_L. Specifically, at the same time of offering more profit premium, it is reasonable to assume that the manufacturer would also like its dealers to raise their effort level to m_H' ($> m_H$).

---

[36] Klein (1980) hints that the two instruments might be substitutes (p.360). In labor economics, there is a large body of theoretical and empirical work examining complementarity between wage premium and supervision. See Prendergast (1999) for review.

To ensure that the heightened effort level is implemented and thus the higher profit premium is justified, the manufacturer is likely to expend a higher supervision level than S_L, say at S_H' on the dealers. I call the change from S_L to S_H' the scale effect on supervision. Whether rent and supervision are substitutes or complements depends on the relative size of the substitution and scale effects. When the scale effect dominates (is dominated by) the substitution effect and renders S_H' larger (smaller) than S_H, economic rent and supervision are complementary (substitute) in inducing dealer efforts[37].

This analysis shows that it would be difficult to sign the interdependence of economic rent and supervision *a priori*. Hence, I take the theoretic ambiguity to mean that whether rent and supervision are complements or substitutes is ultimately an empirical matter. Before delving into the empirical analysis, I next provide a brief description on Computec's institutional arrangement, mainly on its supervision effort and dealers' marketing activities that are desired by the manufacturer.

4.4. Institutional Arrangement

Computec has a network of 60 independent dealers throughout the country and has divided the country into eight geographic sales regions. Manufacturers in this industry in China are challenged by an under-developed infrastructure that inhibits distribution and marketing of their products to interior towns and peripheral cities where economic development is rapid. Table 8 presents economic indicators, viz. the income levels and economic growth rates across the eight sales regions. To capitalize on the rapid economic growth, manufacturers like Computec actively seek dealers that are stable financially and capable of undertaking desired market development activities. Moreover,

---

[37] Recall that this relationship is called as factor interdependence. See footnote 26.

to maintain flexibility Computec uses a non-exclusive distribution system and dealership agreements can be terminated at will from both sides. Indeed, Computec has terminated non-performing dealers in the past. Besides selling, a dealer would be requested to organize and carry out local promotional activities, including product training, marketing materials delivery, and customer development[38]. Since these services (1) are difficult to verify by third parties and (2) may not link to immediate sales, Computec does not use formal agreements to enforce them. Instead, Computec uses both economic incentives and active supervision to induce dealer effort in market development.

Computec believes that leaving dealers a satisfying amount of profits is essential to create incentives for them to sell, carry, and support its products[39]. To generate economic rent, the company adopts the effective two-stage ordering process I examined in previous chapters. Computec also offers subsidies, nominally known as marketing dollars, to selected accounts who are competent and devoted dealers located in strategic markets. These marketing expenses are intended for local advertisements, outdoor displays, or promotional events (see Section 3.3). But the manufacturer usually overcompensates – some times quite significantly – for these activities. According to company executives, this purposeful act is used to indirectly reward these key channel partners for their long-term performance and compliance. Unfortunately, there is no official record on the overcompensated portion and as a result I simply call these marketing dollars as a manufacturer's subsidy. Note that all decisions related to the

---

[38] Customer development activities aim to target those consumers or small retailers who are not familiar with the Computec product. These activities include holiday sales events, small-retailer conferences, and new-product launch campaigns.
[39] See also Kaufmann and Lafontaine (1994) on McDonald's statements referring to its suppliers.

ordering process and marketing subsidies are controlled by Computec's top executives and not by regional managers[40].

Regional managers are responsible for local sales, supervising dealers, and other operational tasks. Supervisory efforts include directing, instructing, supporting, and monitoring downstream activities. Specifically, the regional managers, working together with their staff, direct and monitor dealers' sales efforts. They also help them to organize local sales events, trade shows, and dealer meetings. Recruiting new customers is another important joint effort. Through these interactions, Computec further gathers market intelligence on both intra- and inter- brand competition.

Regional managers spend their supervisory effort in a discriminating fashion across regions and dealers. Field interviews reveal that dealers located in cities and areas with high income or fast economic growth receive the most attention and support. This is because of the huge market potential in remote and peripheral regions and hence it is critical to establish awareness and exploit market opportunities early on. Regional managers also prefer working with devoted dealers who are more likely to concentrate their effort in selling the Computec brand.[41]

More important for the purpose of this chapter, regional managers revealed that their supervisory effort often received with the most cooperative behavior, and thus produced most desirable outcomes, from the dealers who were earning high profits. One reason is that more profitable dealers seem to be those who are competent as well.

---

[40] Given the institutional facts on how the subsidy is structured, this variable may be a candidate instrument for dealer profit. See Sections 4.5 and 4.6.
[41] Computec compensates its regional managers through fixed salaries plus semi-annual bonuses. In addition to sales and market-share considerations, company executives look at dealers' qualities and overall business sustainability in the corresponding region to decide on the exact amount of bonus. Performance review and assessment on these managers are subjective and have never been written into their employment contracts.

According to company officials, two additional reasons explain this. First, the dealer understands that the manufacturer's supervisory activities benefit him in multiple ways[42]. Among other benefits, these include establishing reputation by tying to a nationally recognized brand, improving technical and marketing expertise through manufacturer's training programs, and gaining valuable inputs in joint-promotional events. Second, non-compliance is easier to detect upon close supervision. For the more profitable dealers, this implies a larger loss of future profit in the case of relationship termination. All these observations suggest that Computec's supervisory effort would be expended complementarily with dealer profit to induce downstream marketing effort. Testing this hypothesis requires empirical analysis to which I now turn.

4.5. Empirical Methods

There is an increasing amount of work investigating complementarity in organizational design issues such as human resources management (e.g., Ichniowski, Shaw, and Prennushi 1997), decision-rights allocation (Arrunada, Garicano, and Vazquez 2001), contract provisions in franchising (e.g., Brickley 1999; Lafontaine 1992), research and design (e.g., Arora and Gambardella 1990; Cassiman and Veugelers 2005; Cockburn, Henderson, and Stern 2002; Nesta and Saviotti 2005; Sakakibara 2001), procurement management (Mayer, Nickerson, and Owan 2004), product development (Stern and Novak 2007), and adoption of information technology (Athey and Stern 2002). To test the complementarity between the intensities of downstream economic rent and

---

[42] This does not preclude the existence of undesired characteristics such as a sense of loss of autonomy caused by supervision from the dealer's perspective. Therefore, there are limits to what and how much the regional managers may get involved with the dealer's operations. For example, without a dealer's explicit permission, Computec is not allowed to audit a dealer's accounting records.

supervision in encouraging dealers to supply of marketing effort, I employ the empirical methods along the lines of those used in recent studies on complementarity in organizational design. Since this literature is not widely cited in marketing, I provide some background information. In this section, I review three approaches that have been used in the organizational design literature as follows.

Adoption Approach

Arora and Gambardella (1990) formulate a reduced form method which is sometimes called the "adoption approach"[43] and find internal and external alliances are complementary in biotechnological innovations. Cassiman and Veugelers (2006) apply this method to study the make-or-buy decisions of R&D strategies. In the franchising literature, Brickley (1999) looks at complementarity among provisions in franchise contracts and Lafontaine (1992) explores interdependence between franchise fees and royalty rates in the same way. The advantage of using the adoption approach is its ease of implementation. Moreover, it is very attractive in those contexts in which outcome or productivity measures are not readily available. Arora and Gambardella show that if two instruments x and y are complements, i.e. $f_{xy} \geq 0$, and each practice is (weakly) decreasing in return, i.e. $f_{xx} \leq 0$ and $f_{yy} \leq 0$, then the covariance between any two instruments, say x and y, conditional upon firm characteristics θ is non-negative:

(12) $$E[(x - E(x \mid \theta)) \cdot (y - E(y \mid \theta))] \geq 0.$$

Implementing the adoption approach in the context of Computec is quite simple. First, the adoption variables – in my case, rent and supervision – are linearly and independently regressed on dealer characteristics, X_i:

---

[43] See also Arora (1996).

56

$$x_i = \alpha X_i + \mu_{1i}$$

(13)

$$y_i = \beta X_i + \mu_{2i}.$$

Then complementarity is inferred from the correlation between the residuals obtained

from these regressions. Specifically, Arora and Gambardella (1990) show that a non-

negative pair-wise correlation between the OLS residuals, i.e. $\text{Cov}(\hat{\mu}_{1i}, \hat{\mu}_{2i}) \geq 0$, would

suggest complementarity between x_i and y_i.

The estimation method specified in (13) assumes that the manufacturer chooses

the optimal intensities of downstream rent and supervision effort at the individual dealer

level. It also assumes that $E(\mu_1 \bullet \mu_2 | X_i)$ is a diagonal matrix, i.e. shocks to x_i and y_i are not

correlated after controlling for observed dealer characteristics. For the Computec data, I

start off by using this reduced form model. Note that non-negative correlation between

the residuals, according to Arora and Gambardella's derivation of (12), is only necessary

for but sufficient for complementarity. Moreover, unobserved dealer heterogeneity that

affects Computec's optimal choice of supervision intensity can lead to omitted-variable

bias in the supervision regression (Athey and Stern 2003; Cassiman and Veugelers 2006).

Therefore, a non-negative correlation is only suggestive, but not conclusive, evidence for

complementarity.

Adoption Approach – Instrumental Variables

One implication from supermodular functions is that x and y are positively

correlated if they are interdependent and thus regressing one activity on another activity

can help to detect complementarity. In order to reduce biases caused by unobserved

heterogeneity and sample selection, instrumental variables or exclusion restrictions can

be used. Novak and Stern (2007) adopts the instrumental variable approach to study

vertical integration decisions in automobile systems while Miravete and Pernias (2006)

structurally derive exclusion restrictions to investigate the relationship between production and process innovations in the Spanish ceramics industry. For the Computec data, I regress supervision intensity on dealer's profit, controlling for observable dealer characteristics:

$$y_i = \gamma_1 x_i + \gamma_2 X_i + \text{error}.$$

where, x_i and y_i are dealer profit and supervision respectively. Having supervision as the dependent variable assumes that the regional manager choose his optimal level of supervising effort on the basis of how much profit the dealer is making and other dealer characteristics. This is reasonable since the amount of downstream economic rent is fundamentally determined by three factors that are outside the control of the regional manager: (1) Computec's net wholesale prices and sales volume, (2) whether to extract these rents – both decisions are made by Computec's top executive, and (3) entrepreneurship and management skills of the dealership owner/executives.

Nevertheless, profit would be endogenous for two reasons. Recall that calculations of downstream profit are based on estimated prices, together with other cost assumptions. There might be measurement errors in these. In addition, the manufacturer's supervisory effort could also affect dealer's profit. These endogeneities caused by both potential simultaneity and measurement errors should be taken care of. I use dealer's monthly office rent and the manufacturer's subsidy as instruments for dealer profit. Office rent affects dealer cost but should have no effect on supervision, so this would be a valid instrument. Moreover, as I discussed in Sections 3.3 and 4.4, manufacturer's subsidy is used to create additional profit to loyal and/or key dealers by overcompensating their marketing activities and hence, seems to be another instrument

candidate for dealer profit. Indeed, overidentification tests confirm the validity of both instruments.

Outcome Approach

When productivity or outcome data is available, one can specify an organizational–design production function to study the effect of organizational choice on outcomes (Athey and Stern 2003). The outcome approach can be thought of an application of production economics analysis (e.g, Beattie and Taylor 1985; Coelli et al 1998). Cassiman and Veugelers (2006), Nesta and Saviotti (2005), and Sakakibara (2001) are recent studies that adopt the outcome approach to investigate the impact of innovation practices on R&D outcomes.

According to the self-enforcement framework, the purpose of leaving rent and supervision is to induce non-contractible yet desired market development effort downstream. This is exactly what Computec hopes to achieve in its channel management system. As a result, I assume that dealer i's promotional effort, P_i, is a function of the amount of economic rent he earned (x_i) and the supervision effort Computec expended on the dealership(y_i). Specifically, I use a quadratic functional form to allow maximum flexibility:

(14) $$P_i = a_1 x_i + b_1 y_i + a_2 x_i^2 + b_2 y_i^2 + c\,(x_i \cdot y_i) + d\,X_i + \text{error},$$

where P_i, is the desired outcome. Notice that the quadratic functional form can be thought as a second-order local approximation or Taylor expansion of any functional form (Beattie and Taylor 1985; Coelli et al 1998).

In this specification, profit could still be endogenous since idiosyncratic factors such as entrepreneurship that would affect dealer effort might correlate with dealer profit.

59

Moreover, measurement error is a concern for dealer profit. Therefore, I estimate (14) by instrumenting profit, specifically the three terms involving profit – x_i, x_i^2, and $(x_i \cdot y_i)$, to remove potential biases caused by unobserved dealer heterogeneity and measurement errors. The instrumental variables I use are office rent, subsidy, their squared terms, and their interaction terms with supervision. Supervision is assumed to be exogenous to the dealer in my first set of estimations.

Would supervision be endogenous as well? There are two commons reasons that would make all the adoption variables endogenous. First, when adoption variables are discrete in cross-section inter-firm data, they are susceptible to sample selection bias (Athey and Stern 2003; Cassiman and Veugelers 2006): the econometrician only observes the selected part of the "full" data. But the nature of my context and data would have little concern for sample selectivity since I have the population of Computec's dealers in my data and further, supervision is measured as a continuous variable.

The second reason that supervision might be endogenous is unobserved heterogeneity. In cross-sectional organizational studies that have used the outcome approach, adoption decisions and their outcomes reside in the same firm, which makes the former likely to be correlated with the error term. In contrast, in my case the decisions on downstream marketing effort and manufacturer's supervision intensity are made by two *different* entities. The dealer chooses its promotional effort (partly) based on the regional manager's supervisory effort, which in turn is largely influenced by internal management guidelines and employment incentives. This should allay the issue of unobserved heterogeneity of this type.

Still, in making his decision on supervisory effort, the regional manager would take into account, in addition to observed dealer characteristics, some unobserved ones that affect dealer effort at the same time. In that case, I need to instrument both profit and supervision. To instrument supervision, I use the commonly-used variable "distance from headquarters" and test complementarity by assuming both variables are endogenous.

Lastly, potential multicollinearity might make the effects of the linear and quadratic terms difficult to separate from that from the interaction term in (14) and thus the complementarity result would be sensitive to specifications. Marketing researchers, for instance Aiken and West (1991) and Jaccard, Turrisi, and Wan (1991), have suggested to mean-center all the terms involving the two variables in the interaction term to alleviate the multicollinearity concern[44]. Following this tradition, I mean-center supervision, profit, their quadratic terms, and the interaction term to produce a robust check on my previous results obtained from the outcome approach.

4.6. Data

The data used for testing complementarity cover 59 dealers[45]. In addition to the transactional data that were used in Chapter 3, I used data from a survey that was administered to regional managers. Each regional manager, together with his staff, serves and supervises several dealers operating in the region. The questionnaire was developed after intensive interviews of the national sales director and two regional managers. These interviews provided background information on the industry, business practices, and

---

[44] Nonetheless, this method may not be effective to reduce multicollinearity. Echambadi and Hess (2007) prove that mean-centering alters the interpretation of related coefficients but does not change the precisions of estimates.

[45] Computec has a total of 60 dealers, but one dealer's information is not complete for the purpose of this chapter.

distributional and contractual arrangements. The questionnaire includes questions on dealer characteristics such as revenue in the past year, tenure of the dealership, number of competing brands carried, and cost information like rental charges. A regional manager also estimated the average number of working hours per month he worked with a specific dealer on various marketing activities. This measures Computec's supervision intensity. Dealer effort is measured by the average number of working hours per month a dealer spent on various market development activities on the Computec product. Regional managers provided these estimates for those dealers under their corresponding jurisdictions. These estimates are presumed to be reliable since the regional managers had worked very closely with their dealers. The data collected from the surveys are assumed to be constant for the 12-month period. Supplementing the survey data, I collected 2004-5 city-level economic data from China Provincial Statistics Yearbooks (published by National Statistics Bureau), viz. GDP per capita, and growth rates of GDP, telecommunication volume, and car ownership (see also Table 8). Table 9 describes the variables. Table 10 summarizes their pairwise correlations and descriptive statistics.

4.7. Empirical Results

In this section, I present the empirical results on the interdependence of downstream economic rent and manufacturer's supervision and its effect on dealer marketing effort. Empirical evidence from Computec's data strongly supports my field interviews that these two control instruments are used in a complementary manner in inducing dealer marketing efforts. These results are robust across the three estimation approaches.

Table 11 presents the results of the adoption approach. In column 1, as we would expect, dealer profit is strongly associated with the dealer size and manufacturer subsidy. Large dealers benefit from economies of scale and manufacturer's subsidy money increases dealer's profitability. The supervision regression in column 2 shows that a regional manager's choice of supervisory effort is largely associated with the economic environment in which his dealer operates. The installed base of computers is larger in more developed cities and dealers located there maintain a higher level of Computec-specific marketing activities. In turn, their corresponding regional managers supervise more. High growth regions also attract more attention from the regional managers. Notice that even after controlling for economic growth, Computec invests heavily in its effort on those dealers who are farther away from its headquarters, although the effect of distance is increasing at a decreasing rate. The last two results confirm the manufacturer's claim that they value peripheral markets due to their strategic importance for future market-share considerations. Most importantly, the correlation between the residuals from the two adoption regressions is a significant 0.31 ($p < 0.02$), suggesting complementarity between downstream economic rent and supervision.

<insert Table 11 about here>

To reflect the internal decision structure that regional managers use to choose their supervisory effort on based on dealer profit, dealer characteristics, and regional economic environment, I specify an alternative adoption approach – the instrumental-variable adoption method – by letting supervision be the dependent variable. I also tried specifications that controlled for manufacturer's subsidy, but the effect on supervision

was insignificant[46]. Hence only results that exclude subsidy as a regressand are reported in Table 12. As expected, dealer profit has a significant and positive effect on supervision in the OLS regression. In the two IV regressions, the effect of profit in 2SLS is not significant but becomes significant again in the GMM specification. The results on the IV regressions are not surprising: GMM has the advantage of being more efficient than 2SLS (Cameron and Trivedi 2005; Hayashi 2000). The p-value of the Sargent statistic in 2SLS is only marginally insignificant (p=0.11) which implies the instrumental variables might be correlated with the residuals in this specification. For these reasons, I focus my discussions on the OLS and GMM results.

Again, the evidence is consistent with the hypothesis that Computec's supervision intensity is complementary to economic rent left downstream. It is also worth pointing out that supervision is increasing in local income and local growth, as well as in the peripheral areas in the country. However, supervision is not significantly associated with dealer size, tenure, and number of competing brands carried, although the coefficients are directionally reasonable.

Together, these results are very similar to those obtained by the original adoption method: they all suggest that the manufacturer's supervisory effort is increasing in dealer profit on the one hand and driven by local economic environment on the other.

<insert Table 12 about here>

To directly investigate the nature of the interdependence between downstream rent and supervision and its effect non-contractible dealer marketing effort, I turn to the outcome approach. Column 1 in Table 13 shows the OLS result, while in Columns 2 and

---

[46] This implies that profit might mediate the relationship between subsidy and supervision and subsidy would be a valid instrument for profit (Baron and Kenny 1986).

3 profit and its associated terms, viz. (profit)^2 and (profit*supervision) are assumed to be endogenous. Results across the three regressions are qualitatively similar. Nevertheless, the Hausman's tests reject the null hypothesis that they are the same and hence I discuss the results mainly based on 2SLS and GMM methods.

First and foremost, the coefficient of the interaction term (profit*supervision) in the IV regressions are significant and positive, supporting the claim that these two instruments are complements in inducing the desired outcome – dealer marketing effort. Recall our discussion on the notion of supermodular functions in Section 4.2., sign of the coefficient of the interaction term can be regarded as a direct test on complementarity between downstream profit and supervision. Recall that the results obtained from the earlier two sets of reduced forms are consistent with this direct evidence.

<insert Table 13 about here>

Second, dealer marketing effort is strongly and positively increasing in the economic profit the dealer makes. This positive effect is decreasing, however, as shown by the negative estimate of the squared term of profit. On the other hand, neither supervision nor its squared term has significant effects. Showing positive first-order effect of profit but insignificant first-order effect of supervision on dealer compliance is similar to what Murry and Heide (1998) find. Note that the second-order effects satisfy the key assumptions that are used to derive the validity of the adoption approach, i.e., weakly decreasing in both variables (see Equation (12) in Section 4.5.). This increases confidence in the reduced form results shown in Table 11.

Third, dealers located in fast emerging markets and with longer tenure spend more marketing effort in promoting Computec's product, whereas larger dealers do less

Computec-specific effort. The latter result is reasonable since dealers who have larger total revenues are more likely to engage in volume-based wholesale business which focuses on pricing decisions and thus are less likely to spend effort in market development activities.

The GMM specification in Column 4 of Table 13 assumes that both profit and supervision are endogenous. All the variables that are related to the two variables are instrumented in this specification. Possibly due to the large number of endogenous variables needed to be instrumented, the Anderson statistic is not significant, suggesting potential weak IVs. Indeed, looking at the standard errors in Column 4 reveal that they are all larger than the OLS ones in Column 1. But even so, the interaction term (profit*supervision) remains significantly positive, which indicates complementarity between the two variables. Overall results are directionally similar to those of the OLS specification as marked by the insignificant Hausman result.

Finally, I mean-center the five terms involving profit and/or supervision and report the results in Table 14. There is no change in the signs and significances of all coefficients of the control variables. Furthermore, the signs and standard errors of all mean-centered variables on dealer effort across specifications are qualitatively similar to those in Table 13[47]. Most importantly, the point estimate and standard error for the coefficient of the interaction term (Profit*Supervision) are identical to the un-mean-centered ones and thus the complementarity effect is robust to mean-centering.

<center><insert Table 13 about here></center>

---

[47] The interpretations of the linear and quadratic terms are no longer marginal effects and rates of change of marginal effects, respectively (Echambadi and Hess 2007). They are, however, of lesser concern in my context as I focus on the coefficient of the interaction term or complementarity.

<center>66</center>

As a summary, the Computec data strongly support the hypothesis that the manufacturer uses economic rent and supervision in a complementary manner to encourage dealers to expend their non-contractible market development effort. This result is robust under a variety of econometric specifications. To the best of my knowledge, this is the first empirical evidence that shows the exact nature of the interdependence of economic rent and supervision intensity in the self-enforcement setup.

4.8. Conclusions

Manufacturers often use multiple control mechanisms to manage their downstream channel members. Self-enforcement theory has particularly focused on the role of economic rent and supervision in enforcing private agreements. Although the theory suggests their co-existence, it does not offer a clear prediction on their interdependence. As I showed, when desired effort level can be varied continuously, signing their interdependence a priori would be difficult since the net effect of scale and substitution effects is ambiguous.

In this chapter, I adopted recently developed econometric methods that have used in the organizational design literature to explore the interdependence between downstream economic rent and supervision intensity. Evidence from the Computec data supports my hypothesis that these two control instruments are complementary. This finding confirms my qualitative field observations. Moreover, my analysis suggests that, instead of being discrete, desired dealer effort can be affected by the size of downstream economic rent and/or supervision intensity in a continuous fashion. These results call for extensions of self-enforcement and efficiency-wage theories.

The complementarity result supports the economic rationale that the more capable the manufacturer in directing and observing dealer compliance and performance, the higher the marginal value of using economic rent to incentivize dealer effort. This rationale is not only consistent with the measurement and disciplinary connotations of supervision (Heide et al 2007), but is also agreeable with the information provision and productivity enhancing aspects of supervisory efforts (Anderson and Oliver 1987). Furthermore, as noted Heide (1994), long-term vertical relationships are often open-ended. Supervision within such a relationship would not like a discrete event, i.e. detection of non-compliance leading to immediate termination. This ongoing nature of supervision in non-spot-market-based governance suggests that supervision might be necessarily complementary with economic rent in self-enforcing agreements[48].

Finally, my findings in this chapter have important managerial implications. Although self-enforcement and efficiency-wage arguments see downstream premium and supervision intensity are substitute control mechanisms, the evidence in this paper shows otherwise. This finding, nevertheless, is consistent with the practice that has been adopted by Computec, a leading manufacturer in its industry. Although this is a case study, the proven practice would imply that it would be more effective for managers not only to use incentive premiums and supervision together, but also to adjust them in a complementary manner to enforce compliance in long-term vertical relationships.

---

[48] I thank Scott Masten for pointing out this to me.

Chapter 5

Limitations and Future Research

It is well-known that manufacturers use multiple control mechanisms to manage their downstream channel members. Based on the institutional context in which a leading local manufacturer of a key computer accessory in China operates and using the company data, this dissertation aimed to examine the creation, extent, and role of economic rent in distribution contracts. As were outlined in the introductory section, I defined three specific goals:

(1)   to show how the two-stage ordering process adopted by various manufacturers and industries enables an upstream firm to endogenously determine the intensity of downstream competition and thus affect the economic rents earned by its dealers;

(2)   to estimate the extent of downstream rent by linking the game theoretic results to the data I collected from the accessory manufacturer; and

(3)   to empirically investigate the complementarity between economic rent and supervisor in inducing the supply of non-contractible dealer effort.

These goals have been addressed in Chapters, 2, 3, and 4, respectively. In the reminder of this section, I will discuss the limitations of this dissertation and look forward to future research that could be built upon my theoretical and empirical findings.

69

First, Chapter 2's theoretical model looks at how the two-stage process affects downstream outcomes by assuming quantity discount as the only choice variable for the manufacturer. I linked the results of the model to the Computec data and then estimated the amount of downstream economic rent which, in turn, allows me to empirically explore the relationship between rent and supervision in Chapter 4. As we saw in the latter chapter, nevertheless, the manufacturer also decides on its supervision intensity, in addition to affecting the amount of downstream rent through quantity discount. A meaningful extension of the game theoretical model will be to include both quantity discount and supervision intensity in the two-stage ordering process. This would provide a more accurate account of Computec's control system on the one hand and to generate testable hypotheses related to the interdependence between the amount of downstream profit and supervision intensity on the other hand.

Another limitation related to the game theoretic model is that it only includes three players, one manufacturer and two dealers. Permitting inter-brand competition and allowing each manufacturer to have more than two dealers would improve the realism of the model[49]. Another extension would be to permit dealers to carry inventories from one ordering cycle to the next as the year progresses. Uncertain demand and inventory carry-over are not decision-making drivers in the computer accessory channel that I considered; but they can be important factors that affect competition outcomes in other contexts such as the fashion apparel industry. To study those situations, modeling uncertainty would be a worthwhile undertaking. Most importantly, in future work I plan to compare formally

---

[49] This is not problematic in my case because all of Computec's major competitors, *regardless of size*, use a qualitatively similar two-stage ordering process with their dealers. As such, strategic inter-brand rivalry motives are less likely to explain the adoption of this practice.

the two-stage ordering process to alternative institutions which the manufacturer chose not to adopt.

Due to the limited panel, I could only estimate the unobserved prices at the regional level in Chapter 3. Moreover, since there is no data under alternative mechanisms like pure Bertrand and with quantity discounts, I was constrained to infer the effectiveness of the two-stage process by comparing my results with anecdotal evidence. In the future, data collection efforts should be extended to panel data that covers multiple regimes and longer periods of time. This enables individual-level estimations and investigating counterfactuals. Such data would also permit me to structurally estimate the outcomes of the two-stage process per the theoretical model.

The empirical findings on the complementarity between economic rent and supervision call for extending the self-enforcement and efficiency-wage theories. Evidence suggests that the desired level of dealer effort would be affected by the intensities of dealer profit and supervisory effort in a continuous fashion. Future theoretic work on self-enforcement should take account of both the endogeneity and continuity nature of dealer effort. Furthermore, since an upstream firm's supervisory efforts are part of the joint effort which helps to increase the productivity of its downstream members, supervision itself brings in intrinsic value, on top of its disciplinary function, to induce desired outcomes. This implies that in ongoing bilateral relationships, supervision is not a discrete event that directly and immediately links to relationship termination when dealers are caught non-compliant. As rightly noted by Alchian and Demsetz (1972), it would be very difficult to separate the multiple functions of supervision. Therefore,

production or "outcome" functions should incorporate the productive nature of manufacturer's supervision[50].

As with any case study, my findings are set in the institutional context I described in this dissertation. Although both the two-stage ordering process and the rent-supervision complementarity were found to achieve their respective purposes in my data, the effectiveness of these mechanisms in general would depend on the specific institutional settings in which the economic players operate. I encourage future research to look at broader inter-firm and/or cross-industry contexts in order to provide more generalizable insights related to economic rent.

Finally, studying issues related to economic rent is both important and challenging. It is important because, as theory suggests and my dissertation showed, leaving downstream rent can motivate dealers to perform. It is challenging because there is a lack of formal theory regarding economic rent and its relationship to self-enforcing contracts; in addition, empirical analyses require extremely detailed firm level data. As insights accumulate on the economic rationale for leaving downstream rent, it will become possible to give more valuable advice to companies about how to organize their distribution activities efficiently and to antitrust authorities about how to formulate more effective competition policies.

---

[50] Extending classical agency theory, Bhattarchayya and Lafontaine (1995) include efforts of both the principal and the agent in the production function to look at double-sided hazard in share contracts. This would be a good starting point for the extension I mentioned here.

FIGURE 1: TIMELINE OF COMPUTEC'S QUARTERLY SALES CYCLE

Time

Computec announces schedule of quantity discounts from the wholesale price

Dealers simultaneously place orders and make full payments

Computec ships products according to dealers' delivery requests and dealers sell the product. Additional orders (if any) do not qualify for quantity discounts. Dealers may not return any unsold units for refunds.

Stage 1
(Order-taking)
5 days

Stage 2
(Order-fulfillment)
2 ¾ months

FIGURE 2: SEQUENCE OF MOVES

Stage 0 | The profit-maximizing manufacturer announces a linear quantity-discount schedule

Stage 1 | Dealers simultaneously make (and pay for) orders based on manufacturer's quantity discount schedule

Stage 2 | Dealers receive shipped orders. Amounts of orders become common knowledge. Dealers simultaneously set prices to maximize profits. They can order additional units. Dealer may not return any unsold units for refunds.

Note: dealers' demand functions are common knowledge throughout the game.

FIGURE 3: DEALER i'S PRICING DECISION IN STAGE 2
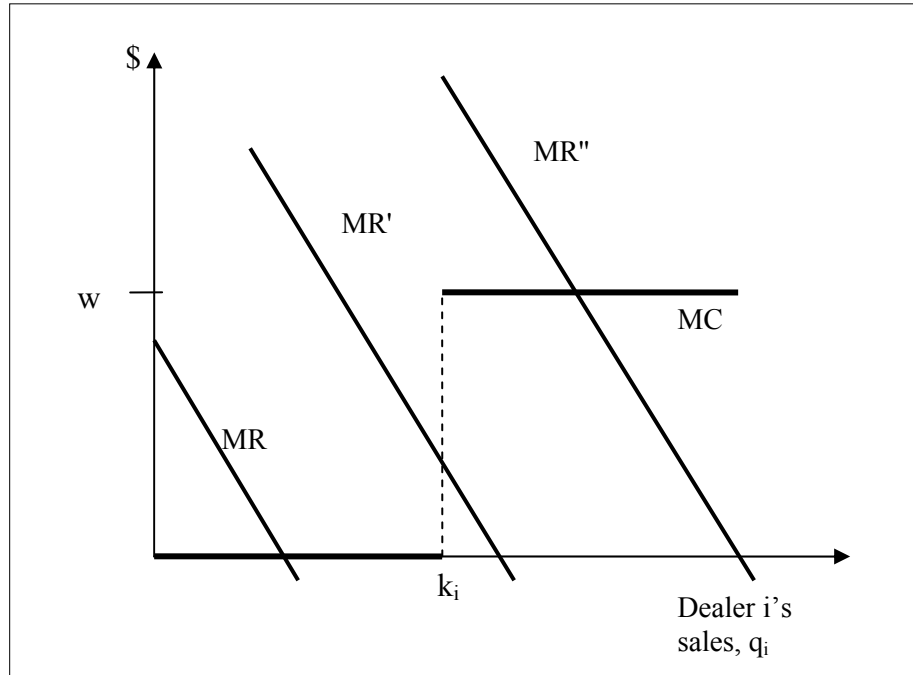
FIGURE 4: PRICE REACTION CURVES

74
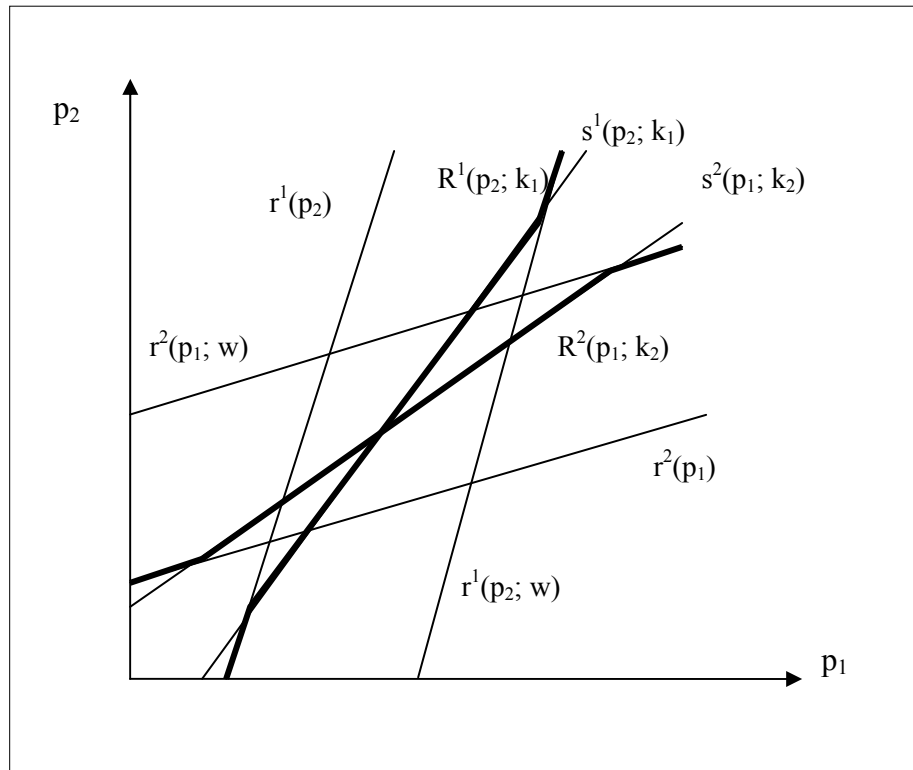
FIGURE 5: DEALER i'S PREORDERING DECISION IN STAGE 1
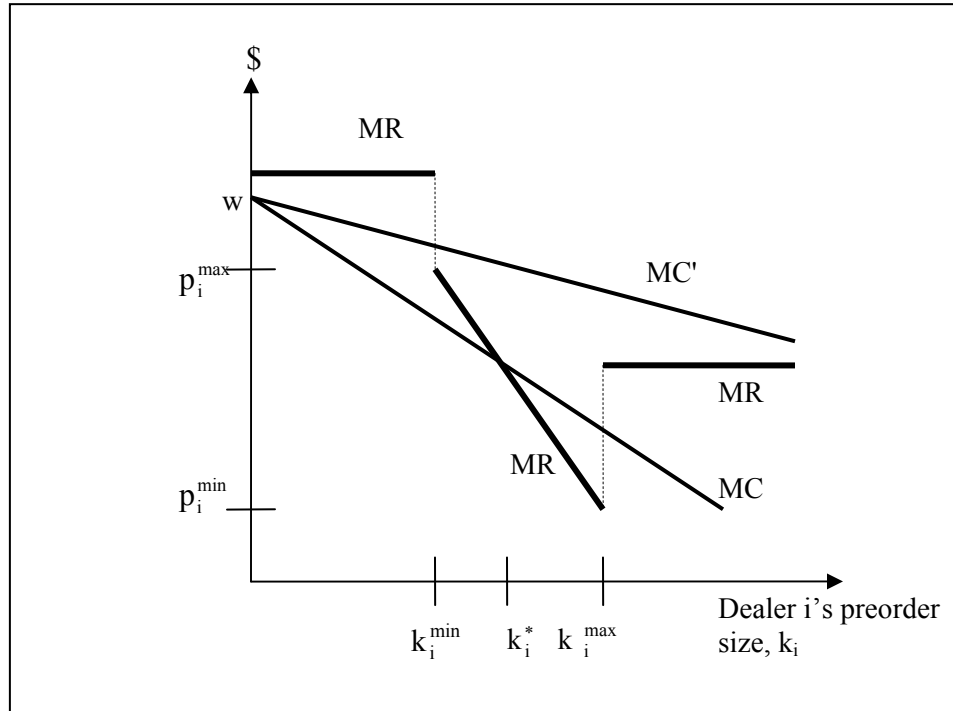
FIGURE 6: BERTRAND AND COURNOT PRICES
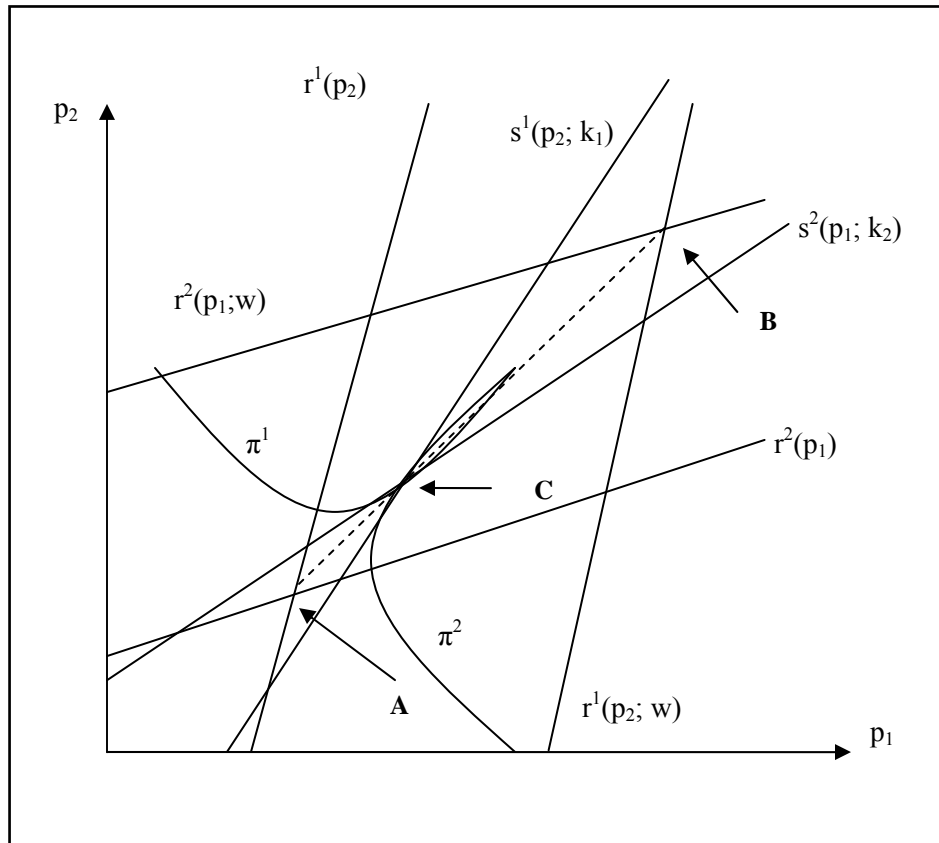
TABLE 1: OPTIMAL QUANTITY DISCOUNTS AND OUTCOMES

	Bertrand Regime	**Cournot Regime**
Range of quantity discount	$0 \le d \le \delta$	$0 < \delta < d$
Optimal quantity discount	$d_B^* = 0$	$d_C^* = \dfrac{(2+b)((3w-2m)(1-b)-a)}{2(1-b^2)(a-(1-b)(2m-w))}$
Manufacturer's Profit	$\pi_m^B = \dfrac{2(w-m)(a-w(1-b))}{2-b}$	$\pi_m^C = \dfrac{(1+b)(a-m(1-b))^2}{4(2-b-b^2)}$
Dealer Prices	$p_i^{B*} = \dfrac{a(2+b)-w(2+b)}{4-b^2}$	$p_i^{C*} = \dfrac{a(3+b)+(1-b^2)(2m-w)}{2(2-b-b^2)}$
Dealer Quantities	$k_i^{B*} = \dfrac{a(2+b)+w(1-b)(2+b)}{4-b^2}$	$k_i^{C*} = \dfrac{(1+b)(a-(1-b)(2m-w)}{2(2+b)}$
Dealer Profits	$\pi_i^B = \dfrac{(a-(1-b)w)^2}{(2-b)^2}$	$\pi_i^C = \dfrac{(1+b)(a-(1-b)(2m-w))(a(4+b)+(1-b)(2bm-4w-3bw)}{8(1-b)(2+b)^2}$

TABLE 2: SUMMARY STATISTICS – TRANSACTIONAL DATA

Variables	Number of Observations	Mean	SD
Monthly quantity, in '000	720	41.28	86.69
Net (after-discount) wholesale price	720	1410.82	72.18
Manufacturer's subsidy, in million Y$	720	0.034	0.15
Marketing expenses at regional level, in million Y$	96	0.030	0.14
Advertising expenses at country level, in million Y$	12	3.94	3.48
Public relations expenses at country level, in million	12	5.17	3.83
Wholesale market price of competing manufacturer 1	12	1221.17	33.90
Wholesale market price of competing manufacturer 2	12	1185.75	27.89
Wholesale market price of competing manufacturer 3	12	2446.58	49.33

TABLE 3: PAIRWISE CORRELATIONS – TRANSACTIONAL DATA

	1	2	3	4	5	6	7	8	9
1. Quantity ('000)	-								
2. Net wholesale price	-0.41*	-							
3. Wholesale market price – competitor 1	0.03	-0.24*	-						
4. Wholesale market price – competitor 2	0.06	0.06	-0.24*	-					
5. Wholesale market price – competitor 3	-0.00	0.17*	-0.71*	0.14*	-				
6. Ad expenses (mil Y$)	0.14*	-0.14*	0.74*	-0.18*	-0.53*	-			
7. PR expenses (mil Y$)	0.02	-0.07	0.42*	0.07	-0.47*	0.13*	-		
8. Regional marketing expenses (mil Y$)	0.32*	-0.04	-0.11*	0.17*	0.09*	0.06	-0.15*	-	
9. Manufacturer's subsidy (mil Y$)	0.20*	-0.11*	0.02	0.07	0.06	0.12*	-0.07	-0.05	-

*significant at 0.05.

TABLE 4: DEMAND ESTIMATION: POOLED NATIONAL ESTIMATES

Dependent Variable: Quantity (in '000)

Independent Variables	(1)	(2)
Own price	-0.34***	-0.33***
	(0.076)	(0.074)
Competing dealers' price		0.26***
		(0.10)
Competing manufacturer 1's price	0.14	0.16
	(0.23)	(0.23)
Competing manufacturer 2's price	0.18**	0.16**
	(0.076)	(0.075)
Competing manufacturer 3's price	0.44***	0.41***
	(0.12)	(0.12)
Subsidy[‡]	73.00***	74.52***
	(24.91)	(25.10)
Regional-level marketing[‡]	140.47**	140.25**
	(55.63)	(55.46)
National-level advertising[‡]	4.01***	3.95***
	(1.09)	(1.09)
National-level PR[‡]	2.61***	2.64***
	(0.63)	(0.62)
Sales cycle effects	Yes***	Yes***
R^2	0.24	0.25
Error autocorrelation	No	No
Endogenous own price	No	No
Endogenous "dealer marketing"	No	No
Observations	720	720
Number of Dealers	60	60

[‡] in million Y\$. Heteroskedasticity robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Testing strict endogeneity and error term correlation follow the procedure specified in Wooldridge (2002) on p.284-285 and p.275 respectively. See also Cameron and Trivedi (2005, p.276). The endogeneity test is a modified Hausman test.

TABLE 5: DEMAND ESTIMATION: POOLED REGIONAL ESTIMATES
Dependent Variable: Quantity (in '000)

Independent Variables	Region							
	(1) **Beijing**	**(2)** **North-east**	**(3)** **North**	**(4)** **North-west**	**(5)** **East**	**(6)** **South**	**(7)** **Central**	**(8)** **South-west**
Own price	-0.82***	-0.10*	-0.07**	-0.14*	-0.26***	-0.47***	-0.08**	-0.11**
	(0.26)	(0.06)	(0.03)	(0.07)	(0.07)	(0.15)	(0.04)	(0.05)
Competing dealers' price	1.15***	0.02	0.17*	0.02	0.43**	0.83*	0.04	-0.26
	(.44)	(0.16)	(0.09)	(0.15)	(0.18)	(0.49)	(0.11)	(0.17)
Subsidy‡	# N.A.	6.86	44.15*	37.88	-15.93	150.72***	51.26***	61.43***
		(26.23)	(26.75)	(48.23)	(47.50)	(35.07)	(15.83)	(18.27)
Competing manufacturer 1's price				0.15				
				(0.23)				
Competing manufacturer 2's price				0.14**				
				(0.07)				
Competing manufacturer 3's price				0.36***				
				(0.12)				
Regional-level marketing‡				137.15***				
				(50.98)				
National-level advertising‡				4.11***				
				(1.07)				
National-level PR‡				2.56***				
				(.63)				
Sales cycle effects				Yes***				
R^2				.33				
Number of Dealers	11	7	11	3	10	4	8	6

‡ in million Y$. Heteroskedasticity robust standard errors in parentheses. * $p < 0.10$,** $p < 0.05$, *** $p < 0.01$
# Only two non-zero observations in the Beijing region which are dropped from the estimation. No. of observations: 720.

TABLE 6: ESTIMATED FINAL PRICES BY REGION

Region	Final Prices (Y$)	
	Mean	SD
(1) Beijing	1511.72	38.72
(2) Northeast	1690.60	51.82
(3) North	1749.36	52.93
(4) Northwest	1732.53	75.20
(5) East	1580.29	33.48
(6) South	1612.41	52.78
(7) Central	1860.52	88.26
(8) Southwest	1626.36	103.22
National average	1663.31	126.83

TABLE 7: ESTIMATED GROSS AND NET ECONOMIC RENT

Region	Gross Rent[†]		Net Rent[‡]	
	Mean	SD	Mean	SD
(1) Beijing	11.86	12.89	7.67	9.65
(2) Northeast	3.56	2.56	2.13	2.03
(3) North	2.88	2.03	1.40	1.85
(4) Northwest	7.21	9.69	5.10	9.66
(5) East	6.03	7.49	4.08	8.40
(6) South	11.71	13.60	8.61	10.01
(7) Central	7.09	5.70	6.00	5.26
(8) Southwest	3.33	2.65	2.61	2.94
National average	6.54	8.18	4.48	6.78

[†]Gross rent is calculated by $\Pi_i = \sum_{t=1}^{12} (\hat{p}_{it} - \omega_{it}) \cdot q_{it}$.

[‡]Net rent is calculated by $\Pi_i = \sum_{t=1}^{12} (\hat{p}_{it} - \omega_{it}) \cdot q_{it} - F_i$

TABLE 8: REGIONAL ECONOMIC INDICATORS

	Bei-jing	East	South	NE	N	NW	Central	SW
City-level per capita GDP (US$)	2345	1929	1930	1188	1379	1117	1213	1170
Growth rate of GDP	11.63	11.16	7.78	11.14	11.57	10.75	10.31	9.15
Growth rate of telecom	20.49	23.98	19.87	19.30	24.42	23.78	22.49	21.21
Growth rate of car ownership	12.49	16.20	13.05	13.31	14.97	16.50	14.49	12.18

Source: China Provincial Statistics Yearbook (2005, 2006)

TABLE 9: VARIABLES AND THEIR DESCRIPTIONS – SURVEY DATA

Variable	Description
Profit	Economic rent earned by dealer in 2005 (mil Y$)
Supervision	Number of hours the regional manager works with dealer each month in the following five marketing tasks: customer training, POP materials handing, organizing customer conference, customer relationship building, and market intelligence
Dealer Marketing Efforts	Number of hours per month dealer (regional manager's counterpart) spends in the following four tasks: customer training, POP materials handling, organizing customer conference, and customer relationship building
Dealer Size	Sales revenue in previous year (2004; mil Y$)
Tenure	Number of years in dealership
Competing Brands	Number of competing brands carried by dealer (excluding Computec)
Income Level	GDP per capita (2004-5) of the city in which dealer is located
Growth Rate	Growth rate (2004-5) in telecommunications at city level
Distance	Number of kilometers from base location of regional manager
Subsidy	Manufacturer's subsidy for dealer profitability and marketing dollars (mil Y$)
Rental Charges	Dealer's monthly office rents in 2004 ('000 Y$)

TABLE 10: PAIRWISE CORRELATIONS AND DESCRIPTIVE STATISTICS – SURVEY DATA

	1	2	3	4	5	6	7	8	9	10	11
1. Dealer efforts	1.00										
2. Dealer profit	0.49*	1.00									
3. Supervision	0.26	0.32*	1.00								
4. Size	0.11	0.63*	0.13	1.00							
5. Tenure	0.08	0.16	0.13	0.25	1.00						
6. Competing brands	-0.06	-0.06	-0.19	0.03	-0.04	1.00					
7. City GDP	-0.14	0.30*	-0.12	0.27*	0.13	0.12	1.00				
8. Growth rate	0.12	-0.13	0.14	-0.11	-0.13	0.37*	-0.06	1.00			
9. Distance	0.09	-0.16	0.07	-0.18	-0.12	-0.20	-0.67*	-0.11	1.00		
10. Subsidy	0.40*	0.54*	0.30*	0.33*	0.10	-0.01	-0.07	-0.00	0.07	1.00	
11. Office rents	0.03	0.54*	-0.03	0.54*	0.32*	-0.02	0.37*	-0.08	-0.20	-0.10	1.00
Mean	39.51	4.55	55.26	390.44	3.66	3.92	1.614	22.09	734.41	0.42	0.16
SD	23.13	6.82	42.71	476.88	2.52	1.73	0.51	3.89	817.48	0.83	0.22

*significant at 0.05.

TABLE 11: ADOPTION APPROACH

Dependent variable	Profit	Supervision
Size	0.006***	0.009
	(0.002)	(0.01)
Tenure	-0.09	1.48
	(0.20)	(2.07)
No. of competing brands	-0.29	-2.87
	(0.37)	(3.37)
City income level	3.33	41.70**
	(2.36)	(21.47)
Market growth rate	-0.07	2.68*
	(0.13)	(1.42)
Manufacturer subsidy	3.36***	11.09*
	(0.86)	(6.49)
Distance	0.49	99.54***
	(2.59)	(34.15)
$(Distance)^2$	-0.09	-29.06***
	(0.70)	(9.58)
Constant	-1.93	-111.82*
	(4.53)	(61.95)
R^2	0.57	0.32
Number of observations	59	59
Correlation between residuals	0.31**	

* $p < 0.10$,** $p < 0.05$, *** $p < 0.01$. Standard errors in parentheses.

TABLE 12: ADOPTION APPROACH – INSTRUMENTAL VARIABLES
Dependent Variable: Manufacturer Supervision Effort

	(1) OLS	(2) 2SLS#	(3) GMM#
Profit	2.67***	1.38	3.27**
	(0.92)	(1.25)	(1.50)
City income level	32.83	37.24*	30.34**
	(20.67)	(19.64)	(14.68)
Market growth rate	2.89**	2.84**	2.94***
	(1.35)	(1.27)	(0.85)
Size	-0.007	0.004	-0.01
	(0.01)	(0.01)	(0.01)
Tenure	1.75	1.67	1.62
	(1.97)	(1.85)	(1.99)
No. of competing brands	-2.06	-2.37	-1.67
	(3.22)	(3.03)	(2.73)
Distance	99.32***	102.25***	99.46***
	(32.40)	(30.48)	(22.09)
$(Distance)^2$	-29.11***	-29.81***	-29.20***
	(9.09)	(8.55)	(5.84)
Constant	-107.50†	-111.75**	-107.22***
	(58.98)	(55.44)	(36.51)
F-statistics	3.91***	2.88***	7.09***
LR test for identification (Anderson statistic)	-	χ^2=38.73 (p=0.000)	χ^2=17.21 (p=0.000)
Overidentification test (Sargent statistic)	-	χ^2=2.59 (p=0.11)	-
Overidentification test (Hansen J-statistic)	-	-	χ^2=0.06 (p=0.81)
Hausman test	-	Not sig.	Not sig.
Number of observations	59	59	59

* $p < 0.10$; **$p < 0.05$; ***$p < 0.01$. Standard errors in parentheses
# Endogenous variables: Profit. Excluded instrument variables: Office Rent, Subsidy.

Dependent Variable: Dealer Marketing Effort

	(1) OLS	(2) 2SLS[#]	(3) GMM[#]	(4) GMM[‡]
Profit	2.17*	5.44**	5.94***	1.65
	(1.29)	(2.44)	(2.24)	(4.13)
Supervision	-0.04	-0.10	-0.02	0.97
	(0.18)	(0.20)	(0.20)	(0.74)
$(Profit)^2$	-0.05	-0.20**	-0.22***	-0.11
	(0.04)	(0.08)	(0.06)	(0.12)
$(Supervision)^2$	-0.0009	-0.0008	-0.001	-0.095*
	(0.001)	(0.001)	(0.001)	(0.006)
Profit*Supervision	0.025**	0.021*	0.020**	0.049*
	(0.01)	(0.01)	(0.01)	(0.026)
City income level	-9.74*	-7.23	-6.50	-0.11
	(5.31)	(5.55)	(5.30)	(9.27)
Market growth rate	1.26*	1.38*	0.94	1.74*
	(0.69)	(0.71)	(0.77)	(1.04)
Size	-0.02**	-0.02**	-0.02**	-0.02**
	(0.007)	(0.008)	(0.008)	(0.009)
Tenure	1.61	2.13**	2.64**	2.45
	(1.01)	(1.05)	(1.03)	(1.49)
No. of competing brands	-1.03	-1.20	-0.84	-3.59*
	(1.53)	(1.54)	(1.36)	(2.18)
Constant	23.57	14.54	17.95	-9.31
	(17.22)	(17.69)	(15.31)	(28.08)
F-statistic	4.94***	2.93***	4.40***	10.87***
LR test for identification (Anderson statistic)	-	χ^2=18.24 (p=0.001)	χ^2=18.24 (p=0.001)	χ^2=1.94 (p=0.59)
Overidentification test (Sargent statistic/ Hansen J-statistic)	-	χ^2=2.97 (p=0.40)	χ^2=3.50 (p=0.32)	χ^2=0.25 (p=0.88)
Hausman test	-	**Significa nt	**Significa nt	Not. Sig.
No. of observations	59	59	59	59

[†]$p < 0.10$; **$p < 0.05$; ***$p < 0.01$. Standard errors in parentheses

* $p < 0.10$; **$p < 0.05$; ***$p < 0.01$. Standard errors in parentheses

[#]Endogenous variables: Profit, $(Profit)^2$, Profit*Supervision. Excluded instrument variables: Office Rent, Subsidy, $(Office Rent)^2$, $(Subsidy)^2$, Office Rent*Supervision, Subsidy*Supervision

[‡]Endogenous variables: Profit, $(Profit)^2$, Supervision, $(Supervision)^2$, Profit*Supervision. Excluded instrument variables: Office Rent, Subsidy, $(Office Rent)^2$, $(Subsidy)^2$, Office Rent*Subsidy, Distance, $(Distance)^2$

Dependent Variable: Dealer Marketing Effort

	(1) OLS	(2) 2SLS[#]	(3) GMM[#]	(4) GMM[‡]
Profit[†]	3.11***	4.77***	5.09***	3.30
	(0.75)	(1.41)	(1.36)	(2.09)
Supervision[†]	-0.03	-0.09	-0.06	0.14
	(0.09)	(0.11)	(0.11)	(0.24)
$(Profit)^{2†}$	-0.05	-0.20**	-0.22***	-0.11
	(0.04)	(0.08)	(0.06)	(0.12)
$(Supervision)^{2†}$	-0.0009	-0.0008	-0.001	-0.095*
	(0.001)	(0.001)	(0.001)	(0.006)
Profit*Supervision[†]	0.025**	0.021*	0.020**	0.049*
	(0.01)	(0.01)	(0.01)	(0.026)
City income level	-9.74*	-7.26	-6.50	-0.11
	(5.31)	(5.55)	(5.30)	(9.27)
Market growth rate	1.26*	1.38*	0.94	1.74*
	(0.69)	(0.71)	(0.77)	(1.04)
Size	-0.02**	-0.02**	-0.02**	-0.02**
	(0.007)	(0.008)	(0.008)	(0.009)
Tenure	1.61	2.13**	2.64**	2.45
	(1.02)	(1.05)	(1.03)	(1.49)
No. of competing brands	-1.03	-1.20	-0.84	-3.59*
	(1.53)	(1.54)	(1.36)	(2.18)
Constant	33.61**	32.69*	40.91***	32.66
	(16.73)	(16.87)	(15.22)	(20.92)
F-statistic	4.94***	2.93***	4.40***	10.87***
LR test for identification (Anderson statistic)	-	χ^2=18.24 (p=0.001)	χ^2=18.24 (p=0.001)	χ^2=1.94 (p=0.59)
Overidentification test (Sargent statistic/ Hansen J-statistic)	-	χ^2=2.97 (p=0.40)	χ^2=3.50 (p=0.32)	χ^2=0.25 (p=0.88)
Hausman test	-	**Significant	**Significant	Not. Sig.
No. of observations	59	59	59	59

*p < 0.10; **p < 0.05; ***p < 0.01. Standard errors in parentheses. [†] Mean-centered variables.

[#]Endogenous variables: Profit, $(Profit)^2$, Profit*Supervision. Excluded instrument variables: Office Rent, Subsidy, $(Office Rent)^2$, $(Subsidy)^2$, Office Rent*Supervision, Subsidy*Supervision

[‡]Endogenous variables: Profit, $(Profit)^2$, Supervision, $(Supervision)^2$, Profit*Supervision. Excluded instrument variables: Office Rent, Subsidy, $(Office Rent)^2$, $(Subsidy)^2$, Office Rent*Subsidy, Distance, $(Distance)^2$

Bertrand Prices, Quantities, and Profits for Dealers

Solving $r_1^b(p_2;w)$ and $r_2^b(p_1;w)$, I obtain the Bertrand price pair:

$$p_i^B(w) = \frac{a+w}{2-b}, \quad i = 1, 2.$$

Substituting the prices into the demand functions $D_i(p_i, p_j) \equiv q_i = a - p_i + b\, p_j$, I obtain

the Bertrand quantities pair:

$$q_i^B(w) = \frac{a - (1-b)w}{2-b}, \quad i = 1, 2.$$

Further substituting the prices and quantities into dealer's profit

function $\pi_i = (p_i^B - w)\, q_i^B$, I obtain the Bertrand profits for dealers for $0 < d \leq \delta$ as

$$\pi_i^B(w - 2d\, k_i) = \frac{(1-d)(a - (1-b)w)^2}{(2 - b + 2d - 2\, b\, d)^2}, i = 1,2.$$

Moreover, when $d = 0$, $\pi_i^B(w - 2d\, k_i) = \dfrac{(a - (1-b)w)^2}{(2-b)^2}, i = 1,2.$

Cournot Prices, Quantities, and Profits for Dealers

Cournot prices can be obtained by solving dealer's profit maximization problem:

$$\max_{p_i} \pi_i = (p_i - (w - d\ (a - p_i + b\, p_j)))(a - p_i + b\, p_j), \text{ subject to } k_j = a - p_j + b\, p_i.$$

Substituting the constraint into the profit function and using the first order conditions, I
work out the Cournot price reply functions in terms of competing dealer's preorder k_j:

$$r_i^C(k_j; w - 2d\, k_i) = \frac{(1 - 2(1 - b^2)d)(a + a\, b - b\, k^2) + (1 - b^2)w}{2(1 - b^2 + (1 - b^2)^2 d)}, \quad i = 1, 2;\ i \neq j. \text{ Using}$$

Lemma 1 and substituting $k_j = a - p_j + b\, p_i$ into it, I get the Cournot price reply

functions in terms of competing dealer's price p_j:

$$r_i^C(p_j; w - 2d\,k_i) = \frac{(1 - 2(1 - b^2)\,d)(a + b\,p_j) + (1 - b^2)w}{2(1 - d) - b^2(1 - 2\,d)}, \quad i = 1, 2; \ i \neq j.$$ Solving the last

set of reply functions, the Cournot price pair are given by:

$$p_i^C(w - 2d\,k_i) = \frac{a(1 - 2(1 - b^2)d) + (1 - b^2)w}{(1 - b)(2 + b - 2(1 - b^2)d)}, \quad i = 1, 2.$$

Substituting the prices into the demand function $D_i(p_i, p_j) \equiv q_i = a - p_i + b\,p_j$, the

Cournot quantities are given by:

$$q_i^C(w - 2dk_i) = \frac{(1 + b)(a - (1 - b)w)}{(2 + b - 2(1 - b^2)d)}, \quad i = 1, 2.$$

Finally, the Cournot profits given by the profit functions are:

$$\pi_i^C(w - 2dk_i) = \frac{(1 + b)(1 - (1 - b^2)d)(a - (1 - b)w)^2}{(1 - b)(2 + b - 2d(1 - b^2))^2}, \quad i = 1, 2.$$

Critical Discount

From $p_i^C(w - 2\,\delta\,k_i) = p_i^B(w)$, we can solve for δ: $\delta = \dfrac{b^2}{2(1 - b^2)}$.

I assume that the manufacturer can only offer a unified discount schedule for all dealers.

Therefore, $\delta = \dfrac{b^2}{2(1 - b^2)}$ is the uniquely feasible solution and I call it the critical discount.

It is straightforward to show that $\left.\dfrac{\partial p_i^c}{\partial d}\right|_{d^\cdot} < 0$. Therefore, at δ, the Cournot price

$p_i^c(c + w - 2\,\delta\,k_i)$ cuts the Bertrand price $p_i^b(c + w)$ from below, which is expected.

APPENDIX B: PROOF OF LEMMA 2

Notice that the best response function in k_i, for i=1,2, is given by $k_i(k_j) = D(p_i(k_j),$

$p_j(k_j))$, where $(p_i(k_j), p_j(k_j))$ satisfies

(a1) $\underset{p_i}{\mathrm{Max}} \, (p_i - w + d\,k_i) \cdot k_i$ subject to

(a2) $k_j = a - p_j + b\,p_i$

(a3) $r^i(p_j) \le p_i \le r^i(p_j; w)$.

(a2) and (a3) are direct implications from the lemma: $k_i = q_i = D_i\,(p_i, p_j)$, for i=1, 2. (a2)

says that the optimal price response must lie on Part 2 of rival's reaction function. (a3)

mandates that the best response price falls between the range that is under the conditions

of $k_i > q_i$ and $k_i < q_i$.

I divide my analysis into three cases:

(1) $d > \delta$. As I showed in Section 3 and using the lemma, (a1) and (a2) give rise

the Cournot price $p_i^C(w - 2\,d\,k_i)$. $p_i^C(w - 2\,d\,k_i)$ also satisfies (a3) (see Figure 4).

$q_i^C(w - 2\,d\,k_i)$ is the optimal quantity and by the lemma, this is also the optimal preorder

size k_i in the first stage. Given small discount, specifically with d < 1, the second order

condition of the constrained optimization problem of (a1) and (a2), i.e.

$-2(1 - b^2)(1 - d) < 0$, is also satisfied. Together with the fact that the first order

condition gives a unique maximum, the optimal solution is unique. The same reasoning is

also true for the other dealer. Hence, the Cournot price pair

$(p_1^C(w - 2\,d\,k_1), p_2^C(w - 2\,d\,k_2))$ is optimal. Dealers' preorders (k_i, k_j) that equal the

corresponding Cournot quantity pair $(q_1^C(w - 2\,d\,k_1), q_2^C(w - 2\,d\,k_2))$ implement these

prices. Graphically, Point C is at the intersection of Part 2 of the two reaction functions at which each dealer reaches the highest possible Cournot profit.

(2) $0 < d \leq \delta$. At $d = \delta$, the solution to (a1) to (a3) coincides with the intersection point of the two curves $r_1^B(p_2; w)$ and $r_2^B(p_1; w)$, which is the Bertrand price pair $(p_1^B(w), p_2^B(w))$ or point B in Figure 4. For discounts that fall into the range $0 < d \leq \delta$, dealer i still preorders $k_i = q_i^B(w)$. A smaller preorder shifts the s_i curve downward and thus its intersection point with $r_i^B(p_j; w)$ is beneath B. To satisfy (a2), the equilibrium point that intersects Part 2 of his rival's reaction curve lies on Part 3 of his reaction curve; in other words the dealer will supplement his preorders in Stage 2. But this contradicts the lemma. Notice that at B, the dealer receives the highest possible profit. The same reasoning applies to the other dealer. Therefore, preorders (k_i, k_j) that equal to $(q_1^C(w), q_2^C(w))$ implement the Bertrand price pair. Note that the total cost of ordering k_i is $(w - d k_i) \cdot k_i$ in the relevant range of discount values.

(3) Finally at $d = 0$, the two-stage game is equivalent to a one-stage Bertrand game. Equilibrium price and quantity pairs are $(p_1^B(w), p_2^B(w))$ and $(q_1^C(w), q_2^C(w))$ respectively. However, the sizes of dealers' preorders are indeterminate because the Bertrand price can be implemented by any preorders with $k_1 \in [0, q_1^B(w)]$ and $k_2 \in [0, q_2^B(w)]$. Q.E.D.

References

Aiken, Leona. S. and Stephen G. West (1991), *Multiple Regression: Testing and Interpreting* Interactions. Newbury Park, CA: Sage Publications.

Alchian, Armen A. and Harold Demsetz (1972), "Production, Information Costs, and Economic Organization," *American Economic Review*, 62(5), 777-795.

Allgulin, Magnus and Tore Ellingsen (2002), "Monitoring and Pay," *Journal of Labor Economics*, 20(2), 201-216.

Anderson, Erin and Richard L. Oliver (1987), "Perspectives on Behavior-Based versus Outcome-Based Salesforce Control Systems," *Journal of Marketing*, 51(4), 76-88.

Arora, Ashish (1996), "Testing for Complementarities in Reduced-Form Regressions: A Note," *Economic Letters*, 50, 51-55.

Arora, Ashish and Alfonso Gambardella (1990), "Complementarity and External Linkages: The Strategies of the Large Firms in Biotechnology," *Journal of Industrial Economics*, 38(4), 361-379.

Arrunada, Benito, Luis Garicano, Luis Vazquez (2001), "Contractual Allocation of Decision Rights and Incentives: The Case of Automobile Distribution," *Journal of Law, Economics, and Organization*, 17(1), 257-284.

Athey, Susan and Scott Stern (2002), "The Impact of Information Technology on Emergency Health Care Outcomes," *RAND Journal of Economics*, 33(3), 399-432.

Athey, Susan and Scott Stern (2003), "An Empirical Framework for Testing Theories About Complementarity in Organizational Design," mimeo.

Baron, R. M. and Kenny, D. A. (1986), "The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic and Statistical Considerations," *Journal of Personality and Social Psychology*, 51, 1173-1182.

Barzel, Yoram (1982), "Measurement Costs and the Organization of Markets," *Journal of Law and Economics*, 25(1), 27-48.

Baye, Michael and Shyh-Fang Ueng (1998), "Commitment and Price Competition in a Dynamic Differentiated-Product Duopoly," *Journal of Economics*, 69(1), 41-52.

Beattie, Bruce R. and C. Robert Taylor (1985), *The Economics of Production*, New York: Wiley.

Bello, Daniel C. and David I. Gilliland (1998), "The Effect of Output Controls, Process Controls, and Flexibility on Export Channel Performance," *Journal of Marketing*, 61(Jan.), 22-38.

Becker, Gary S. and George J. Stigler (1974), "Law Enforcement, Malfeasance, and Compensation of Enforcers," *Journal of Legal Studies*, 3(1), 1-18.

Benerji, Shumeet (1990), *A Theory of Gray Markets: The Case of the Personal Computer Industry*, dissertation, Northwestern University.

Berry, Steven (1994), "Estimating Discrete-Choice Models of Product Differentiation," *Rand Journal of Economics*, 25(2), 242-262.

Bhattacharyya, Sugato and Francine Lafontaine (1995), "Double-Sided Moral Hazard and the Nature of Share Contracts," *RAND Journal of Economics*, 26, 761-781.

Blair, Roger D. and Francine Lafontaine (2005), *The Economics of Franchising*, New York: Cambridge.

Blair, Roger D. and David L. Kaserman (1983), *Law and Economics of Vertical Integration and Control*. Orlando, FL: Academic Press.

Blattberg, Robert C. and Scott A. Neslin (1990), *Sales Promotion*, New Jersey: Prentice-Hall.

Bresnahan, Timothy F. (1989), "Empirical Studies of Industries with Market Power," in *Handbook of Industrial Organization*, Vol. II, Richard Schmalensee and Robert D. Willig (ed), Elsevier: Amsterdam.

Brickley, James A. (1999), "Incentive Conflicts and Contracting: Evidence from Franchising," *Journal of Law and Economics*, 42(2), 745-774.

Brickley, James A., Frederick Dark, and Michael Weisbach (1991), "The Economic Effects of Franchise Termination Laws," *Journal of Law and Economics*, 34(1), 101-132.

Bucklin, Louis P. (1973), "A Theory of Channel Control," *Journal of Marketing*, 37(Jan.), 39-47.

Cameron, A. Colin and Pravin K. Trivedi (2005), *Microeconometrics*, New York, NY: Cambridge.

Cassiman, Bruno and Reinhilde Veugelers (2006), "In Search of Complementarity in Innovation Strategy: Internal R&D and External Acquisition," *Management Science*, 52(1), 68-82.

Celly, Kirth S. and Gary L. Frazier (1996), "Outcome-Based and Behavior-Based Coordination Efforts in Channel Relationships," *Journal of Marketing Research*, 33(May), 200-210.

Chen, Xinlei, George John, and Om Narasimhan (2006), "Assessing the Consequences of A Channel Switch," *Marketing Science*, forthcoming.

Cheung, Stephen N. S. (2001), *Economic Explanations*. Hong Kong: Acadia. (in Chinese)

Chintagunta, Pradeep K. (2002), "Investigating Category Pricing Behavior at a Retail Chain," *Journal of Marketing Research*, 29(May), 141-154.

Chintagunta, Pradeep K. and Sudeep Haldar (1998), "Investigating Purchase Timing Behavior in Two Related Product Categories," *Journal of Marketing Research*, 35 (Feb.), 43-53.

Chintagunta, Pradeep K. and Ramarao Desiraju (2005), "Strategic Pricing and Detailing Behavior in International Markets," *Marketing Science*, 24(1), 67-80.

Cockburn, Iain M., Rebecca M. Henderson, and Scott Stern (2002), "Balancing Incentives: The Tension Between Basic and Applied Research," mimeo.

Coelli, Tim, D.S. Prasada Rao, and George E. Battese (1998), *An Introduction to Efficiency and Productivity Analysis*, Norwell, MA: Kluwer.

Coughlan, Anne T. and Birger Wernerfelt (1989), "On Credible Delegation by Oligopolists: A Discussion of Distribution Channel Management," *Management Science*, 35 (2), 226-239.

Coughlan, Anne T., Erin Anderson, Louis W. Stern, and Adel I. Ansary (2006), *Marketing Channels*, New Jersey: Pearson.

Desai, Preyas (2000), "Multiple Messages to Retain Retailers: Signaling New Product Demand," *Marketing Science*, 19(4), 381-389.

Dube, Jean-Pierre and Puneet Manchanda (2005), "Differences in Dynamic Brand Competition Across Markets: An Empirical Analysis," *Marketing Science*, 24(1), 81-95.

Dutta, Shantanu, Mark Bergen, and George John (1994), "The Governance of Exclusive Territories When Dealers Can Bootleg," *Marketing Science*, 13(1), 83-99.

Dutta, Shantanu, Jan. B. Heide, and Mark Bergen (1999), "Vertical Territorial Restrictions and Public Policy: Theories and Industry Evidence," Journal of Marketing(Oct.), 63, 121-134.

Duvvuri, Sri Devi, Asim Ansari, and Sunil Gupta (2007), "Consumers' Price Sensitivities Across Complementary Categories," *Management Science*, 53 (12), 1933-1945.

Ghosh, Mrinal and George John (1999), "Governance Value Analysis and Marketing Strategy," *Journal of Marketing*, 63 (Special Issue), 131–45.

Ghosh, Mrinal and George John (2005), "Strategic Fit in Industrial Alliances: An Empirical Test of Governance Value Analysis," *Journal of Marketing Research*, 42(Aug.), 346-357.

Hayashi, Fumio (2000), *Econometrics*, Princeton, New Jersey: Princeton.

Heide, Jan B.(1994), "Interorganizational Governance in Marketing Channels," *Journal of Marketing*, 58(Jan.), 71-85.

Heide, Jan B., Kenneth H. Wathne, and Askel I. Rokkan (2007), "Interfirm Monitoring, Social Contracts, and Relationship Outcomes," *Journal of Marketing Research*, 44(Aug.), 425-433.

Ichniowski, Casey, Kathryn Shaw, and Giovanna Prennushi (1997), "The Effects of Human Resources Management Practices on Productivity: A Study of Steel Finishing Lines," *American Economic Review*, 87(3), 291-313.

Ingene, Charles, and Mark Parry (1995), "Channel Coordination When Retailers Compete," *Marketing Science*, 14(4), 360-377.

Ingene, Charles, and Mark Parry (2004), *Mathematical Models of Distribution Channels*, New-York: Kluwer.

Jaccard, James, Robert Turrisi, and Choi K. Wan (1990), *Interaction Effects n Multiple Regressions*, Newbury Park, CA: Sage Publications.

Jaworski, Bernard J. (1988), "Toward a Theory of Marketing Control: Environmental Context, Control Types, and Consequences," *Journal of Marketing*, 52(3), 23-39.

Jaworski, Bernard J., Vlasis Stathakopoulos, and H. Shanker Krishnan (1993), "Control Combinations in Marketing: Conceptual Framework and Empirical Evidence," *Journal of Marketing*, 57(1), 57-69.

Kadiyali, Vrinda (1996), " Entry, Its Deterrence, and Its Accommodation: A Study of the U.S. Photographic Film Industry," *RAND Journal of Economics*, 27(3), 452-478.

Kadiyali, Vrinda, Pradeep Chintagunta, and Naufel Vilcassim (2000), "Manufacturer-Retailer Channel Interactions and Implications for Channel Power: An Empirical Investigation of Pricing in a Local Market," *Marketing Science*, 19(2), 127-148.

Kaufmann, Patrick J. and Francine Lafontaine (1994), "Cost of Control: The Source of Economic Rent for McDonald's Franchisees," *Journal of Law and Economics*, 37(2), 417-453.

Klein, Benjamin (1980), "Transaction Cost Determinants of "Unfair" Contractual Arrangements," *American Economic Review*, 70(2), 356-362.

Klein, Benjamin (1995), "The Economics of Franchising Contracts," *Journal of Corporate Finance*, 2, 9-37.

Klein, Benjamin (1996), "Why Hold-Ups Occur: The Self-Enforcing Range of Contractual Relationships," *Economic Inquiry*, 34(3), 444-464.

Klein, Benjamin (1999), "Distribution Restrictions Operate by Creating Dealer Profits: Explaining the Use of Maximum Resale Price Maintenance in State Oil v. Khan," *Supreme Court Economic Review*, 7, 1-58.

Klein, Benjamin and Keith Leffler (1981), "The Role of Market Forces in Assuring Contractual Performance," *Journal of Political Economy*, 89, 615-641.

Klein, Benjamin and Kevin M. Murphy (1988), "Vertical Restraints as Contract Enforcement Mechanism," *Journal of Law and Economics*, 31(2), 265-297.

Klein, Benjamin and Kevin M. Murphy (1997), "Vertical Integration as a Self-Enforcing Contractual Arrangement," *American Economic Review*, 87(2), 415-420.

Klick, Jonathan, Bruce Kobayashi, and Larry Ribstein (2008), "The Effect of Contract Regulation: The Case of Franchising," working paper.

Kolay, Sreya, Greg Shaffer, and Janusz A. Ordover (2004), "All-Units Discount in Retail Contracts." *Journal of Economics and Management Strategy*, 13(3), 429-459.

Kreps, David M. and Jose A. Scheinkman (1983), "Quantity Precommitment and Bertrand Competition Yield Cournot Outcomes," *Bell Journal of Economics*, 14(2), 326-337.

Lafontaine, Francine (1992), "Agency Theory and Franchising: Some Empirical Results," *RAND Journal of Economics*, 23(2), 263-283.

Lafontaine, Francine and Emmanuel Raynaud (2002), "The Role of Residual Claims and Self-Enforcement in Franchising Contracting," NBER working paper #8868.

Lafontaine, Francine and Margaret E. Slade (1996), "Retail Contracting and Costly Monitoring: Theory and Evidence," *European Economic Review*, 40, 923-932.

Lal, Rajiv, John Little, and J. Miguel Villas-Boas (1996), "A Theory of Forward Buying, Merchandising, and Trade Deals," *Marketing Science*, 15(1), 21-37.

Lal, Rajiv and Charkravarthi Narasimhan (1996), "The Inverse Relationship Between Manufacturer and Retailer Margins: A Theory," *Marketing Science*, 15(2), 132-151.

Maggi, Giovanni (1996), "Strategic Trade Policies with Endogenous Mode of Competition," *American Economic Review*, 86(1), 237-258.

Manchanda, Puneet, Asim Ansari, and Sunil Gupta (1999), "The 'Shopping Basket': A Model for Multicategory Purchase Incidence Decisions," *Marketing Science*, 18(2), 95-114.

Marvel, Howard P. (1982), "Exclusive Dealing," *Journal of Law and Economics*, 25(1).

Masten, Scott (2007), "Long-Term Contracts and Short-Term Commitment: Price Determination for Heterogeneous Freight Transactions," mimeo.

Mathewson, Frank and Ralph Winter (1985), "The Economics of Franchise Contracts," *Journal of Law and Economics*, 28, 503-26.

Mayer, Kyle J., Jack A. Nickerson, and Hideo Owan (2004), "Are Supply and Plant Inspections Complements or Substitutes? A Strategic and Operational Assessment of Inspection Practices in Biotechnology," *Management Science*, 50(8), 1064-1081.

Michael, Steven C. and Hollie J. Moore (1995), "Returns to Franchising," *Journal of Corporate Finance*, 2, 133-155.

Milgrom, Paul and John Roberts (1990), "The Economics of Modern Manufacturing Technology: Technology, Strategy, and Organization," *American Economic Review*, 80(3), 511-528.

Milgrom, Paul and John Roberts (1995), "Complementarities and Fit: Strategy, Structure, and Organizational Change in Manufacturing," *Journal of Accounting and Economics*, 19, 179-208.

Miravete, Eugenio J. and Jose C. Pernias (2006), "Innovation Complementarity and Scale of Production," *Journal of Industrial Economics*, 54(1), 1-29.

Murry, John P. and Jan B. Heide (1998), "Managing Promotion Program Participation within Manufacturer-Retailer Relationships," *Journal of Marketing*, 62(1), 58-68.

Nesta, Lionel and Pier P. Saviotti (2005), "Coherence of the Knowledge Base and the Firm's Innovative Performance: Evidence from the U.S. Pharmaceutical Industry," *Journal of Industrial Economics*, 53(1), 123-142.

Novak, Sharon and Scott Stern (2007), "Complementarity Among Vertical Integration Decisions: Evidence From Automobile Product Development," NEBR working paper #13232.

Oliver, Richard L. and Erin Anderson (1994), "An Empirical Test of the Consequences of Behavior- and Outcome-Based Sales Control Systems," *Journal of Marketing*, 58(4), 53-67.

Pindyck, Robert S. and Daniel L. Rubinfeld (2001), *Microeconomics*. Prentice-Hall: New Jersey.

Prendergast, Canice (1999), "The Provision of Incentives in Firms," *Journal of Economic Literature*, 37(1), 7-63.

Rebitzer, James B. (1995), "Is There a Trade-Off Between Supervision and Wages: An Empirical Test of Efficiency Wage Theory," *Journal of Economic Behavior and Organization*, 28, 107-129.

Reiss, Peter C. and Frank A. Wolak (2005), "Structural Econometric Modeling: Rationales and Examples from Industrial Organization," Working Paper, 2-20-2005 version.

Roberts, John (2004), *The Modern Firm*, New York: Oxford.

Roy, Abhik, Dominique Hanssesn, and Jagmohan Raju (1994), "Competitive Pricing by a Price Leader," *Management Science*, 40(7), 809-823.

Sakakibara, Mariko (2001), "The Diversity of R&D Consortia and Firm Behavior: Evidence from Japanese Data," *Journal of Industrial Economics*, 49(2), 181-196.

Shaffer, Greg (1991), "Slotting Allowances and Resale Price Maintenance: A Comparison of Facilitating Practices," *RAND Journal of Economics*, 22(1), 120-135.

Shapiro, Carl and Joseph E. Stiglitz (1984), "Equilibrium Unemployment as a Worker Discipline Device," *American Economic Review*, 74(3), 433-444.

Song, Inseong and Pradeep K. Chintagunta (2007), "A Discrete-Continuous Model for Multi-Category Purchase Behavior of Households," *Journal of Marketing Research*, 44(Nov.), 595-612

Stump, Rodney L. and Jan B. Heide (1996), "Controlling Supplier Opportunism in Industrial Relationships," *Journal of Marketing Research*, 33(4), 431-441.

Sudhir, K. (2001), "Competing Pricing Behavior in the Auto Market: A Structural Analysis," *Marketing Science*, 20(1), 42-60.

Telser, Lester G. (1960), "Why Should Manufacturers Want Fair Trade," *Journal of Law and Economics*, 3(Oct.), 86-105.

Telser, Lester G. (1980), "A Theory of Self-Enforcing Agreements," *Journal of Business*, 53(1), 27-44.

Topkis, Donald (1994), "Manufacturing and Market Economics," Working Paper.

Villas-Boas, J. Miguel and Ying Zhao (2005), "Retailer, Manufacturers, and Individual Consumers: Modeling the Supply Side in the Ketchup Marketplace," *Journal of Marketing Research*, 42(Feb), 83-95.

Villas-Boas, Sofia B. (2007), "Vertical Relationships Between Manufacturers and Retailers: Inference With Limited Data," *Review of Economic Studies,* 74(2), 625-652.

Wathne, Kenneth H. and Jan B. Heide (2000), "Opportunism in Interfirm Relationships: Forms, Outcomes, and Solutions," *Journal of Marketing*, 64(Oct.), 73-89.

Wathne, Kenneth H. and Jan B. Heide (2004), "Relationship Governance in a Supply Chain Network," *Journal of Marketing Research*, 68(Jan.), 73-89.

Weitz, Barton A. and Sandy D. Jap (1995), "Relationship Marketing and Distribution Channels," *Journal of the Academy of Marketing Science*, 23(4), 305-326.

Woodridge, Jeffrey M. (2002), *Econometric Analysis of Cross Section and Panel Data*, Cambridge, NY: MIT.