EFFORT AND COMPENSATION IN RELATIONAL CONTRACTS

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Abstract

To generate downstream sales, manufacturers often spend both effort and compensation when working with their dealers. Existing theories are inconclusive about the interdependent role of the two kinds of instruments in motivating dealer effort; that is, whether they are substitutes or complements. There is little empirical evidence to inform their relations either. We first examine the conditions that determine the interdependencies among monetary compensation – both formal and informal – and manufacturer effort in a game-theoretical framework. We show that monetary compensation and manufacturer effort are complementary instruments in motivating dealer effort if the manufacturer's effort is primarily about monitoring. They become substitutes when the manufacturer's effort is primarily productive and thus provides indirect compensation. We then empirically illustrate some of these novel predictions in the distribution channel of the leading manufacturer of a computer accessory and its sixty dealerships in China. In particular, evidence from company archival and survey data shows complementarity between informal compensation and manufacturer effort in motivating dealer effort. This result appears to hold only when the dealers are situated in highly relational contexts. Theoretical and managerial implications are drawn from our analyses.

Key words: Distribution channels; Incentives; Monitoring; Effort; Manufacturer; Dealer; Agency Theory; China.

INTRODUCTION

Monetary compensation and field efforts of both the manufacturer and its dealers all help to generate sales and profit in distribution channels (e.g., Klein and Murphy 1988; Murry and Heide 1998; Buvik and John 2000; Kashyap, Antia, and Frazier 2012). It is well-known that monetary compensation incentivizes downstream effort (Murry and Heide 1998; Kashyap, et al. 2012) and manufacturer effort can serve both productive and/or monitoring purposes (e.g., Stump and Heide 1996; Celly and Frazier 1996; Bello and Gilliland 1997; Buvik and John 2000). That manufacturers use both monetary compensation and effort to manage the downstream, however, is *not* informative about the interdependencies across these instruments. Our paper fills this void by formally identifying conditions that make these two classes of instruments to be complements or substitutes. We also empirically illustrate some of the theoretical predictions through a proprietary data set collected from a major manufacturer in China.

Theoretical arguments in marketing and economics provide conflicting perspectives on the interdependent role of manufacturer effort and monetary compensation in motivating downstream effort. On the one hand, studies in relationship marketing (e.g., Murry and Heide 1998; Wathne and Heide 2000; Lafontaine and Raynaud 2002) claim that they are complements because effort facilitates information exchange, behavioral guidance, and detection of shirking, which in turn increases the value of using monetary rewards to sanction the downstream. On the other hand, the efficiency wage theory in economics (Becker and Stigler 1974; Klein 1980; Roberts 2004) views the principal's effort and monetary compensation as substitute tools to enforce agent effort. This perspective suggests that if manufacturer effort can achieve perfect detection of malfeasance, then market-level compensation is sufficient to enforce optimal dealer effort. If the manufacturer's effort is not effective in effort detection, however, then she should

offer a stream of compensation premium above what the market offers as a "performance bond" that will be taken away in the case of non-compliance (see also Klein and Murphy 1988). In other words, the manufacturer should tradeoff between her effort and monetary compensation such that the two are "inversely related" (Becker and Stigler 1974, p. 6).

To reconcile these conflicting perspectives, we develop a principal-agent model of an ongoing relationship between the manufacturer and the dealer who engage in sales production. Not restricting their efforts as either *technological* substitutes or complements in the sales production function[1], we analyze how the dealer's effort optimally responds to the manufacturer's triple offers in terms of formal compensation, an informal bonus, and her effort. In a benchmark static game where the informal, subjective bonus plays no role, we show that the dealer's effort increases in formal compensation and its strategic reaction to the manufacturer's effort depends only on whether they are technological substitutes or complements in the sales function.

In the repeated game, dealer effort is higher than that under the static case of fully myopic players. More importantly, we find that even if manufacturer and dealer efforts are technological substitutes, the two efforts can become strategic complements due to the additional governance roles played by manufacturer effort in the repeated game. In particular, such effort now provides an additional, indirect avenue of compensation, where the dealer benefits from the manufacturer involvement because of its productive impact on increasing downstream sales, *and* a monitoring role, which allows the manufacturer to withdraw the relational elements of the partnership in terms of both her additional effort and the informal bonus in the case of detected dealer malfeasance. The two additional roles increase the value of effort to the dealer: the first

[1] A clarification of our exact usage of the terminology on the interdependence of two factors (e.g., substitutes and complements) is included on pp.6-7 in the next section.

increasing the size of the reward and the second the likelihood that the reward is lost if the agreement is not adhered to, and can override the direct, technological substitutability between the efforts of the two parties.

Finally, monetary – informal and formal – compensation can be either a complement or substitute to manufacturer effort in motivating the dealer. These instruments are complements when the monitoring role of the manufacturer's effort dominates; but they are substitutes when the manufacturer's involvement is primarily productive and thus acts as an indirect form of compensation to the dealer. Our analysis reconciles the apparently conflicting perspectives by formally integrating the technological and governance (i.e., indirect compensation and monitoring) roles of manufacturer effort in vertical relationships. In the process, we are able to identify the missing factors that lead to the contradictory claims made in existing literature.

We empirically illustrate some of the above comparative statics in the channel context of a major manufacturer in China. The size of the Chinese market, along with the vast geographical area it covers and the dispersion of cities and towns with under-developed infrastructure (Knowledge at Wharton 2006), yields a very a fragmented distribution structure. In addition, the costly and inefficient legal system in countries like China makes it expensive to write and enforce formal contracts (Djankov et al. 2003; Zhou and Poppo 2010), making the role of informal promises and threats sustained by the relationship itself important. Our unique data set and field information show that (i) the informal, subjective compensation offered to its 60 non-exclusive dealers is a strategic complement to the latter's effort, and (ii) informal compensation and the manufacturer's effort are complements in motivating dealer effort. Our results on the effect of manufacturer effort also suggest a tension between its technological role in sales production and its governance functions in terms of monitoring and indirect compensation in

relational contracting with dealers. Moreover, these results appear to hold only when dealers are situated in highly relational contexts: when they are more likely to (i) stay in business, (ii) to have growth potentials, or (iii) to lose more by deviating from cooperation with the manufacturer.

The paper proceeds as follows. In the next section, we explain key concepts and review the literature. Afterward, we present our analytical model. Then we describe the institutional context of distribution in China and the manufacturer's distribution arrangements. Next, we describe our data and present our empirical findings. Lastly, we conclude by discussing implications for research and practice.

LITERATURE REVIEW

In this section, we delineate the key concepts that inform our research question and review the literature.

Multiple instruments play important roles in inter-firm governance and relationships. The literature on channel governance has looked at both effort and monetary compensation as two commonly used instruments that motivate downstream partners (e.g., Bucklin 1973; Anderson and Oliver 1987; Klein and Murphy 1988; Kaufmann and Lafontaine 1994; Bradach 1998). Monetary compensation may include both formal and informal payments such as front-end discounts, free goods, back-end rebates, and discretionary allowances (Blattberg and Neslin 1990; Palmatier, Stern, and El-Ansary 2015, Ch.6). Studies find that manufacturers often provide resale margins and incentive premiums as compensation to motivate dealers' marketing effort and/or to cover their costs of distribution (e.g., Bergen, Dutta, and Walker 1992; Murry and Heide 1998; Kashyap et al. 2012; Lo and Salant 2016). For instance, Murry and Heide (1998) find that when manufacturers can only partially observe the implementation of promotions inside independent liquor and grocery stores, higher levels of formal, front-end discounts lead to higher participation

and compliance of pre-agreed effort levels. In car dealerships, Kashyap et al. (2012) show that informal bonuses and payments induce compliance and cut down undesired behavior downstream.

While compensation is straightforward in terms of its incentive role ("money is money"), the literature entails two notions on manufacturer effort or involvement at the downstream. Studies have looked at its *monitoring* function – that is, detecting malfeasance – (e.g., chemical industry in Stump and Heide 1996) and its effect on the compliance of optimal effort, pre-agreed contractual provisions, and established standards (e.g., Blair and Lafontaine 2005 in the franchising context). Prior work has shown that policing behavior deviations helps to reduce opportunism (e.g., gasoline distribution in John 1984) and increase compliance (e.g., distributing consumer products in Antia et al. 2006). However, Murry and Heide (1998) find that stringent monitoring of in-store promotions reduces retailers' participation and compliance, despite of the authors' theoretical conjecture that monitoring may alleviate information asymmetry.

The second but broader notion of manufacturer effort refers to a range of *additional* manufacturers' initiated actions such as support, guidance, and information exchange (Alchian and Demsetz 1972; Heide and John 1990; Nevin 1995; Buvik and John 2000). These additional activities are productive per se; as such they also indirectly compensate downstream dealers. Bello and Gilliland (1997) find some support that export manufacturers' effort positively correlates with their foreign distributors' effort and performance. Buvik and John (2000) discover that joint effort in supplier-OEM dyads decreases inefficiencies. Furthermore, Joshi (2009), Gundlach and Cannon (2000), and Heide et al. (2007) also show that one's effort increases its partners' performance in industrial markets.

On the interaction between monetary compensation and effort, classical efficiency wage models and self-enforcing contracts view them as substitutes (e.g., Becker and Stigler 1974; Klein 1980; Shapiro and Stiglitz 1984; see also Roberts 2004, p.35). The rationale is that an increase in the principal's effort lowers the value of monetary incentives: if the principal perfectly detects shirking through her effort, and if termination always ensues, then the agent can be properly motivated by merely receiving a competitive or market level of compensation. This implies that the principal trades off the levels of compensation with her effort to induce the agent's provision of effort (Becker and Stigler 1974, p. 6). Nonetheless, empirical evidence in labor economics is inconclusive and some theoretical work in that area also expresses alternative views (e.g., Allgulin and Ellingsen 2002).

While the interdependence of compensation and manufacturer effort has not been formally and empirically examined in the distribution channel literature, some studies claim that they are complements (e.g., Wathne and Heide 2000; Lafontaine and Raynaud 2002). This is because monetary rewards work effectively only when information on and guidance to downstream behavior are available. For, if the manufacturer engages little with its dealers, it is almost impossible to assess and direct dealers' effort. This impedes the manufacturer's ability to use monetary incentives to reward desired behavior.

It is worthwhile to notice that throughout our analysis, we clarify our usage of the concept of factor interdependence as follows since the notion and its usage in vertical relationship studies are not always clear. First, two factors are complements (substitutes, respectively) when the increase of one factor increases (decreases) the marginal effect of the other factor on an outcome variable. An important outcome variable in our analyses is dealer effort which is often what a manufacturer intends to motivate through her governance

instruments mentioned above. Second, the role of two input factors in the production function defines their technological relationship (Beattle and Taylor 1985, pp.32-36). Specifically applied to our context of sales production, manufacturer effort is a technological complement (substitute) to dealer effort when an increase in the former increases (decreases) the marginal contribution to sales at downstream. Lastly, two variables are *strategic* complements (substitutes) when the optimal response of one variable to an increase in the other variable is to increase (decrease) its level (Tirole 1988, pp.207-208).

Having reviewed related work, we introduce our formal model in the next section.

THE MODEL

Model assumptions and setup

The sales production

Consider the following simple model of sales production involving a manufacturer ("she") as the principal and her dealer ("he") as the agent. The dealer and the manufacturer are engaged in a repeated relationship. In each period, the realized downstream sales, y, can be either 0 (low) or 1 (high). The probability that the sales is high is equal to

$$y = e_A - be_Ae_P + de_P ,$$

where e_A is the effort of the dealer and e_P is the effort of the manufacturer. The parameter $0 \leq d \leq 1$ captures the relative productivity of the manufacturer in relation to the dealer while the parameter $|b| \in [0, d)$ captures the technological relations of the two efforts: they are technological substitutes and complements if b is in its positive (> 0) and negative (≤ 0) ranges respectively. In other words, we allow both the dealer and the manufacturer to contribute effort.

The cost of effort is $C(e) = \frac{1}{2}e_i^2$, $i = A, P$.[2] We assume that the manufacturer can verify the dealer's sales outcome, $y \in \{0, 1\}$, and thus formal contracts on it are possible.

The manufacturer's triple instruments

We assume that the dealer is protected by limited liability and thus the formal contract will consist of a monetary reward α that is paid in the case of output being high in any given period. In addition to the formal reward, α, the manufacturer may observe (but not formally contract on) the dealer's effort level e_A in any given period. Thus, in addition to the formal contract, the manufacturer may offer the dealer a subjective, informal reward, *B*, which is paid to the dealer as long as the manufacturer sees no evidence of the dealer deviating from the informally agreed-upon, observable yet non-verifiable effort level, e_A.[3]

The manufacturer can also promise a given effort level e_P to the dealer. Note that her effort plays three roles. First, it is part of the technology that defines the sales production function and hence is directly productive in terms of helping to generate downstream sales. Second, it provides an indirect avenue of compensation to the dealer because of its productive role as well: a higher contribution by the manufacturer increases the likelihood of a high output, which increases the likelihood that the dealer receives his formal compensation. Third, the effort helps the manufacturer to monitor the dealer on deviations. Our goal is to analyze how the triple

[2] This assumption of binary verifiable output eliminates the shape of the optimal compensation contract as an issue. To be rigorous, we would need an additional parameter on the cost function to guarantee that the equilibrium success probability is always less than one. That is simply an additional parameter with no economic significance so we sidestep this technical restriction here.

[3] This fits our context because all dealers have long term relationship with the manufacturer, so "not-shirking-unless-being-caught" matches the manufacturer view as the default state. Technically, a similar solution would have the manufacturer pay the subjective bonus *B* only when there is evidence of the right level of effort, but that would require a larger value of the absolute bonus and thus less likely to be incentive-compatible to the manufacturer to pay. A richer analysis would allow all observations to be imperfect and for the manufacturer to learn from the outcomes over time, but that would significantly complicate the model without any real additional insights. Thus, we restrict our set of equilibrium strategies considered to maintain tractability of the basic logic.

instruments (α, B, e_P) can jointly be used to motivate the dealer's effort e_A and how the three interact with the latter.

Manufacturer effort and monitoring

We assume that the manufacturer's ability to observe the dealer's effort level, i.e., monitoring, may depend on her intensity of involvement with the dealer in generating downstream sales. To model this, we assume that she observes the dealer's effort perfectly with probability $P(e_P)$ and observes nothing with probability $1 - P(e_P)$. The probability $P(e_P)$ is given by

$$P(e_P) = \underline{p} + (\overline{p} - \underline{p})e_P^{\gamma},$$

where $0 \leq \underline{p} < \overline{p} \leq 1$ measure the baseline observability of the dealer's effort and $\gamma \leq 1$ measures the marginal effectiveness – in terms of monitoring and observing dealer effort – of the manufacturer's effort. Notice that higher γ means lower detection probability for a given level of e_P. For example, letting $\gamma \to 0$, even minimal effort makes the dealer's effort observable at probability $\overline{p}$.[4]

The timing of the game

The timing of the stage game is as follows. First, the manufacturer offers the contract (α, B, e_P) and requests the effort level e_A from the dealer. The dealer, whose outside option is zero, either accepts or rejects the offer. The parties then simultaneously choose their effort levels. The sales output is realized, the manufacturer observes the dealer's effort level with probability $P(e_P)$ while the dealer observes the manufacturer's effort level with probability 1. If no deviation is detected, the manufacturer then chooses whether to honor the promise B and the contractible transfer is made if the sales output was high. If a deviation by either party is detected, the parties revert to the static Nash equilibrium of the stage game. Then, the game moves on to the next

[4] The parameters assumed guarantee that the manufacturer's effort never exceeds 1.

period. The game is infinitely repeated and, for simplicity, the parties discount the future at a common rate $\delta \leq 1$. The equilibrium of the repeated game is also known as the "relational contract."

Analysis

We analyze the game in three steps. First, we will summarize the outcome under static contracting, where the parties are myopic and do not attempt to maintain a relationship; hence the contract consists only of the formal bonus, α, based on verifiable sales output. This also works as the threat point for the relationship if a deviation by either party from the agreed-upon behavior is detected.[5] Second, we will consider the dealer's effort problem under the relational contract that introduces the manufacturer's effort level and the informal compensation, B, as additional parameters of choice. Finally, we will outline the manufacturer's maximization problem and consider the equilibrium outcome. For our empirical purpose, the sub-section on the dealer's constraints provides the foundations for the analysis and is thus our focus. The manufacturer's problem is more complex when dealing with multiple dealers, and the equilibrium analysis of this last part is to be taken more suggestive of the basic tradeoffs and equilibrium outcomes between the manufacturer and a representative dealer.

Static equilibrium

The static equilibrium (equivalent to fully myopic players) is straightforward. Given the formal bonus α, each party chooses the effort level that maximizes their expected payoff, giving their best-response functions. These are given by

$$e_A = \alpha(1 - be_P) \qquad \text{and} \qquad e_P = (1-\alpha)(d - be_A),$$

[5] The manufacturer could also potentially replace the dealer following a deviation, which would push the dealer's outside option lower. But this would only affect the total surplus from the relationship, making it more sustainable for lower discount factors, without affecting the comparative statics regarding the on-path equilibrium play.

so that the relation of the efforts depends on the sign of *b*: they are strategic substitutes whenever they are technological substitutes ($b > 0$); otherwise they are strategic complements. Further, $\frac{\partial^2 e_A}{\partial \alpha \partial e_P} = -b$, so that the effect of manufacturer effort on the effectiveness of monetary incentives on dealer effort depends on the technological relationship between the two efforts. Intuitively, if the manufacturer works harder and it lowers (increases, respectively) the marginal value of effort to the dealer, then the formal compensation becomes a less (more) efficient means of motivating the dealer.

Solving the two together gives us then the equilibrium effort levels as

$$e_A = \frac{\alpha(1-bd(1-\alpha))}{(1-\alpha b^2(1-\alpha))} \quad \text{and} \quad e_P = \frac{(1-\alpha)(d-\alpha b))}{(1-\alpha b^2(1-\alpha))}$$

so that increasing the formal reward α motivates the dealer while lowering the effort level of the manufacturer. Increasing the efficiency of the manufacturer, *d*, increases her contribution and, because of the technological substitutability or complementarity of efforts, decreases or increases that of the dealer respectively. Finally, given the equilibrium effort levels, the manufacturer chooses the formal reward α to maximize

$$\max_{\alpha} (1-\alpha)(e_A - be_A e_P + de_P) - \frac{1}{2}e_P^2,$$

given the equilibrium effort levels above. This solution then defines the static Nash equilibrium payoffs for the two parties, given by (u_A^{NE}, u_P^{NE}). The solution does not, unfortunately, exist in closed form but is solved numerically below when considering the equilibrium outcomes and works as the benchmark for the solution when the parties engage in a repeated relationship.

Repeated game - the dealer's incentive-compatibility constraint for e_A

Having considered the static equilibrium, we can now consider the repeated game that enables the relational contract. The main interest for our analysis is the dealer's effort choice and how that choice depends on the manufacturer's offer (α, B, e_P). To this end, we know that the effort choice e_A is incentive-compatible as long as the value of the ongoing relationship exceeds the value of deviating and reverting back to the static equilibrium from above. For a given relational contract (α, B, e_P), the ongoing value of the relationship is given by

$$V_A^{eq} = \frac{1}{1-\delta_A}\left(\alpha(\mathrm{e}_A - be_A e_P + de_P) - \frac{1}{2}e_A^2 + B\right).$$

To construct the value of deviating, it is composed as follows. First, if the dealer chooses to deviate, he will do so in a way that he maximizes his expected payoff. Thus, if he expects the manufacturer to honor her commitment and exert effort e_P, then his optimal deviation is given by the stage-game best-response function, $e_A^{dev} = \alpha(1-be_P)$, which then gives the deviation payoff as

$$u_A^{dev} = \frac{\alpha\left(\alpha + 2de_P - \alpha be_P(2-be_P)\right)}{2}.$$

Following the deviation, the dealer is caught with probability $P(e_P)$. If the dealer is not caught, the game continues on the equilibrium path. If the dealer is caught, then he loses the informal compensation B at the end of the period, plus the per-period continuation value drops to u_A^{NE}. Bringing these components together, we can write the deviation payoff as

$$V_A^{dev} = u_A^{dev} + \frac{\delta_A}{1-\delta_A}P(e_P)u_A^{NE} + \left(1-P(e_P)\right)\left(B + \frac{\delta_A}{1-\delta_A}\left(\alpha(e_A - be_A e_P + de_P) - \frac{1}{2}e_A^2 + B\right)\right).$$

The effort level is then sustainable as long as $V_A^{eq} \geq V_A^{dev}$, which we can rearrange to yield

$$\delta_A P(e_P)\left(\alpha(e_A - be_A e_P + de_P) - \frac{1}{2}e_A^2 - u_A^{NE}\right) + P(e_P)B$$

$$\geq (1-\delta_A)\left(u_A^{dev} - (\alpha(e_A - be_A e_P + de_P) - \frac{1}{2}e_A^2\right).$$

The left-hand side of this expression captures the loss from deviating while the right-hand side captures the gain from deviating. Now, it is immediate that α, B, and e_P help to improve the continuation value by increasing the value the dealer loses in the case of deviating and increased monitoring increases the likelihood of consequences. But variation in them can also affect the reneging temptation. To examine these relationships further, we can use the above constraint to solve for the maximal sustainable effort level as

(1) $$e_A = \alpha(1-be_P) + \sqrt{\Gamma(P(e_P))}\sqrt{\phi}.$$

This expression is composed of three parts: the first term $\alpha(1-be_P)$ gives the myopically optimal level of effort (see p.10), while the multiplication of the other two terms gives the *additional* effort that can be sustained by the ongoing nature of the relationship. For the latter,

(2) $$\Gamma(P(e_P)) = \frac{\delta_A P(e_P)}{1-\delta_A(1-P(e_P))} \geq 0$$

captures the effect of the manufacturer's monitoring and the dealer's patience on the maximal effort sustainable, which is increasing in both the probability of detection and the patience of the agent, reflecting the fact that the relationship is terminated only if evidence of malfeasance is found, and

(3) $$\phi = \left(2\alpha d e_P + \alpha^2(1-be_P(2-be_P)) + 2\left(\tilde{B} - u_A^{NE}\right)\right) \geq 0$$

gives the net compensation value delivered to the dealer by the distribution contract (α, B, e_P), accounting for both the vulnerability of the offered contract to profitable deviation $\left(u_A^{dev}\right)$ and the

rents the dealer can earn under spot contracting $\left(u_A^{NE}\right)$, and where $\tilde{B} = \frac{B}{\delta_A}$ is the normalized informal compensation.

Given this solution for the maximal effort sustainable, we can now consider the comparative statics on how dealer's effort is affected by the contract (α, B, e_P). We get

(4) $$\frac{\partial e_A}{\partial \alpha} = \left(1 - be_P\right) + \frac{\sqrt{\Gamma\left(P\left(e_P\right)\right)}\left(de_P + \alpha\left(1 - be_P\left(2 - be_P\right)\right)\right)}{\sqrt{\phi}} > 0$$

(5) $$\frac{\partial e_A}{\partial \tilde{B}} = \frac{\sqrt{\Gamma\left(P\left(e_P\right)\right)}}{\sqrt{\phi}} > 0$$

(6) $$\frac{\partial e_A}{\partial e_P} = -\alpha b + \frac{\sqrt{\Gamma\left(P\left(e_P\right)\right)}}{\sqrt{\phi}}\alpha\left(d + b\alpha\left(1 - be_P\right)\right) + \frac{\delta_A\left(1 - \delta_A\right)}{2\left(1 - \delta_A\left(1 - P\left(e_P\right)\right)\right)^2}\frac{\sqrt{\phi}}{\sqrt{\Gamma\left(P\left(e_P\right)\right)}}P'\left(e_P\right)$$

>=< 0.

The positive results in (4) and (5) on α and $\tilde{B}$ respectively show that each of the two monetary rewards is a strategic complement to dealer effort as they unambiguously improve the dealer's incentives by increasing the surplus that he would lose in the case he is caught deviating from the agreement.

For the manufacturer's effort e_P, the result in (6) is ambiguous, resulting from the three components in the expression that correspond to the technological, productive (hence, indirect compensation), and monitoring roles of her effort as follows:

i. The first component is the direct impact on the optimal static effort, driven by whether the two efforts are technological substitutes ($b > 0$) or complements ($b \leq 0$) in the sales function.

ii. The second component is the productive effect of the manufacturer's effort on the net compensation value of the relationship, ϕ. This component is always positive and arises

from the fact that an increase in the manufacturer's effort increases the likelihood that the dealer receives his formal compensation. We refer to this effect as the indirect compensation role of the manufacturer's effort.

iii. Finally, the third component is the marginal effect of the manufacturer's effort on monitoring and how it maps onto compensation: an increase in detection probability through her effort increases the likelihood of the dealer's loss of compensation if he has misbehaved. This component is also always positive and thus also increases the maximal sustainable effort level.

If the dealer is sufficiently impatient (i.e., small δ_A) and the efforts are technological substitutes ($b > 0$), the first effect can dominate and the efforts remain strategic substitutes (i.e., $\partial e_A/\partial e_P < 0$), while the latter two effects can dominate and the efforts become complements when the dealer is patient enough (i.e., large δ_A) and the parties make sufficient attempts to sustain an equilibrium that is better than the static optimum. On the other hand, equation (6) predicts the two are always strategic complements (i.e., $\partial e_A/\partial e_P > 0$) when they are technological complements ($b \leq 0$). Note that equation (2) also implies complementarity between (ii) and (iii): the higher the probability of detection, the higher the marginal effect of managerial effort through the productive channel, and the higher the net value of the relationship, the higher the marginal effect of monitoring.

Finally, to examine the interactions between the instruments, we take the cross partial derivatives and obtain the following comparative statics. First, for the interaction between the two forms of monetary incentives (formal, output-based measure and subjective behavior-based measure), we get

$$(7) \qquad \frac{\partial^2 e_A}{\partial \tilde{B} \partial \alpha} = -\sqrt{\Gamma\left(P\left(e_P\right)\right)}\left(1 - be_P\right) + \frac{\left(\alpha + de_P - \alpha be_P\left(2 - be_P\right)\right)}{\phi^{3/2}} < 0$$

so that the two are always substitutes. Intuitively, the more motivated the dealer already is through the formal compensation, the less the additional informal compensation matters for incentives and vice versa.

The interaction of the monetary components with the manufacturer's effort is, however, somewhat more nuanced, and they can be either complements or substitutes, depending on the parameters. For the interaction between the manufacturer's effort level and the subjective reward, we get

$$\frac{\partial^2 e_A}{\partial \tilde{B} \partial e_P} = -\frac{\sqrt{\Gamma\left(P\left(e_P\right)\right)}}{\sqrt{\phi}} \frac{\left(\alpha\left(d - \alpha b\left(1 - b e_P\right)\right)\right)}{\phi} + \frac{\delta_A\left(1-\delta_A\right)}{2\left(1-\delta_A\left(1-P\left(e_P\right)\right)\right)} \sqrt{\frac{1}{\delta_A P\left(e_P\right)\left(1-\delta_A\left(1-P\left(e_P\right)\right)\right)}} \frac{1}{\sqrt{\phi}} P'\left(e_P\right) >=< 0. \tag{8}$$

Our main, *novel* prediction in (8) is thus that the manufacturer's effort and compensation can be either complements or substitutes depending on whether the manufacturer's involvement serves primarily a productive (indirect compensation) or a monitoring role:

i. The first component reflects the interaction between the compensation role of effort[6] and the informal compensation, which is always negative, as with the interaction between the monetary forms of compensation. If the manufacturer is already rewarding the dealer heavily through her effort and the high likelihood of formal compensation, additional informal, subjective bonus is less effective.

ii. The second component is always positive and reflects the interaction between the marginal effect of effort as monitoring and the informal compensation: the higher the detection probability and the higher the informal compensation, the more the dealer is to lose when caught deviating and thus the two are complements.

[6] To see this, look at the second component in equation (6).

Finally, we repeat the same for the interaction between the formal compensation and the manufacturer's effort level, which yields us

$$\frac{\partial^2 e_A}{\partial\alpha\partial e_P} = -b + \frac{\sqrt{\Gamma\left(P\left(e_P\right)\right)}}{\sqrt{\phi}}\left(\frac{\left(\alpha d e_P + 2\left(\tilde{B} - u_A^{dev}\right)\right)\left(d - \alpha b\left(1 - b e_P\right)\right) - \alpha b\left(1 - b e_P\right)\phi}{\phi}\right) + \frac{\delta_A\left(1-\delta_A\right)}{2\left(1-\delta_A\left(1-P\left(e_P\right)\right)\right)^2}\frac{1}{\sqrt{\Gamma\left(P\left(e_P\right)\right)}}\frac{\left(d e_P + \alpha\left(1 - b e_P\left(2 - b e_P\right)\right)\right)}{\sqrt{\phi}} P'\left(e_P\right) >=< 0. \quad (9)$$

As with the informal compensation, formal compensation and the manufacturer's effort can be either complements or substitutes. The first component is the direct, technological impact of her effort in the sales function. If the efforts are technological substitutes (complements, respectively), increased effort by the manufacturer reduces (increases) the marginal productivity of the dealer's effort, which in turn lowers (increases) the efficiency of the formal reward. The second component measures the compensatory interaction between formal compensation and effort, and can be either positive or negative. The reason is that, on the one hand, the manufacturer's effort and the formal incentives are substitute means of compensation, as with the informal compensation and the manufacturer's effort. On the other hand, contrary to the informal compensation, the likelihood that the formal reward is paid depends on the effort of the manufacturer, and there is thus an element of complementarity. The overall effect here is ambiguous. The third component is the interaction between the compensation role of the formal incentive and the monitoring role of the manufacturer's effort, and this is unambiguously positive. The higher the monitoring effectiveness, the more likely it is that the dealer will lose the continuation value when caught shirking. In total, as with the informal compensation, the relationship can thus be either positive or negative.

Summary: Despite the simplicity of the model, it still displays a rich set of interactions across the parameters of the model which we summarize in Table 1. The key predictions are: even if the

dealer's and the manufacturer's efforts are technological substitutes, they can be strategic complements in a repeated game where the efforts are supported by the value of the ongoing relationship instead of just the direct technological value of effort. Monetary compensation (both informal and formal) and the manufacturer's effort can be either complements or substitutes in motivating dealer effort. They are complements when the monitoring role of effort is high, while they can be substitutes when the primary role of the manufacturer's involvement is productive effort and thus indirect compensation through her effort. With respect to the informal compensation, it substitutes the manufacturer's effort when the latter's monitoring role is small enough. With respect to formal compensation, the two can still be substitutes or complements because an increase in the formal pay increases the indirect compensation role of manufacturer effort.

<insert Table 1 about here>

Therefore, on the one hand, views expressed in channel marketing correctly point out the complementary force of manufacturer effort on monetary compensation to motivate dealer effort (e.g., Wathne and Heide 2000; Lafontaine and Raynaud 2002). However, they neglect (i) its indirect compensation role and thus substitution with formal or informal compensation and (ii) the possibility of technological substitution between manufacturer and dealer effort as in the formal reward case. As such, effort and compensation become substitutes to motivate dealer effort if the latter two forces are strong enough. On the other hand, the efficiency wage theory views principal effort and monetary rewards are substitute instruments to motivate agent effort. This, however, ignores the complementary force of effort on both formal and informal compensation. Our results thus formally synthesize the different perspectives on how the manufacturer involvement and monetary compensation jointly influence dealer effort.

Repeated game - the manufacturer's incentive-compatibility constraint and the sustainability of the relational contract

Above, we focused only on how the dealer's effort choice is influenced by the contract offered by the manufacturer, without yet taking into account how the manufacturer's incentive-compatibility (IC) constraint may restrict the choice across the different motivational tools. In the empirical analysis below, we focus on the dealer's effort decision because the manufacturer faces a much richer challenge of managing relationships with multiple agents at once, and there is no clean way of modeling that interaction and institutional detail while maintaining the simple basic message that we are interested in. For concreteness, however, we provide here illustrative examples of the solution when the manufacturer is interacting with one representative dealer and they share the same discount rate.

For the manufacturer, her goal is to maximize the value of the relationship to herself (u_P), subject to the dealer's IC constraint – equation (1) – from the previous subsection and the manufacturer's own IC constraint, which requires that the promises of e_P and B are credible, as given by

$$(10) \qquad \left((1-\alpha)(e_A - be_Ae_P + de_P) - B - \frac{1}{2}e_P^2\right) \geq (1-\delta_P)u_P^{dev} + \delta_P u_P^{NE},$$

where u_P^{dev} is the maximal deviation payoff to the manufacturer from the optimal deviation to the dealer's effort e_A, as determined by the dealer's IC constraint re equation (1) on p.13. The manufacturer then maximizes the left-hand side of the expression subject to the constraint being satisfied. We denote the solution of the relational contract that maximizes the manufacturer's payoff u_P as $\left(\alpha^*, B^*, e_P^*, e_A^*\right)$. Obtaining more analytic results is cumbersome and we will instead illustrate some numeric examples of the basic themes of the results. These results are illustrated

in Figure 1, where in rows we vary the ease of detection of dealer effort as illustrated by the two different colored lines (dark and grey) in the technological relationship between manufacturer and dealer efforts: substitutes, independence, and complements.

<insert Figure 1 about here>

The basic themes are as follows.

i. The dealer's effort and expected total compensation are increasing in the patience of the players. As the dealer becomes more patient, the more he values the surplus that he can earn in the relationship and thus the more willing he becomes to exert the requested level of effort. The compensation, in turn, is then increased to compensate for this increased effort.

ii. As the players become more patient, there is a general pattern of substitution away from the formal compensation towards the informal bonus. This result follows for two reasons. First, unlike the formal component of the compensation, the informal bonus is not subject to potential gaming by the dealer. This makes informal compensation generally preferred. Second, the informal bonus is effective, however, only when (i) it is credible for the manufacturer to pay it and (ii) the probability of detecting a deviation and thus its motivational effect is sufficiently high. This is also the reason that, when the detection probability is low (dark lines with larger values of γ and $\underline{p}$), the manufacturer again prefers formal compensation when the players are highly patient and so the risk of gaming for the formal compensation is limited.

iii. Most importantly, the equilibrium manufacturer effort level depends on the underlying effort technology in the sales function. When the efforts are technologically independent or complements (2nd and 3rd row graphs), the manufacturer effort is generally increasing,

until the parties become sufficiently patient so that the monitoring role is reduced as the dealer will be willing to supply effort even under limited monitoring. In the case of substitute efforts, however, the manufacturer effort displays a pronounced S-shape, with the effort initially decreasing, then increasing while finally decreasing again. The reason for the initial decrease in effort is two-fold. First, when the two efforts are technological substitutes, additional effort by the manufacturer is directly demotivating to the dealer. Going back to equation (6) and its three underlying effects, the first effect (technological substitutability) dominates for low patience levels and it is optimal to scale back effort to motivate the dealer, until the other two effects (indirect compensation and monitoring) come to dominate for higher patience levels. Second, from equation (9), the relationship between formal compensation and manufacturer effort is ambiguous. Indeed, around the equilibrium (for low discount rates), the two are substitutes and so initially the optimal means of providing net value in the relationship is by increasing formal compensation and decreasing manufacturer effort. Thus, the dealer is initially encouraged to work harder through monetary means with a reduction in manufacturer effort, while later through the use of both monetary compensation and manufacturer involvement.[7]

Empirical Implications

The admitted challenge for our empirical illustration of the framework is that we only observe equilibrium outcomes and only in a cross-section of the data (see the next two sections for details on data and institutional context), which may confound the determinants behind a dealer's choice in terms of the discussion earlier and differences in the equilibrium outcomes. We would like to mention three issues here. First, to relate the model to our data, the data contains no variation in

[7] The second effect is also the reason why, in the other two cases, there is also a little dip in the manufacturer effort before increasing. This is matched by an increase in formal compensation when we increase the parties' patience around the origin.

the formal incentives offered, and thus we cannot identify any substitution between formal and informal compensation. The other comparative statics and patterns, however, continue to analytically hold for a given level of formal compensation.[8]

Second, when estimating the theoretical implications of the model, it is not clear whether we are identifying variations around the equilibrium for the dealer's effort constraint (p.12-18) or whether we are identifying variation in the equilibrium pattern, as captured by the patience of the dyad when the manufacturer's constraint is also considered (pp.19-21). To that end, Figure 1 overlays the sign of the relations between dealer and manufacturer efforts around the particular equilibrium. For technologically independent or complementary efforts, additional effort by the manufacturer always increases the motivation of the dealer and hence they are strategic complements. For technological substitutes, however, the relationship is negative for very low patience levels while being positive for higher patience levels. In other words, the marginal effect of manufacturer effort is negative roughly when the empirical correlation is negative, while being positive when the cross-sectional correlation is positive. The logic for this result is that the equilibrium outcome is, in the end, driven by the impact of manufacturer effort on the dealer, as discussed above. For very low patience levels, the direct technological effect dominates and the efforts are strategic substitutes, while for higher patience levels, the indirect compensation and monitoring effects become more prominent in the dealer's first-order condition and the efforts become strategic complements.

Further, unreported in Figure 1, the interaction between manufacturer effort and informal bonus in motivating the dealer, $\frac{\partial^2 e_A}{\partial \tilde{B} \partial e_P}$, is always positive for the given parameters. If, however, we made monitoring effectiveness even higher so that the monitoring role of effort becomes

[8] Illustrations are available from the authors on request.

smaller, then $\frac{\partial^2 e_A}{\partial \tilde{B} \partial e_P}$ would be negative.[9] While in the estimation we control for much observable heterogeneity in an attempt to identify the effect on a given dealer's effort, in the end we cannot control for all unobserved heterogeneity and so we cannot conclusively say which feature of the model the data captures. However, if we succeed in identifying any meaningful and consistent correlations and patterns in the data in terms of a differential impact of manufacturer effort on the dealer effort and its potential interaction with the level of informal bonus, the results may be suggestive that relational governance matters in the setting and that, depending on the particulars of the relationship, differential use of the governance instruments is warranted.

INSTITUTIONAL CONTEXT

In this section, we briefly describe the key institutional features of distribution in China, and provide details on the structure of the manufacturer's dealerships and sales arrangements. A proprietary data set collected from a leading manufacturer of a major computer product, Computec[10], will be used to illustrate some of the comparative statics identified in our formal model above.

Distribution in China

The business, legal, and social environment in China offers an ideal setting to test a manufacturer's usage of effort and economic rewards on its dealers. The under-developed

[9] As we see in the next section, the case of high monitoring effectiveness might not be applicable to China at the time we collected our data. It is because the vast and dynamic market impeded with under-developed infrastructure made monitoring challenging to many manufacturers. This may also explain why our focal manufacturer emphasized the importance of monitoring to its sales managers. Separately, $\frac{\partial^2 e_A}{\partial e_P \partial \alpha}$ is generally negative in our analytical model except for high patience levels, but we are unable to test this effect in the data because of no variation in formal compensation, α.

[10] To preserve confidentiality, we use the acronym Computec as the company name.

infrastructure in many parts of the country and resulting fragmented distribution systems are major challenges for manufacturers at the time when we collected our data (Knowledge at Wharton 2006). This implies that establishing a vertically integrated channel *de novo* is very expensive; instead, manufacturers seek out potential dealers and attempt to retain those who are able and willing. For instance, Computec actively selects and designates dealers who, in addition to keeping inventory and re-selling its product, can undertake various marketing activities to promote the product. In addition, the physical size of the country, combined with fragmented access to local dealers, makes verifying and hence formally contracting on dealer activities challenging. This is compounded by an inefficient and costly judicial system that makes contract enforcement more than difficult (Djankov et al. 2003). The implication is that manufacturers may not write, and legally enforce, contracts that pre-specify activity levels and impose penalties for non-compliance (Zhou and Poppo 2010). Instead, they have to design simple, implementable arrangements that motivate dealers to put forth marketing effort. In other words, informal rewards and monitoring through manufacturers' involvement would be important aspects of channel governance.

Computec's Distribution Arrangements

At the time (year 2005-6) when we collected the data, Computec had been the market leader of a key computer accessory sold exclusively in China for several years. It sells its product in a CD form through sixty independent dealerships. Dealerships do not involve formal vertical restraints such as exclusive dealing or territorial restrictions. These dealers resell the merchandise to both small local retail outlets and/or consumers. The manufacturer assigns dedicated regional sales managers ("sales managers" hereafter) across its eight sales regions, each of whom has several subordinates, to work with the authorized dealers in their region.

Computec uses a simple quarterly 2-stage process to sell its product to its dealers (Lo and Salant 2016). The first stage of each sales quarter constitutes the preordering stage that lasts two to five days. Dealers place orders and pay in full. As formal compensation, the manufacturer offers a 5-yuan upfront price discount (or $0.71 at the exchange rate at the time) from its list wholesale price ("list price") of 95 yuan (or $13.57).

In the second stage that spans the rest of the quarter, the manufacturer's sales managers work jointly with its dealers to generate downstream sales. After the completion of the sale cycle, a number of *free units* plus occasional marketing allowances may be offered to a dealer only if the manufacturer did not detect any mis-behavior or non-collaborative activities. Since dealers always resell the free units and such reward – together with marketing allowances – is neither written nor disclosed about how it is calculated, we view them as equivalent to a back-end informal, subjective bonus. Finally, dealers cannot negotiate the terms of trade ex ante or ex post. We enclose a translated sample of the manufacturer's sales announcement in the web Appendix.

While company executives motivate dealers' provision of effort through economic rewards, their dedicated sales managers – together with their subordinates – also spend effort such as customer development to work with their dealers. The manufacturer's top management determines the levels of formal and informal compensation, yet the sales managers have significant discretion to customize his involvement with individual dealerships in his region. The primary purpose of the manager's effort is to enable the effectiveness of dealers' marketing effort since it is crucial to maintain the competitiveness of the focal brand. Our interviews revealed that dealers appreciate the support, guidance, training, and information provided by the manufacturer. Dealers also benefit by being associated with a nationally recognized brand, gaining technical and marketing expertise, and receiving inputs and incidental allowances for

their effort. In short, the manufacturer effort is directly productive and increases the value of the relationship to the dealer, but it is a priori unclear whether such effort functions as a technological complement or substitute with dealer effort in the generation of downstream sales.

At the same time, dealers may have their own incentives, in addition to what the manufacturer desires. For instance, a non-exclusive distribution arrangement often faces the challenge of externalities in price and services and the resulting channel conflicts (Mathewson and Winter 1984). From the manufacturer's point-of-view, a dealer's free-riding on others' effort to get customers is easier to detect upon close monitoring. This ensures that dealer effort will benefit the brand as a whole, and in the long run, rather than the narrow self-interest a dealer may pursue. Dealers understand that if the manufacturer detects non-cooperative activities, the dealer might not receive any free units or allowances. Serious cases may lead to suspension or termination of authorized dealership. [11]

DATA AND EMPIRICAL METHOD

We use a combination of archival and survey data in our analysis. First, the manufacturer provided us access to proprietary archival data regarding its list price, price discount, free units, and marketing allowances transferred to dealers. These archival data were collected on site at the firm's Beijing headquarters and cover transactions from December 2004 to November 2005, a total of four sales cycles. We aggregated these data to the yearly level.[12] The data on dealer characteristics are measured as if they were the same throughout the year. In particular, dealer and manufacturer efforts are measured in number of working hours per month. Informal

[11] The manufacturer did carry out this threat during the time of our collected data. For instance, one large dealership in the Beijing region which was caught shirking of pre-agreed market effort in the first quarter of the year was deprived of his subjective bonus for that quarter and was further suspended his dealership in the second quarter as a penalty.

[12] To maintain confidentiality, we cannot disclose the exact number of free units. We nonetheless use this information to calculate the amount of informal compensation.

compensation is calculated by summing up the market value of the free units and promotional allowances. Since the manufacturer kept the upfront discount constant, there is no variation in formal compensation per unit. As such, it does not enter our regression analysis. Economic indicators from government publications are only available on annual basis.

Data

In this subsection, we describe our data. Table 2 shows our variables and measures and their descriptive statistics. Table 3 shows their pairwise correlations.

<Insert Tables 2 & 3 about here>

- *Price. List price*: 95 yuan ($13.57). The list price is the standard price that a dealer pays when there is no promotions or when it supplements its preorders. This price remains the same throughout the period of our data. *Preordering price:* 90 yuan ($12.86). This discounted price remains the same for all dealers throughout the period covered in our data.
- *Informal compensation*. We measure dealers' informal compensation by combining two components: (1) estimated market value of back-end free units and (2) the actual allowances transferred from the manufacturer. Since the list wholesale price is 95 yuan, and to be conservative, we assume that is the market value.

We obtained further data through a survey instrument administered to the manufacturer's sales managers. We developed the questionnaire after several onsite interviews with the national sales director and two of his sales managers. These interviews provided us with a detailed description of the institutional context of the industry, competitive landscape, business practices, distribution-related issues, contracting arrangements, and dealership characteristics. Sales managers at the manufacturer work very closely (on a daily basis via telephone and instant messaging systems, in addition to occasional travels if the dealer is located in a different city)

with their dealers and hence are reliable informants. These managers were asked to report their assessment regarding a variety of dealer-level characteristics as follows:

- *Manufacturer effort* is measured as the number of hours per month that the responsible sales manager spends with each dealership – often its owner or person-in-charge – on the following four marketing activities: (i) customer training, (ii) point-of-purchase, displays and materials handling, (iii) organizing customer conferences, and (iv) customer relationship building.
- *Dealer effort* measures a dealer's marketing effort in number of hours per month. This is estimated by sales managers based on the amount of time his counterpart at the dealership (usually the owner or the general manager of these small-to-medium size companies) spends on the following four Computec-focused marketing activities: (i) customer training, education, and information provision, (ii) point-of-purchase displays and materials management and delivery, (iii) organizing customer conferences, and (iv) customer relationship building.
- *Size* of the dealership is measured by the total number of employees involved in sales, marketing, and technical support. These three categories of employees directly drive business for Computec's product and make up the bulk of a dealership's headcount.

In addition to these main variables, we include the following dealership characteristics in our empirical analysis:

- *Tenure* with Computec refers to the number of years a dealership has been authorized as a Computec dealership.
- *Share of manufacturer business* is the share of the dealership's sales in the previous year that is accounted for by Computec's product. This variable captures the dependency of the dealership on the manufacturer.

- *Distance to manufacturer's headquarters* refers to the physical distance (measured in thousands of miles) of the dealership's main office from the Computec's regional headquarters where the manufacturer's sales manager locates. The manufacturer has three regional headquarters – Beijing, Shanghai, and Guangzhou. This variable controls for the difficulty of spending effort with the dealer by the manufacturer (Kalnins and Lafontaine 2013).
- *Number of competing dealers* measures intra-brand competition by counting the number of Computec dealers, except self, located in the same city.
- *Financial capability*: This 7-point single-item scale rates each dealer's financial strength in terms of cash flow and reserves. Sales managers informed us that they prefer working with dealers with strong finances as those dealers make payments on time, invest in their businesses, and are more likely to stay in business.
- *Number of stores* measures how many retail outlets are under the dealer's operation, which distinguishes dealers who may instead focus on wholesale business.

To further control for the characteristics of local markets where a dealership is located, we collected provincial-level (or its equivalent) economic data of 2004 and 2005 from various China Provincial Statistics Yearbooks (2005, 2006) published by the National Statistics Bureau. We obtained data on *Disposable income per capita* (in thousand US dollars) and year-on-year *Income growth* (2005-over-2004, in percentage points).[13] Each Yearbook reports data for the year preceding its publication date.

Empirical Specifications and Results

In this sub-section, we describe how we use our cross-sectional data to illustrate our main

[13] Beijing and Shanghai municipalities, or direct-controlled municipalities (in Chinese: 直辖市), have the same administrative hierarchy as that of provinces since they are also directly administered by the central government. Therefore, these two cities' demographic and economic indicators are equivalent to those at the provincial level.

propositions on the effect of the manufacturer's effort, informal compensation, and their interactions on dealer effort. We use the following regression in our main analysis:

$$(*) \qquad \begin{aligned} \textit{Dealer effort}_i = {} & \alpha_1 \textit{Manufacturer effort}_i + \alpha_2 \textit{Informal compensation}_i \\ & + \beta(\textit{Manufacturer effort}_i \times \textit{Informal compensation}_i) + \gamma X_i + \varepsilon_i, \end{aligned}$$

where X_i is a vector of the control variables on firm and market characteristics for dealer i, i = 1, 2, …, 60. Notably, the coefficient β in front of the interaction term between *Manufacturer effort* and *Informal compensation* in (*) is our main parameter of interests because its sign determines whether the two are complementary or not to motivate dealer effort. Nevertheless, we omit the interaction term in some regressions so the sign of the coefficient in that analysis in front of *Manufacturer effort* or *Informal compensation* denotes the marginal effect, that is, whether the variable is a strategic complement or substitute with dealer effort. Our regressions use OLS and aim to show correlations. Recall that we cannot analyze the role of formal compensation and its interactions with other instruments because the upfront unit discount was the same for all dealers throughout the year.

As a preview to the relationship between dealer effort and various firm and market characteristics, we use the median value of *Dealer effort* (= 40 hours per month) to separate dealerships into those with high (≥ 40 hours per month) versus those with low (< 40 hours per month) and compare their key characteristics in Table 4. The results show that dealers who earn more informal compensation and receive more effort exerted by the manufacturer are associated with higher downstream effort. Those who do more of their business with the manufacturer, are perceived to have stronger financial capability, and situated in less developed regions also show greater effort. The last observation is consistent with sales managers' claims that the manufacturer particularly values dealers' marketing effort at peripheral regions where growth on computer-related products is anticipated in the near future.

We further split the data by median values of *Manufacturer effort* (= 43.6) and *Informal compensation* (= 0.277) and arrange the high-low values in a 2x2 format in Table 5. First, the total number of dealers in the diagonal cells is twice of that in the off-diagonal. Second, average dealer effort is the lowest in the low-low cell while the highest in the high-high cell. Known as the model-free correlation method of examining complementarity (Brynjolfsson and Milgrom 2012), these observations show that the two instruments are complements instead of being substitutes.

<Insert Table 4 and Table 5 about here>

Table 6 reports four OLS regressions in which dealer effort is the outcome variable. Column 1 includes the manufacturer's effort, informal compensation, and control variables as regressors. Column 2 includes the fixed effects of eight regions per Computec's sales territorial design. Since sales managers are assigned by region, these fixed effects control for unobserved heterogeneity such as region-specific sales and management style and marketing practices, in addition to geographic and demographic factors. Columns 3 and 4 replicate the previous two columns but include the interaction term of *Manufacturer effort* and *Informal compensation*.

The results across the four columns in Table 6 are consistent. First, the direct effect of *Informal compensation* in columns 1 and 2 is positive and statistically significant. The coefficients of *Manufacturer effort* are negative but large standard errors render them not statistically significant. Nevertheless, its magnitude increases by more than three folds after controlling for regional dummies which capture unobserved regional and managerial heterogeneity. When we include the interaction term between the manufacturer's effort and informal bonus in columns 3 and 4, the coefficient on *Informal compensation* becomes negative but not statistically significant, and that of *Manufacturer's effort* changes to be negative and

significant. However, the marginal effects at the mean of those two key variables, shown at the bottom of Table 6, remain consistent across the four models. That is, *Informal compensation* is highly positively correlated with downstream effort and the negative effect of *Manufacturer effort* turns out to be very small and statistically not different from zero.[14] The positive coefficient on *Informal compensation* matches our theoretical prediction in equation (5) on p.14. For the role of *Manufacturer effort*, recall that the effect of manufacturer effort in equation (6) was analytically composed of one positive or negative term (technological complementarity or substitutability) and two positive terms (indirect reward and manufacturer monitoring). The null results thus suggest that the manufacturer and dealer efforts are technological substitutes and that, at the mean, the positive and negative effects roughly cancel each other out.

<Insert Table 6 about here>

Importantly, the coefficients of the interaction terms between *Manufacturer effort* and *Informal compensation* in both columns 3 and 4 are positive and highly significant. This is consistent with the model-free evidence in Table 5 and with the notion that the two instruments are complementary to generate downstream dealer effort.[15] Corresponding to the comparative statics on their interaction shown in equation (8) on p.16, this novel piece of evidence shows that the interaction between the compensation role of effort and informal reward is dominated by the interaction between the monitoring role of effort and informal compensation. Let us also

[14] The marginal effects of *Manufacturer effort* and *Informal compensation* equal their coefficients (α_1 and α_2) – or the main effects – in rows 1 and 2 respectively when there is no interaction term in columns 1 and 2. To calculate the marginal effect of *Manufacturer effort* at the mean of *Informal compensation* in columns 3 and 4, we use the following formula: $\frac{\partial Dealer\ effort}{\partial Informal\ compensattion} = \alpha_1 + \beta * (\text{the mean value of } Manufacturer\ effort)$. The marginal effect of *Manufacturer effort* is estimated similarly.

[15] Quantile regressions, which are subject less to the effect of outliers, are quantitatively similar to the OLS results. In particular, results of the 0.25- and 0.50- quantiles show positive coefficients ($p<0.10$) of the interaction term between *Manufacturer effort* and *Informal compensation* while the coefficient obtained from 0.75-quantile is also positive but not statistically significant ($p=0.19$). These results can be obtained upon request.

interpret its economic significance. For instance, the magnitude of the interaction terms is 0.229 in column 3, which means that an additional hour of the manufacturer's effort boosts the marginal incentives of informal bonus (per thousands of dollars) on dealer effort by about 0.229 hour per thousand US dollars. In other words, an additional hour of the manufacturer's effort on a typical dealer increases its effort level each month by about 0.202 hour (≈0.229×0.880, where 0.880 is the mean of *Informal compensation*).

It is particularly interesting to interpret the results of the complementarity of manufacturer effort and informal compensation *together* with the primary effect of the former. When informal bonus is small, the negative – or the technological substitution – effect of the manufacturer's effort dominates. However, when the manufacturer offers high informal bonus, then our data are consistent with the idea that its effort reinforces the informal bonus to *synergistically* motivate dealer effort. This matches to what we found during our interviews: several sales managers said that they are often intensively involved with those dealers who typically would receive high compensation in order to justify those monetary rewards. All in all, this is a new and nuanced finding in vertical relations and channel management.

As for other independent variables, we find that the more important Computec's business is to a dealer, the more marketing effort it expends. Although the result weakens after controlling for regional fixed effects, this shows that dependence on the manufacturer correlates with effort provision at the downstream. Dealerships with higher *Financial Capability* run their business better and may have a stronger foundation for future growth. Consistent with this, our data show that financial strength correlates with a higher level of dealer effort. As one would expect, intra-brand competition reduces dealer effort, probably due to the standard free-riding concerns

(Mathewson and Winter 1984). Furthermore, the effect of dealer size, number of operating retail outlets, and tenure are all statistically insignificant.

As informed by industry practitioners and company executives, peripheral regions are important and strategic markets where future growth lies. Indeed, the evidence in columns 1 and 3 shows that dealers located in provinces with higher growth rate in personal disposable income spend more effort. The results on the distance to the manufacturer's regional headquarters imply that dealerships in peripheral markets engage in more effort which further confirms the attractiveness of the emerging regional markets.

To check for robustness of these results, we examine whether the more relational a relationship becomes, the stronger the results are on the effect of effort and informal compensation, as our theory would predict. To proxy for the importance of the relationship, we consider three variables. First, *Financial capability* correlates with the likelihood that the dealer stays in business and thus the effective discount rate applied to the relationship. Second, the *Share of manufacturer business* is a good proxy for potential loss from deviation; that is, the reduction of surplus from being an authorized dealership to the value of the outside option if terminated. Third, *Tenure*, by measuring the length of past interaction, may predict the expectation of future interaction.

We median split those three variables into high and low values and rerun the analysis as in Model 3 of Table 6.[16] Notably, the results shown in Table 7 on the High-value subsamples of *Share of manufacturer business* and *Financial capability* in columns (1) and (2) are qualitatively similar whereas the coefficients of the three main variables of the Low-value subsamples in columns (1') and (2') are statistically not different from zero. The main results in columns (3)

[16] Since each set of the split sample has only about 30 dealers, we exclude eight regional dummies from this analysis to economize on the degree of freedom.

and (3') on *Tenure* are, nonetheless, opposite: those of the *short-tenured* instead of the long-tenured subsamples are qualitatively similar to the previous results. One may rationalize this intriguing result by arguing that length of past relationship may not be a good indicator of future interactions, especially when the market is in its early adoption stage. In fact, newly authorized dealerships must go through a rigorous selection process and hence typically are the ones that the focal manufacturer intensively cultivates, hoping to develop them into their key partners. This would be particularly true in fast-growing peripheral regions. [17]

<Insert Table 7 about here>

In sum, our data suggests that the informal compensation received by dealers affects their effort provision. The manufacturer's effort seems to have little effect at the mean, but it is effective when combined with large enough informal rewards because of their complementarity in inducing dealer effort. Our results also imply that even though manufacturer and dealer efforts may be technological substitutes, manufacturer effort and informal bonus are complementary instruments to motivate dealer effort. Finally, these results appear to hold only under high relational contexts: when dealers are more likely to stay in business, be cooperative, or have growth potentials.

CONCLUSION

We have examined how a manufacturer optimally motivates her dealer to supply effort through the combination of monetary incentives, both formal and informal, and her own involvement with the dealer. The insights from the framework are threefold. First, the analysis identifies three interrelated roles for manufacturer effort. First, such effort can be directly productive either as a technological substitute or a complement to dealer effort in the sales function. It can complement

[17] Indeed, *Tenure* has a mild and negative correlation with *Distance to manufacturer's HQs* (ρ = -0.16), *Share of manufacturer business* (ρ = -0.18), and *Provincial income growth* (ρ = -0.14).

the dealer effort if it allows the dealer to perform his tasks more effectively, for example by providing training and information, or it can substitute for dealer effort if it provides direct selling and marketing activities and the like, which makes it easier for the dealer to complete sales even in the absence of his own effort. If the parties focus on spot contracting with no attempts to build an ongoing relationship, this is the only effect and the relationship of manufacturer effort with monetary compensation is determined by this technological relationship. If the dealer and manufacturer efforts are substitutes, then increased managerial effort also lowers the efficiency of formal incentives by lowering the marginal return to effort and vice versa.

If the parties attempt to build a relational contract by utilizing the ongoing nature of the relationship, manufacturer effort gains two additional roles. First, it becomes an additional avenue of compensation: higher manufacturer effort increases the likelihood of high sales and thus the reward that the dealer will receive through his formal compensation. Second, it will perform a monitoring role that helps the manufacturer to keep track of whether the dealer is adhering to the informal part of their agreement. The dealer's objective function also changes. Instead of simply being motivated by the *marginal* return to effort, he is now incentivized by the *level* of rents that he can receive as a part of the relationship. This change in the objectives fundamentally changes the interaction among the manufacturer's governance instruments. In addition to the effect on the marginal value of dealer effort, the monitoring role of manufacturer effort now *complements* both formal and informal incentives by increasing the likelihood of detecting misbehavior and thus the elimination of the rents provided as a motivational tool. This effect is analogous to the logic underlying the efficiency wage theory, except that it highlights that better monitoring allows for higher equilibrium effort levels and thus complements instead

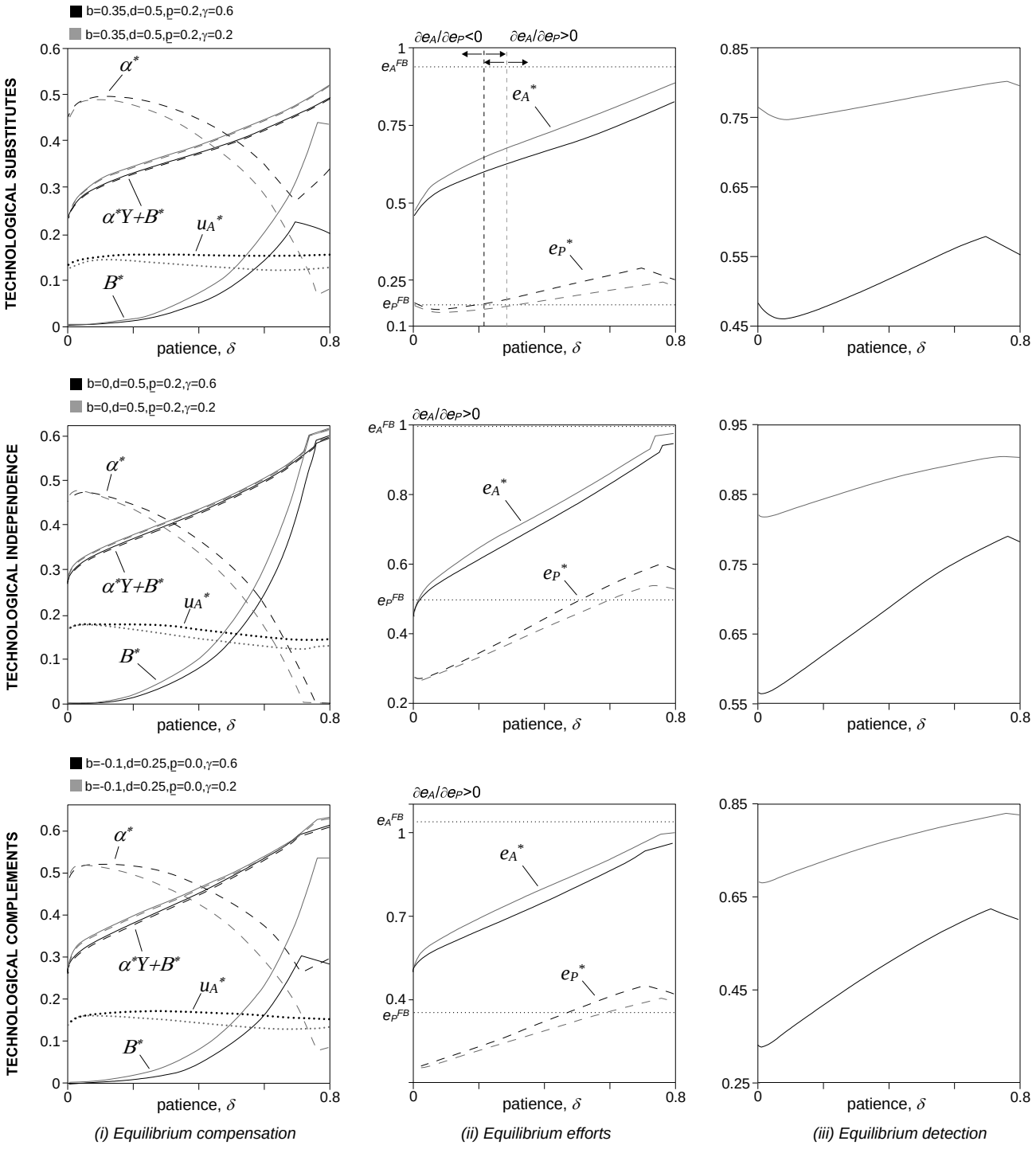
of substitutes for monetary incentives. Further, as an additional channel of rewards for the dealer, manufacturer effort is a *substitute* to informal rewards while either complementing or substituting for formal incentives (since higher manufacturer effort provides rewards through the formal component).

As a result, if the primary purpose of manufacturer effort is monitoring, informal rewards and manufacturer effort become complementary tools for motivating the dealer even if the efforts are technological substitutes, while they remain as substitutes if the primary role is to provide an additional channel of compensation. Further, because of these interactions, the manufacturer and dealer efforts can now be either strategic substitutes or complements, depending on the patience level of the parties, while the dealer effort continues to be increasing in both formal and informal compensation offered. In sum, our model provides novel managerial guidelines to manufacturers on how they should judiciously involve their effort with dealers, depending on both the level and types of economic reward and the main roles of their downstream involvement.

We empirically illustrate some of the above comparative statics in the channel context of a major manufacturer of computer software in China. We show that (i) the informal, subjective compensation offered to the dealers is positively correlated with the dealer's effort, and that (ii) informal compensation and manufacturer effort are complementary tools for motivating the dealer. In particular, the manufacturer effort is (weakly) negatively correlated with dealer effort when the informal compensation is low, while having roughly zero effect when evaluated at the mean levels. This result underscores the tension between its role as a technological substitute and as a complementary governance instrument in relational contracting.

Like other studies, ours has its own limitations. First, we urge readers to be a bit cautious to interpret our empirical results due to the usage of cross-sectional data obtained from a single manufacturer source. Through various analyses, we have tried to establish robust and meaningful correlations on the effect of manufacturer effort – and its interaction with informal bonus – on dealer effort, yet we cannot conclusively say whether our results identify the variations around the equilibrium under dealers' constraints or around the full equilibrium when the manufacturer's constraints are also considered. Second, our data do not offer variations in formal compensation and thus we are unable to analyze any of its effects. A fruitful avenue to fully test our model is then to have more comprehensive data, preferably longitudinal or experimental ones, so that one could establish causality between the governance instruments and channel outcomes such as effort, sales, and profitability. Lastly, based on the institutional setting where our dominant market leader manages a number of relatively small dealerships and for parsimonious reasons, our analytical model only examines a dyad between a manufacturer and a representative dealer. Future work should try to extend this to channel settings where multiple parties are involved in relational contracting where standardized contracts and legal enforcement may also matter and interact with the relational elements we studied (Zanarone, Lo, and Madsen 2016, pp.2109-2110). Nevertheless, our study has clarified the main functions of the triple instruments and identified the intricate conditions that determine their optimal level and effect on the downstream. We hope that our analyses will provide a useful lens for academics to rigorously analyze channel governance issues and for companies to judiciously structure and manage their governance systems.

FIGURE 1: MANUFACTURER'S PREFERRED (α, B, e_P, e_A) AS A FUNCTION OF THE DISCOUNT RATE



Notes: The Figure plots the solution to the manufacturer's problem of maximizing u_P over (α, B, e_P, e_A) subject to equations (1) and (10), as a function of the patience of the two parties. Black and grey lines denote high and low detection probabilities respectively. The first column plots the decomposition of the optimal dealer compensation together with equilibrium dealer profit. The second column plots the equilibrium effort levels of the dealer and the manufacturer, whether the two efforts are strategic complements or substitutes around the particular equilibrium point (equation (6)), and the effort levels that would maximize the joint surplus, e_i^{FB} (when monitoring is not needed). Finally, the third column plots the equilibrium detection probability for malfeasance.

TABLE 1: THE ROLE OF MANUFACTURER EFFORT IN THE REPEATED GAME (RELATIONAL CONTRACT): Key analytical results under dealer's incentive-compatibility constraint for e_A

Comparative Statics		Sign	Relation	Role of manufacturer effort in repeated game		
				Technology in the sales function (Relation of manufacturer and dealer efforts)	Governance in the relational contract (Effect of manufacturer effort in relational contract)	
				Technological substitutes (b>0) or technological complements (b≤0)	Indirect compensation	Monitoring
1	$\frac{\partial e_A}{\partial \alpha}$	>0	(e_A,α): strategic complements	b>0 & b≤0	not applicable	not applicable
2	$\frac{\partial \boldsymbol{e_A}}{\partial \tilde{\boldsymbol{B}}}$	**>0**	**(e_A,B): strategic complements**	b>0 & b≤0	not applicable	not applicable
3	$\frac{\partial \boldsymbol{e_A}}{\partial \boldsymbol{e_P}}$	**>0**	**(e_A,e_P): strategic complements**	b≤0	>0 (as indirect compensation)	>0 (behavior enforcement)
		>=<0	**(e_A,e_P): ambiguous**	b>0		
4	$\frac{\partial^2 e_A}{\partial \tilde{B} \partial \alpha}$	<0	(B,α): substitutes	b>0 & b≤0	not applicable	not applicable
5	$\frac{\partial^2 \boldsymbol{e_A}}{\partial \tilde{\boldsymbol{B}} \partial \boldsymbol{e_P}}$	**>=<0**	**(B,e_P): ambiguous**	b>0 & b≤0	<0 (substitutes compensation)	>0 (behavior enforcement)
6	$\frac{\partial^2 e_A}{\partial \alpha \partial e_P}$	>=<0	(e_P,α): ambiguous	b>0 & b≤0	>=< 0 because: (i) <0 (substitutes compensation) & (ii) >0 (as indirect compensation)	>0 (behavior enforcement)

Notes: (i) The exact range of b is $0 \leq |b| < d$. (ii) $\tilde{B} = B / \delta_A$ is the normalized informal reward. (iii) Results in bold are empirically illustrated in our data.

TABLE 2: MEASURES AND DESCRIPTIVE STATISTICS

Variable	Measure	Mean	S.D.	Min.	Max.
List price	The standard, undiscounted price, in USD, that a dealer pays for orders in non-promotional periods; constant over the year	13.57	0	13.57	13.57
Formal discounted price	Written discounted price, in USD, during promotional periods; constant over the year	12.86	0	12.86	12.86
Dealer effort	Total number of hours per month the dealership spent on four non-contractible marketing activities: customer training, education, and information provision; POP displays and materials management and delivery; organizing customer conferences; and customer relationship building	40.583	24.401	0	112
Manufacturer effort	Total number of hours per month the manufacturer's account manager spent on four non-contractible marketing activities: customer training, education, and information provision; POP displays and materials management and delivery; organizing customer conferences; customer relationship building	55.942	42.667	2.400	192
Informal compensation	Total cash value of back-end free units and marketing-expense allowances offered to the dealership (averaged in 1000s of USD per month)	0.632	0.936	0.008	4.966
Tenure	Number of years served as an authorized dealership	3.625	2.513	0.200	10
Dealership size	Total number of employees on sales, marketing, and technical support	11.850	12.528	2	60
Share of manufacturer business	Percentage points of the dealer's sales in the previous year that was accounted for by the sale of the manufacturer product	22.903	20.531	1	100
Number of stores	Number of retail shops the dealership operates	2.067	3.209	0	20
Number of competing dealers	Number of the manufacturer's authorized dealerships (excluding self) located in the same city	2.967	2.828	0	9
Financial capability	Rated by the manufacturer's regional manager on the dealership's financial strength in cash flow, reserves, and on time payments (single item, 1-7 scale)	4.133	1.467	1	7
Distance to manufacturer's headquarters	Geographical distance, in thousands of miles, of the dealership's main office from the manufacturer's regional headquarters where the corresponding regional manager is located	0.488	0.559	0	2.341
Provincial-level personal disposable income	Personal disposable income, in 1000s of USD, of the province (or direct-controlled municipality) where the dealership is located	1.605	0.514	1.069	2.490
Provincial-level income growth	Growth rate, in percentage points, of personal disposable income of the province (or direct-controlled municipality) where the dealership is located	10.747	1.390	7.780	13.310

TABLE 3: CORRELATIONS TABLE

	1	2	3	4	5	6	7	8	9	10	11	12
1. *Dealer effort*	-											
2. *Manufacturer effort*	0.280*	-										
3. *Informal compensation*	0.396*	0.222*	-									
4. *Dealership size*	-0.056	-0.030	0.204	-								
5. *Tenure*	0.032	0.112	0.194	0.422*	-							
6. *Share of manufacturer business*	0.285*	0.095	0.130	-0.184	-0.155	-						
7. *No. of competing dealers*	-0.185	-0.127	0.175	-0.123	0.036	0.301*	-					
8. *No. of stores*	0.007	-0.074	0.217*	0.115	0.385*	0.086	0.122	-				
9. *Financial capability*	0.408*	0.402*	0.327*	-0.064	0.110	-0.069	-0.211	0.185	-			
10. *Distance to manufacturer's HQs*	0.231*	0.115	-0.134	-0.245*	-0.148	-0.039	-0.365*	-0.114	0.055	-		
11. *Disposable income*	-0.172	-0.139	0.280*	0.036	0.141	0.198	0.740*	0.245*	-0.106	-0.620*	-	
12. *Income growth*	0.029	-0.017	-0.135	0.030	-0.142	0.262*	0.262*	-0.051	-0.107	-0.447*	0.091	-

Number of observations: 60. * Significant at 0.10.

TABLE 4: COMPARISON BY MEDIAN SPLIT OF DEALER EFFORT

	(1) High Dealer Effort (≥ 40 hours/month; n=31)	(2) Low Dealer Effort (<40 hours/month; n=29)	Student t-Test (1) vs. (2)
Manufacturer effort (hours/month)	66.713	44.428	(1) > (2) **
Informal compensation ('000 US$/month)	0.880	0.366	(1) > (2) **
Share of manufacturer business (%)	27.119	18.397	(1) > (2) *
Size of Dealer	10.290	13.517	(1) = (2)
Tenure (year)	3.903	3.328	(1) = (2)
Number of competing dealers	2.548	3.414	(1) = (2)
Distance to manufacturer's HQs ('000 miles)	0.595	0.425	(1) = (2)
Number of retail outlets	2.258	1.862	(1) = (2)
Financial capability (1-7 single-item scale)	4.806	3.414	(1) > (2) ***
Provincial-level personal disposable income ('000US$/year)	1.512	1.705	(1) < (2) *
Provincial-level income growth (%)	10.882	10.603	(1) = (2)

Two-sample t-test: * p < 0.10; **p < 0.05; ***p < 0.01.

TABLE 5: MANUFACTURER EFFORT BY INFORMAL COMPENSATION: Distribution of Dealers and Averages of Their Key Characteristics

		Manufacturer effort	
		Low	High
Informal compensation	Low	**N = 20** **Dealer effort = 29.88 hours** Tenure = 3.15 years Size = 12.55 Share of mfg. biz = 15.8% Financial capability = 3.5 No. of outlets = 1.5 Intra-brand competitors = 2.8	**N= 10** **Dealer effort = 39.55 hours** Tenure = 3.5 years Size = 7.7 Share of mfg. biz = 30.7% Financial capability = 4.1 No. of outlets = 1.3 Intra-brand competitors = 2.54
	High	**N = 10** **Dealer effort = 39.68 hours** Tenure = 4.2 years Size = 10.8 Share of mfg. biz = 28.47% Financial capability = 4 No. of outlets = 4.5 Intra-brand competitors = 3.65	**N = 20** **Dealer effort = 52.26 hours** Tenure = 3.88 years Size = 13.75 Share of mfg. biz = 19.02% Financial capability = 4.85 No. of outlets = 1.8 Intra-brand competitors = 2.33

High and Low are defined by median splits. N denotes for number of observations. Summary statistics are means.

TABLE 6: EFFECT OF MANUFACTURER EFFORT AND INFORMAL COMPENSATION: FULL SAMPLE

Dependent variable: *Dealer effort*

	1	2	3	4
Main variables				
Manufacturer effort	-0.019	-0.065	-0.155*	-0.169*
	(0.085)	(0.086)	(0.086)	(0.087)
Informal compensation	10.322***	10.545***	-4.939	-3.865
	(3.110)	(3.217)	(5.787)	(5.383)
*Manufacturer effort*Informal compensation*			0.229***	0.219***
			(0.081)	(0.068)
Other variables				
Tenure	1.380	1.405	1.640	1.565
	(1.448)	(1.243)	(1.522)	(1.254)
Dealer Size	-0.144	-0.084	-0.043	-0.050
	(0.201)	(0.260)	(0.219)	(0.251)
Share of manufacturer business	0.342**	0.266	0.341**	0.258
	(0.166)	(0.182)	(0.158)	(0.184)
Number of retail stores	-1.076	-1.327	-0.654	-0.693
	(0.730)	(0.871)	(0.618)	(0.828)
Financial capability	4.574*	6.060**	5.016*	6.162**
	(2.469)	(2.450)	(2.662)	(2.467)
Number of competing dealers	-2.583*	-2.638	-1.649	-2.512
	(1.400)	(1.732)	(1.424)	(1.656)
Distance to manufacturer's HQs	15.907*	10.616	19.491**	21.938**
	(8.735)	(11.236)	(9.375)	(10.560)
Personal disposable income	5.565	0.500	5.311	2.151
	(10.365)	(11.893)	(10.881)	(11.294)
Personal income growth	4.598**	0.644	5.253**	3.196
	(2.002)	(3.291)	(2.126)	(3.173)
Constant	-51.552	0.392	-60.438	-20.365
	(38.496)	0.392	(41.422)	(49.379)
Regional fixed effect	No	Yes (8 regions)	No	Yes (8 regions)
Adjusted R^2	0.353	0.392	0.412	0.435
F statistic	3.681***	4.957***	4.611***	10.779***
Marginal effect at the mean[+]				
Manufacturer effort	-0.019	-0.065	-0.010	-0.031
	(0.085)	(0.086)	(0.061)	(0.072)
Informal compensation	10.322***	10.545***	7.864***	8.389***
	(3.110)	(3.217)	(2.833)	(3.153)
Number of observations	60	60	60	60

* p < 0.10; **p < 0.05; ***p < 0.01. Robust standard errors in parentheses. [+]Marginal effect at the mean is calculated by formulae specified in footnote 14 on p.32.

TABLE 7: EFFECT OF MANUFACTURER EFFORT AND INFORMAL COMPENSATION: SUB-SAMPLES

Dependent variable: *Dealer effort*

Sub-sample by median split	*Share of manufacturer business*		*Financial capability*		*Tenure*	
	Large	Small	High	Low	Long	Short
	1	1'	2	2'	3	3'
Main variables						
Manufacturer effort	-0.336*	0.174	-0.213*	-0.116	0.106	-0.264**
	(0.175)	(0.160)	(0.123)	(0.185)	(0.147)	(0.123)
Informal compensation	-3.858	5.980	-13.982	-6.525	39.062**	-19.147***
	(8.650)	(11.376)	(8.778)	(28.900)	(18.032)	(5.996)
*Manufacturer effort*Informal compensation*	0.298**	-0.018	0.330***	0.207	-0.374	0.351***
	(0.118)	(0.154)	(0.113)	(0.447)	(0.271)	(0.060)
Other variables						
Tenure	0.581	1.559	1.266	1.173	1.136	1.143
	(6.263)	(1.459)	(2.124)	(2.402)	(4.418)	(5.338)
Dealer Size	-0.425	-0.140	0.476	-0.222	-0.739	0.229
	(1.653)	(0.236)	(0.455)	(0.253)	(0.556)	(0.276)
Share of manufacturer business	0.355*	0.453	0.254**	0.801***	0.444	0.515***
	(0.216)	(1.005)	(0.116)	(0.232)	(0.456)	(0.200)
Number of retail stores	-1.076	1.170	-1.109	0.284	-1.747	-4.875***
	(0.809)	(1.063)	(0.846)	(2.822)	(1.177)	(1.760)
Financial capability	4.470	2.195	3.073	1.644	4.941	8.500***
	(3.921)	(3.662)	(4.901)	(7.605)	(3.947)	(2.112)
No. of competing dealers	-1.682	-5.142*	0.041	1.205	-8.068*	-2.257
	(4.572)	(2.863)	(2.219)	(2.170)	(4.164)	(1.919)
Distance to manufacturer's HQs	25.247	16.574*	29.578***	11.551	17.170*	21.139
	(20.010)	(8.887)	(11.034)	(13.722)	(9.740)	(15.514)
Personal disposable income	8.675	10.966	19.651*	-35.736*	8.080	19.093
	(37.258)	(10.350)	(11.911)	(20.726)	(23.567)	(15.717)
Personal income growth	2.467	4.290	7.470**	7.567	5.405	4.231
	(4.544)	(3.123)	(3.357)	(6.436)	(3.931)	(4.127)
Constant	-22.570	-54.190	-102.403	-25.984	-48.650	-77.437
	(84.670)	(39.936)	(64.091)	(91.144)	(56.718)	(73.351)
Adjusted R^2	0.389	0.439	0.471	0.224	0.344	0.441
F statistic	4.223***	12.879***	2.515**	5.705***	8.503***	24.538***
Marginal effect at the mean[+]						
Manufacturer effort	-0.147	0.162*	-0.004	0.015	-0.130	-0.042
	0.138	0.097	0.075	0.162	0.105	0.100
Informal compensation	12.835**	4.990	4.501	5.056	18.149***	0.477
	5.913	4.271	3.741	10.590	5.546	4.547
Number of observations	28	32	30	30	26	34

* p < 0.10; **p < 0.05; ***p < 0.01. Robust standard errors in parentheses. High and Low are defined by median split of the corresponding variable. Regional fixed effects are excluded to economize on degree of freedom. [+]Marginal effect at the mean is calculated by formulae specified in footnote 14 on page 32.

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WEB APPENDIX: COMPUTEC 2005 2ND QUARTER SALES ANNOUCNEMENT
Computec Product Sales Policy

Respected Computec Dealers and Distributors:

After several years of hard work and cooperation between Computec and our dealers, Computec's product has enjoyed growing market share. Our sales trend is strong and every region is exhibiting hot sales. This makes our product the unassailable leading brand in the market.

To enhance consumer demand in the summer, Computec is launching our "New Version" product, together with millions of yuan of marketing expenses, to organize this promotion campaign. At the same time, to reward our core channel partners and retail outlets during summer holidays, we will start the "1000-store Cool Gift" campaign. We hope our dealers will seize this opportunity to set another sales record.

In this summer promotion campaign, we will stabilize channel prices to protect the profitability of our dealers by penalizing those who viciously lower channel prices below costs.

Our sales policies for the promotion are:

A. Product and Price

- Product name: "Computec Consumer Product X"
- Suggested retail price: 198 yuan/unit*
- Wholesale price: 90 yuan/unit

B. Duration

- July 7 – 8, 2005 (based on the time shown on your bank telex deposits)
- From July 9 onward, Computec Version X reverts to its regular list wholesale price of 95 yuan/unit

C. Ordering Policy

- Product delivery starts on July 10, 2005 in the order in which we have received payments during the promotion period#.
- Computec's sales managers may assign sales quotas†. We will offer additional marketing and advertising support for those whose orders exceed these quotas.
- Orders from this promotion on July 7 and 8 are further eligible for quantity discounts – in the form of free units – in addition to the upfront 5 yuan discount mentioned earlier.

Computec Technology Co. Ltd.

Authors' notes:

* Customers of Computec's dealers are both small retailers and consumers. Computec does not enforce the suggested retail price of 198 yuan; the price is merely used to provide a consistent perceived street value for the product. Nevertheless, Sales managers work to ensure dealers will not sell below their order costs.

Although a dealer has to take all deliveries before the last day of the order-fulfillment stage, the dealer is free to divide its total preorder into smaller portions and decide when to take delivery of each portion during that 2 ¾ months' time. This shows that Computec's sales process is not used to shift merely inventory to its dealers.

† Computec may have sales targets for strategic dealerships. Sales managers have to convince and work with those dealers on achieving those targets.