When Suppliers Climb the Value Chain: A Theory of Value Distribution in Vertical Relationships

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ABSTRACT

While offshore outsourcing has become an important strategy to lower production costs among western firms, it gives rise to a phenomenon of value chain climbing – suppliers in emerging markets can develop capabilities by supplying, with aspirations to compete with the buyers in the product market. We build an analytical model to study the impact of value chain climbing on value distribution in vertical relationships. The analysis identifies a set of dominant relationships, and shows how the buyer’s choice among these relationships depends on firms’ relative competitiveness in the product market and the supplier’s speed of capability development. The results provide new insights into our understanding of value distribution in vertical relationships across different contexts. We further extend the model to a dynamic setting, showing how vertical relationships and, consequently, value distribution evolve over time. By endogenizing the supplier’s entry into the product market, our study enriches the literatures on vertical relationships, market entry, and the management of global value chains.
1 Introduction

Offshore outsourcing is a key strategy that western firms use to manage their value chain. By outsourcing, firms (henceforth buyers, to distinguish from suppliers) can retain high value-added activities (e.g., R&D and marketing) in house, while contracting out low value-added activities (e.g., manufacturing) to suppliers in emerging economies where labor costs are low. The importance of outsourcing is manifested by its sheer volume. According to the United Nations 2011 World Investment Report, contract manufacturing and services activities, mostly in developing countries, generated $1.1–1.3 trillion sales in 2010. Due to its importance, offshore outsourcing has attracted increasing interest among both academics and practitioners over the last two decades (Feenstra, 1998; Grossman and Helpman, 2005; Gereffi, Humphrey, and Sturgeon, 2005; Elms and Patrick, 2013).

While outsourcing reduces the buyer’s production costs, it gives rise to a phenomenon whereby the supplier can climb the value chain by supplying. Specifically, outsourcing opens a window of opportunity for the supplier to enter the product market, which is often the more lucrative part of the global value chain controlled by the buyer. As a result of close interactions with the buyer, the supplier can develop technological and marketing capabilities that are necessary to compete in the product market but are difficult to develop independently (Alcácer and Oxley, 2014). Despite the buyer’s efforts to prevent the supplier’s capability development, outsourcing has facilitated the transformation of many suppliers into direct competitors across a variety of industries such as electronics, garments, pharmaceuticals, and IT (Arruñada and Vázquez, 2006; Alcácer and Oxley, 2014). One prominent example of this transformation is HTC of Taiwan. Beginning as a contract cell phone manufacturer in the 1990s, HTC entered the smartphone market with its own brand in 2002, and was once among the top five smartphone brands in the world (Paik and Zhu, 2014; Yoffie, Alcacer, and Kim, 2012). Sharing a similar path is Galanz in mainland China. Originally a contract manufacturer, Galanz successfully established itself as one of the world’s largest microwave oven makers (Zeng and Williamson, 2003).

1Recent literature has also recognized other concerns with offshore outsourcing, including how it can undermine the development of new technologies by western firms (Pisano and Shih, 2009; Fuchs and Kirchain, 2010).
The growth of value-chain-climbing activities has been catalyzed by several environmental factors. First, increasing disposable income in emerging countries (e.g., China and India) has created sizable domestic markets, which serve as a foothold for local suppliers to enter and become established before they are able to expand globally (Zeng and Williamson, 2003; Bartlett and Ghoshal, 2000). This is unlike the past, when the major product markets resided in developed countries, and were nearly impossible for the suppliers from emerging markets to directly enter. Second, due to institutional changes such as trade liberalization, the emerging competitors can start their internationalization journey by selling to other developing countries; having accumulated overseas experiences, they are then poised to enter the developed countries (Khanna and Palepu, 2006). Third, technological advances, including e-commerce, have significantly decreased entry barriers such as distribution channels, further enabling the suppliers’ efforts to climb the value chain. While these suppliers typically begin at the low end of the value chain and many may fail in their endeavor to climb the value chain, some may eventually threaten the incumbent firms’ lucrative positions in the global product market. Thus, value chain climbing, facilitated by profound environmental change, can have significant strategic consequences, highlighting the need for both practitioners and academics to re-assess the management of global value chain.

Despite the intriguing implications of suppliers climbing value chains, this phenomenon has received little attention in the scholarly research, except for a few practitioner-oriented case studies (e.g., Arruñada and Vázquez, 2006) and a recent empirical investigation (Alcácer and Oxley, 2014). We aim to fill this gap by developing one of the first analytical models on the role of value chain climbing. In particular, although the phenomenon opens many potential research opportunities, we have chosen to focus on how value chain climbing affects value distribution in vertical relationships. This focus is relevant because it lies at the intersection of the value chain climbing phenomenon and a fundamental question in the strategy field: “How does competition among economic actors determine the value each appropriates?” (MacDonald and Ryall, 2004, 1319). In the context of

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2The catalyst role of technological advances can be illustrated by the experience of a former IKEA supplier, Joyme, in China (the following description is constructed based on public information and the authors’ field interviews). After Joyme quit the supply relationship with IKEA in 2012, it simultaneously opened a showroom store near a subway station in Beijing and an online store at Alibaba (China’s e-commerce giant, equivalent to a combination of Amazon, eBay, and PayPal). A consumer can begin her shopping by visiting an IKEA store to find the furniture she likes, and then go to Joyme’s showroom store to check product differences (often minor) and price differences (often major). She can then go home to place orders at Joyme’s online store at Alibaba, with the furniture being shipped to her apartment in a few days. Thanks to this business model, which would have been inconceivable without e-commerce, Joyme’s venture quickly took off after its founding.
our study, the supplier is a potential entrant to compete with the buyer, which gives rise to a new form of competition; within this context, the value that each economic actor appropriates, or the value distribution between the buyer and supplier, is a central concern in the value chain literature (Chatain and Zemsky, 2007; de Fontenay and Gans, 2008; Chatain, 2011; Jia, 2013). Taken together, given our interest in value chain climbing, we are naturally concerned with how this new form of competition can affect value distribution in vertical relationships.

Our model complements the existing models of buyer-supplier relationships in the strategy literature (Chatain and Zemsky, 2007; de Fontenay and Gans, 2008; Chatain, 2011; Jia, 2013) by incorporating a component of market entry (Tirole, 1988; Cabral, 2014) and studying its impacts on the formation of the buyer-supplier relationship and on the implied value distribution. A novel feature of the model is that the supplier develops capabilities necessary for market competition by supplying the buyer (see our conceptualization in Section 2), resulting in equilibrium connections between the supplier’s market entry prospect and the vertical relationship formation – the vertical relationship engenders the supplier’s value chain climbing incentives, actions and outcomes, while the anticipation of supplier capability development and competition in turn influences the buyer’s choices of relationship structures. This model allows us to identify the dominant relationship types in equilibrium, to draw cross-sectional implications, and to study how the buyer-supplier relationship may evolve over time.

We show that a variety of relationship types (accommodating, dumping, and squeezing) can exist in response to competitive considerations. Moreover, the buyer’s optimal choice among them depends on the product market competitiveness of the two firms – what each would earn on the product market should the supplier enter. As a key theoretical construct in the literature on entrants and incumbents (Tirole, 1988; Cabral, 2014), product market competitiveness is relevant in our research because the supplier is the potential entrant into the buyer’s (the incumbent) product market. When the supplier’s competitiveness is low, the buyer prefers to offer the supplier a value share slightly higher than the supplier’s competitiveness, so that the supplier has no incentive to enter. In other words, the buyer prefers to accommodate a low-competitiveness supplier with a long-term relationship. When the supplier’s competitiveness is high, however, the accommodating strategy becomes expensive. Intuitively, if the supplier poses a high threat of climbing the value chain, the buyer will choose to dump (i.e., terminate the relationship with) the supplier and thus
close the window to the supplier’s capability development.

Interestingly, our analysis shows that dumping is not necessarily the only alternative to accommodating. In fact, the buyer may find a novel solution, in which it offers the supplier a value share even lower than the supplier’s outside option, effectively *squeezing* or exploiting the supplier; in such a relationship the supplier tolerates the exploitation, with the goal of developing the desired capabilities, but leaves the relationship as soon as it has achieved its goal, much like an apprentice who pays tuition (e.g., in the form of free labor) to the master in exchange for learning. Unlike accommodating, which leads to a long-term relationship, and dumping, which results in a terminated relationship, squeezing takes the form of a short-term relationship, in which both firms are interested to engage. Despite its short-term nature, the squeezing relationship exists in equilibrium over a wide range of parameter space.

Our analysis lays out the specific conditions under which each of the three types of relationships prevails, providing a complete picture of the equilibrium vertical relationships. The full picture then allows us to conduct cross-sectional analyses, examining how variations of contextual characteristics can affect the equilibrium vertical relationship and the implied value distribution. We specifically focus on two dimensions of variations, capability development speed and product market competitiveness, since they are, respectively, key characteristics of firms’ underlying capabilities and manifested products, a duality proven valuable for understanding firm strategy (Wernerfelt, 1984) and industry dynamics (Pacheco-de-Almeida and Zemsky, 2012). Given that significant variations in capability and competition exist across different contexts (e.g., industries or countries), our analysis can thus provide new insights into value distributions in vertical relationships.

For example, our analysis finds an interesting non-linear relation between product market competitiveness and value distribution. As the supplier’s competitiveness increases, its value share will initially increase, if the relationship is in the accommodating regime, because the buyer needs to pay more to retain a more competitive supplier. However, once increasing supplier competitiveness shifts the equilibrium regime to squeezing, the supplier’s value share will decrease, because a more competitive supplier needs to pay higher tuition. Thus, the marginal impact of product market competitiveness within the same regime and a switch between regimes jointly generate an (approximated) inverted U shape relation between the value the supplier captures and its competitiveness.

After characterizing the dominant relationships and conducting cross-sectional analyses, we
extend the model to a two-stage model, which accounts for the possibility that firms may adjust their relationship over time. We show that the existence of the dominant relationships is robust to this extension. Furthermore, by examining the dynamic patterns of vertical relationships, we delineate conditions under which the relationship type persists or switches over time. In particular, in considering the case of switching, our analysis reveals which switching patterns are possible and which ones are not, shedding new light on the inter-temporal evolution of vertical relationships.

Our study draws from and contributes to three strands of strategy literature. First, it contributes to the research on how knowledge and capabilities complement the traditional focus on transaction costs in managing vertical relationships (Argyres and Zenger, 2012). Recent research in this area shows that the consideration of knowledge spillovers beyond the focal transaction may significantly affect the governance of the focal transaction (Mayer, 2006; Kang, Mahoney, and Tan, 2009). To expand our understanding of this area, we examine how the management of buyer-supplier relationships is influenced by the interplay between capability development and product market competition, an intersection that has gained increasing attention in the formal modeling literature in the strategy field (Pacheco-de-Almeida and Zemsky, 2012).

Second, our study also contributes to the growing body of work that addresses the role of competition among economic actors in determining value appropriation (MacDonald and Ryall, 2004). One important stream in this literature focuses on the competition of forming coalitions among buyers and suppliers, and studies how this type of competition influences value distribution and, in turn, affects the management of vertical relationships (Chatain and Zemsky, 2007; de Fontenay and Gans, 2008; Chatain, 2011; Jia, 2013). We introduce the study of a different type of competition – the supplier’s entry to the product market – and examine how it influences the formation and stability of vertical relationships. To focus on this new type of competition, we consider a focal pair of one buyer and one supplier, and assume the buyer possesses the full bargaining power to determine the value distribution. This simplification allows us to highlight the emerging possibility that suppliers may climb the value chain, and to examine how this possibility influences the set of value appropriation strategies firms should consider.

Last but not least, our study adds to a long-standing literature concerning the challenges new entrants pose to industry incumbents in the industry evolution process (Schumpeter, 1934). While the early work in this stream outlined the impact of economic incentives and organizational capa-
bilities (Tushman and Anderson, 1986; Gilbert and Newbery, 1982; Henderson, 1993; Reinganum, 1983), more recent studies have deepened the analysis by capturing emerging issues such as licensing (Gans and Stern, 2000), innovation trajectories (Cabral, 2002), and platform-based competition (Zhu and Iansit, 2011). Building on this momentum, we study a new type of market entry that stems from the rapidly-changing global integration process. In this context, market entry is not exogenously generated by environmental change such as a technological breakthrough; rather, since the potential entrant already has an existing role as a supplier to MNCs, market entry is endogenously determined by the supplier’s decision regarding whether to switch to the new role of direct competitor. The market entry decision is intertwined with the value distribution between the buyer (incumbent) and the supplier (potential entrant). The unique feature of this type of market entry thus points to the importance of examining alternative preemptive strategies (Cabral, 2014), a task to which our study aims to contribute.

2 Capability development by supplying

In this section, we conceptualize the supplier’s capability development that is gained by supplying, the key theoretical concept in our paper. To begin, consider the well-known smiling curve in the outsourcing literature (Bartlett and Ghoshal, 2000). The smiling curve has acquired its name because the two ends of the value curve (creating and marketing the products) command much higher profitability than does the middle segment (manufacturing the products). As such, the buyer keeps R&D and marketing activities in house while outsourcing manufacturing to the suppliers in emerging markets. If suppliers aspire to move up the value curve, they need to develop the technological and marketing capabilities necessary to become a viable competitor in the product market.

However, it is challenging for a new player to develop technological and market capabilities due to time compression diseconomies (Pacheco-de-Almeida and Zemsky, 2007; Dierickx and Cool, 1989). Moreover, these capabilities cannot be readily purchased “off the shelf” on the market (Sutton, 2012). For example, even if a Chinese firm purchases machines, it may lack capable designers to create the products or marketers to create global brand recognition. To be sure, the Chinese firm can try to acquire an established western firm with existing technologies or a brand, as part of its self-development process. But this process can be too costly due to ex ante information asymmetry
and ex post integration cost. In fact, despite the persistent efforts of Chinese firms to make overseas acquisitions, many of them have failed (Williamson and Raman, 2011).

Compared to a self-developing entrant, a supplier has a significant advantage in the effort to develop capabilities, because the supply process opens a window of opportunity for the supplier to closely interact with the buyer. For example, even though the buyer may want to share only a minimum amount of R&D knowledge and design knowhow, the supplier can inevitably take this opportunity to gain other relevant knowledge, because different pieces of knowledge are embedded within each other. The supplier can also gain marketing knowledge, because the buyer often needs to show the supplier how the distribution channel works and how the end customers use the product. While the purpose of offering this access is to help the supplier provide better intermediate inputs, the supplier can come to understand channel providers and end consumers. Further, by working for a branded buyer, the supplier may gain the confidence of consumers and leverage this confidence to build its own brand. Finally, the supplier may not be limited by what they learn from the buyer; they are also in a position to combine and recombine the newly gained knowledge with their other expertise to create stronger capabilities. A good example is the capability development process of Samsung, a former OEM manufacturer.

The above conceptualization has two implications. First, since supplying activities and supplier capability development are intricately connected and hard to separate, supplier capability development is inevitable as long as the buyer and the supplier maintain their relationship, even if the buyer seeks to minimize the speed of supplier capability development (Alcácer and Oxley, 2014). Second, it is faster to develop desired capabilities by working as a supplier than pursuing them independently. These two implications underpin the tradeoffs faced by the buyer and the supplier, respectively. The buyer needs to balance leveraging the lower production cost of the supplier and the negative consequences of the supplier developing capabilities. The supplier, on the flip side, can develop capabilities by supplying, but may need to pay “tuition” to do so.

The concept of capability development by supplying can be further understood by comparing it with two related but distinct concepts: vertical spillovers in the foreign direct investment (FDI) literature and the violation of intellectual property. Vertical spillovers, or the transfer of basic production knowhow from the buyer to the supplier, help the supplier improve the quality of the oursourced items to meet a desired standard. This type of knowledge transfer has been the focus
of existing research (Javorcik, 2004), where the primary concern is whether the focal supplier can utilize the learned knowledge to serve the competitors of the buyer (Bönte and Wiethaus, 2007) or whether the knowledge is diffused to the other suppliers (Pack and Saggi, 2001). Despite these concerns, the literature concludes that the buyer has an incentive to transfer knowledge due to either the existence of common benefits (e.g., both parties can benefit from high-quality intermediate products) (Bönte and Wiethaus, 2007) or the increase in competition and efficiency (Pack and Saggi, 2001). Capability development by supplying and vertical spillovers are clearly related, in that certain knowledge spills over from the buyer to the supplier, but these two concepts differ in several important aspects. Vertical spillovers involve knowhow for manufacturing intermediate products, while capability development is concerned with technological and marketing capabilities for market competition. Whereas vertical spillovers are mutually beneficial, through its capability development, the supplier benefits at the expense of the buyer. As such, the buyer typically voluntarily initiates vertical spillovers, but tries to thwart the supplier’s efforts to develop its own technological and marketing capabilities (Alcácer and Oxley, 2014).

The concept of capability development by supplying is also distinct from the violation of intellectual property. Although the supplier’s capability development concerns core technologies, it does not necessarily entail a violation of intellectual property. For example, the supplier may not need to illegally copy the buyer’s core technology; rather, by observing and interacting with the buyer, the supplier can innovate around it (Alcácer and Oxley, 2014; Arruñada and Vázquez, 2006; Khanna and Palepu, 2006). But of course, how fast the supplier can develop capabilities may correlate with the strength of intellectual property regime. In the extreme case, if the intellectual property law is so strong that it does not allow the supplier to conduct any business even remotely related to the buyer’s core product, then developing capabilities by supplying is not much faster than doing so independently. On the other hand, if the intellectual property law is very lenient, then it is much easier for the supplier to develop necessary capabilities. Given these differences, we do not focus on the issues of intellectual property or vertical spillovers; in the conclusion section we discuss research opportunities that may arise from their connections to capability development.
3 Base model

We consider a buyer (she, subscripted by $b$) and a supplier (he, subscripted by $s$). From time $t = 0$ to $t = 1$, the two firms engage in a supply chain relationship. The base model horizon begins at time $t = 1$, when the supplier may or may not be capable of entering the buyer’s market as a competitor; the supplier’s capability is his private information and the buyer has the belief that the supplier is incapable with probability $\tau$ and is capable with probability $1 - \tau$. We treat $\tau$ as exogenous in the base model. In the next section, we extend the base model to a two-stage one that starts at $t = 0$, where we examine the formation of the belief $\tau$.

At time $t = 1$, the buyer proposes a supply chain relationship that offers the supplier value stream $v$. If the supplier rejects the offer, he enters the buyer’s market (if he is capable) or the two firms turn to their reservations (if he is incapable). The supplier’s reservation gives him value stream $r$ and the buyer’s reservation gives her value stream $1 - c$. If the supplier accepts the offer, the supply chain relationship gives the buyer and the supplier value streams $1 - v$ and $v$, respectively. An incapable supplier develops his capabilities and becomes capable at some later time. If the incapable supplier is in the supply chain relationship, he becomes capable at time $t = 1 + L$, where $L$ represents a random time length; if he is not in the supply chain relationship (i.e., if he rejected the buyer), he does not become capable until time $t = 1 + \tilde{L}$, where $\tilde{L}$ represents a stochastically longer time than $L$ because the supplier can develop capabilities faster by supplying than doing so independently, as explained in Section 2. A capable supplier can choose to enter the buyer’s market any time. Once the supplier enters the market, the value streams to the buyer and the supplier change to $\pi_b$ and $\pi_s$, respectively. All value parameters $v$, $1 - v$, $r$, $1 - c$, $\pi_b$, and $\pi_s$ represent the rates of the value streams per unit of time.

The buyer’s offer $v$ is her decision variable, which determines how value is allocated in the vertical relationship.3 All the other value rates and the distributions of $L$ and $\tilde{L}$ are exogenous and common knowledge. One can interpret 1 as the total value created by the buyer’s supply chain. We assume $c \geq 0$, and one can interpret it as the buyer’s cost of using her best alternative arrangement, which can be, for example, the cost of running an integrated business, or the cost to use another

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3We assume that the buyer can make a take-it-or-leave-it offer and extract most of the surplus, given that buyers tend to have disproportionally high bargaining power in the offshore outsourcing setting with respect to the OEM suppliers (Moran, 2001; Harrison and Scorse, 2010).
supplier. To capture the supplier’s entry incentive, we assume \( \pi_s > r \). The supplier’s entry will reduce the buyer’s value, namely, \( \pi_b < 1 - c \), and the duopoly competition will yield total profits that are lower than the monopoly profit that the supply chain would create, namely, \( \pi_b + \pi_s < 1 \) (Budd, Harris, and Vickers, 1993).

We assume both firms make decisions to maximize their expected net present value and let \( \beta \in (0, 1) \) denote the discount factor per unit of time. Therefore, a capable supplier will forego the supply chain relationship with the buyer and choose to enter the market if and only if \( v < \pi_s \). An incapable supplier compares his choices at time \( t = 1 \): if accepting the buyer’s offer and developing his capabilities by supplying, he has a net present value (discounted to time \( t = 1 \)) equal to \( [(1 - B)v + B \max\{\pi_s, v\}] / (1 - \beta) \), where \( B \equiv E[\beta^L] \); by contrast, if rejecting the offer and developing his capabilities independently, he has a net present value discounted to time \( t = 1 \) equal to \( [(1 - \tilde{B})r + \tilde{B}\pi_s] / (1 - \beta) \), where \( \tilde{B} \equiv E[\beta^L] \). This implies that he will accept the buyer’s offer only if \( v \geq \underline{v} \equiv \frac{(1 - B)r - (B - \tilde{B})\pi_s}{1 - B} \).

### 3.1 Dominant relationship types

Given the supplier’s strategies, the buyer has three undominated options regarding \( v \), and all other options are dominated by one of those three options. Option 1 is to offer (slightly above) \( v = \pi_s \) so that the supplier would accept the offer and never enter the market regardless of his current or future capabilities. We refer to this option as the accommodating strategy. Any choice of \( v > \pi_s \), despite achieving the same goal, gives the buyer lower value and hence is dominated by \( v = \pi_s \).

Option 2 is to offer (slightly above) \( v = \underline{v} \) such that an incapable supplier would accept it and a capable supplier (or when an originally incapable supplier becomes capable) would enter. We refer to this option as the squeezing strategy because \( \underline{v} \) is surely lower than the supplier’s reservation value \( r \) and therefore, if used, the buyer squeezes value from the incapable supplier through the relationship. Similarly, any choice of \( v \in (\underline{v}, \pi_s) \) achieves the same goal but gives lower value to the buyer and hence is dominated by the choice of \( v = \underline{v} \). Option 3 is to offer any \( v < \underline{v} \) so that the supplier rejects the offer regardless of his capabilities. This option is equivalent to the buyer’s choice of terminating the relationship with the supplier. We refer to this option as the dumping strategy. Let \( u_i^{(k)} \) denote her expected present value (discounted to \( t = 1 \)) of firm \( i = b, s \), under each of the three options \( k = 1, 2, 3 \).
Lemma 1. The buyer chooses among three options regarding \( v \), which together dominate all other options.

- Option \( k = 1 \): accommodating; i.e., \( v = \pi_s \). In equilibrium, the supplier does not enter, and thus \((1 - \beta)u_b^{(1)} = 1 - \pi_s\), and \((1 - \beta)u_s^{(1)} = \pi_s\).

- Option \( k = 2 \): squeezing; i.e., \( v = v \). In equilibrium, the incapable supplier accepts the offer but enters as soon as being capable, and thus \((1 - \beta)u_b^{(2)} = \tau[(1 - B)(1 - v) + B\pi_b] + (1 - \tau)\pi_b\), and \((1 - \beta)u_s^{(2)} = \tau[(1 - B)v + B\pi_s] + (1 - \tau)\pi_s\).

- Option \( k = 3 \): dumping; i.e., \( v < v \). In equilibrium, the supplier rejects the offer and enters as soon as capable. We have \((1 - \beta)u_b^{(3)} = \tau[(1 - \tilde{B})(1 - c) + \tilde{B}\pi_b] + (1 - \tau)\pi_b\), and \((1 - \beta)u_s^{(3)} = \tau[(1 - \tilde{B})r + \tilde{B}\pi_s] + (1 - \tau)\pi_s\).

We compare the three options to identify the buyer’s optimal strategy. Accommodating is qualitatively different from squeezing and dumping in terms of the equilibrium outcome – If the buyer chooses accommodating, the supplier will never enter; however, in the other two options the supplier will enter at some point, despite the difference of the expected entry timing. Therefore, we first discuss when it is optimal for the buyer to preempt entry by accommodating, and then examine how she chooses between squeezing and dumping.

When to preempt entry?

The option of accommodating benefits the buyer by maintaining her monopoly profit, but it costs the buyer the value transfer \( v = \pi_s \), which is higher than that in the other two options. Therefore, intuitively, it is optimal to accommodate when \( \pi_s \) is sufficiently low, compared with the prospect loss due to the supplier’s entry in the other two options.

Specifically, we compare \((1 - \beta)u_b^{(1)}\) and \((1 - \beta)u_b^{(2)}\) and find the former is larger if and only if

\[
\pi_s < \pi_s^{(12)}(\pi_b) \equiv \frac{(1 - \tau + \tau\tilde{B})(1 - \pi_b) + \tau(1 - \tilde{B})r}{1 - \tau\tilde{B} + \tau\tilde{B}}.
\]

We compare \((1 - \beta)u_b^{(1)}\) and \((1 - \beta)u_b^{(3)}\) and find the former is larger if and only if

\[
\pi_s < \pi_s^{(13)}(\pi_b) \equiv (1 - \tau + \tau\tilde{B})(1 - \pi_b) + \tau(1 - \tilde{B})c.
\]
Both thresholds \( \pi_s^{(12)}(\pi_b) \) and \( \pi_s^{(13)}(\pi_b) \) are always lower than \( 1 - \pi_b \) given the model assumptions \( r < \pi_s < 1 - \pi_b \) and \( c < 1 - \pi_b \). This implies that accommodating can never completely dominate squeezing or dumping as \( \pi_s \) increases from 0 to \( 1 - \pi_b \). However, as \( \pi_s \) increases, should the buyer prefer dumping or squeezing? We examine this question next.

**Squeezing or dumping?**

To analyze the tradeoff in the choice between squeezing and dumping, we compare the two options by decomposing the difference:

\[
(1 - \beta) u_b^{(3)} - (1 - \beta) u_b^{(2)} = \tau \left[ (B - \tilde{B})(1 - \pi_b) - (1 - \tilde{B}) c - (1 - B)(-v) \right].
\] (1)

The benefit of dumping is that it delays the supplier’s entry by a time period \( (B - \tilde{B}) \), during which the buyer enjoys the monopoly profit 1 as opposed to duopoly profit \( (\pi_b) \). Thus, the benefit is measured as \( (B - \tilde{B})(1 - \pi_b) \). However, if dumping the current supplier, the buyer needs to switch to a more costly sourcing alternative, incurring the cost \( c \) for a period \( (1 - \tilde{B}) \) until the supplier enters via self-development. Thus, the term \( (1 - \tilde{B}) c \) measures the direct cost associated with the dumping strategy.

In addition, if choosing dumping over squeezing, the buyer foregoes the opportunity to “exploit” the supplier. In the squeezing relationship, the buyer gives the supplier value \( v \) for a period \( (1 - B) \), which is equivalent to the supplier paying the buyer \( (1 - B)(-v) = (B - \tilde{B})\pi_s - (1 - \tilde{B})r \). Indeed, the degree of squeezing can be so great that the value allocation \( v \) falls below zero (and hence \( (1 - B)(-v) \) is positive), implying that the supplier “pays” the buyer (rather than getting paid) to supply.\(^4\)

Equation (1) suggests that it is better to use the squeezing strategy when the opportunity cost is sufficiently high. In particular, the opportunity cost term in Equation (1), \( (1 - B)(-v) = (B - \tilde{B})\pi_s - (1 - \tilde{B})r \), increases with \( (B - \tilde{B})\pi_s \), which is the benefit that the supplier can obtain from his expedited entry measured by time length \( (B - \tilde{B}) \). The supplier wants to develop necessary capabilities by supplying now and gaining in the future, akin to an apprentice who needs to pay

\(^4\)In our model, we normalize the supplier’s production cost to zero, and hence \( v < 0 \) means that prior to his entry the supplier bears negative profit but does not necessarily make a cash payment to the buyer.
tuition to the master to learn. The benefit \((B - \tilde{B})\pi_s\) minus the outside option cost \((1 - \tilde{B})r\) is analogous to the tuition that the supplier pays the buyer in exchange for faster entry. From the perspective of the buyer, she chooses squeezing over dumping with respect to suppliers who can pay sufficiently high tuition, namely, those with high competitiveness \(\pi_s\).

Formally, Equation (1) implies that squeezing is preferred to dumping if and only if

\[
\pi_s > \pi_s^{(32)}(\pi_b) \equiv 1 - \pi_b - \frac{(1 - \tilde{B})(c - r)}{B - \tilde{B}}.
\]

**Full picture of the optimal choice among the three options**

We now combine the pairwise comparisons of the three options and produce a full picture about the buyer’s optimal choice. It is easy to verify that all three threshold curves \(\pi_s^{(12)}(\pi_b)\), \(\pi_s^{(13)}(\pi_b)\), and \(\pi_s^{(32)}(\pi_b)\) intersect when \(\pi_b = \pi_b \equiv 1 - c - \frac{c - r}{r(B - B)}\) and \(\pi_s = \pi_s \equiv c + \frac{(1 - \tau + r\tilde{B})(c - r)}{r(B - B)}\). Note that \(c < r\) implies \(\pi_s^{(32)}(\pi_b) > 1 - \pi_b\), and therefore for all \(\pi_s < 1 - \pi_b\), dumping dominates squeezing; in other words, the condition \(c > r\) is a necessary condition for the squeezing relationship to exist.

We discuss the case with \(c > r\) in Proposition 1, and report the case with \(c \leq r\) in Proposition 2.

**Proposition 1.** If \(c > r\), the buyer’s optimal strategy is characterized as follows: When \(\pi_b > \pi_b\), it is optimal to accommodate if \(\pi_s \leq \pi_s^{(12)}(\pi_b)\), and it is optimal to squeeze, otherwise; when \(\pi_b \leq \pi_b\), it is optimal to accommodate if \(\pi_s \leq \pi_s^{(13)}(\pi_b)\), it is optimal to squeeze if \(\pi_s > \pi_s^{(32)}(\pi_b)\), and it is optimal to dump, otherwise.

Figure 1 illustrates Proposition 1. As discussed earlier, when the supplier’s competitiveness \(\pi_s\) is small and hence accommodating is not too costly, the buyer finds it optimal to accommodate and hence preempt the supplier’s entry incentive; further, when \(\pi_s\) is sufficiently high and hence the supplier can pay high tuition, the buyer finds it optimal to squeeze rather than to dump the supplier.

The new insight in Proposition 1 centers on the condition under which dumping is optimal. Dumping is an intuitive choice when the buyer expects the supplier to rebel, but finds it too costly to preempt this behavior by accommodating the supplier. While this intuition may be valid under certain conditions (to be examined in Proposition 2), Figure 1 shows that dumping is never optimal when \(\pi_b\) is sufficiently high (\(\pi_b > \pi_b\)): When \(\pi_b\) is large the benefit term in equation (1) is low,
Figure 1: The buyer’s optimal strategy when $c > r$.

and thus dumping is not worthy of consideration. Dumping is optimal only when the buyer’s own competitiveness is low ($\pi_b \leq \pi_k$, and hence she has much to lose upon the supplier’s entry) and the supplier’s competitiveness $\pi_s$ is intermediate, in which case the supplier is not only too costly to accommodate but also offers tuition that is too low to be worth squeezing.

### 3.2 Implications for cross-sectional analyses

Proposition 1 offers the opportunity to conduct comparative analyses. Our dependent constructs are the equilibrium relationship types (discrete) and the associated share of value distribution (continuous), core interests of our model. For the independent constructs, we focus on the speed of capability development and firms’ product market competitiveness. We choose these two factors because they are, respectively, key characteristics of firms’ underlying capabilities and manifested products. While sometimes considered separately in different literatures, examining both factors provides a more complete perspective for us to understand firm strategy (Wernerfelt, 1984) in dynamic environments (Pacheco-de-Almeida and Zemsky, 2012).

Note that Proposition 1 has already studied the impact of product market competitiveness on the choice of relationships and the impact of the speeds of capability development on value share distribution. Therefore, in the following analysis, we focus on how the speed of capability development influences the choice among different relationship types and how product market competitiveness influences value share distribution.
3.2.1 Capacity development speeds and regime shifts

The speed of capability development can vary significantly across different contexts (industries or institutions), depending on the nature of the knowledge that underlies the development of technological and marketing capabilities. For example, in contexts where knowledge is tacit, it is more difficult for the supplier to imitate the buyer from outside than within the supply relationship, which affords intimate interactions with the buyer and, in turn, facilitates the acquisition of tacit knowledge (Winter, 1987). In such contexts, capability development through supplying is much faster than independent development, equivalent to increasing $B$ while holding $\tilde{B}$ constant. Conversely, in contexts with abundant public knowledge or skilled workers, perhaps due to a well-developed public infrastructure (e.g., universities or government research labs), self-development becomes easier relative to capability development by supplying. This is equivalent to increasing $\tilde{B}$ while holding $B$ constant. Below we analyze how varying speeds of capability development can affect the thresholds of different regimes in Figure 1.

**Corollary 1.** $\pi_s^{(12)}$ increases in both $B$ and $\tilde{B}$. $\pi_s^{(13)}$ increases in $\tilde{B}$. $\pi_s^{(32)}$ increases in $B$ and decreases in $\tilde{B}$.

One can easily verify the monotonicity of the thresholds $\pi_s^{(12)}$, $\pi_s^{(13)}$, and $\pi_s^{(32)}$ by examining their first-order derivatives with respect to $B$ and $\tilde{B}$. Below we briefly explain the economic intuition. The variations of $B$ and $\tilde{B}$ shift the thresholds because they affect the buyer’s expected value under each of the three options in different ways. Under the accommodating option, per Lemma 1, neither $B$ nor $\tilde{B}$ affects the buyer’s expected value $u_b^{(1)}$, because these two capability development speed parameters are irrelevant when the supplier does not plan for entry. Similarly, under the dumping option, the speed of capability development by supplying $B$ is irrelevant, and hence does not affect the buyer’s expected value $u_b^{(3)}$; however, as the self-development speed $\tilde{B}$ increases, the buyer suffers sooner from the supplier’s entry, and hence $u_b^{(3)}$ decreases.

Finally, under the squeezing option, as either $B$ or $\tilde{B}$ increases, the buyer derives lower value $u_b^{(2)}$. Specifically, as $\tilde{B}$ increases, the supplier’s self-development option becomes more attractive, so the buyer has to offer a higher $v$, namely, to squeeze less. As $B$ increases, there are two opposing effects, namely, a lower $v$ (i.e., to squeeze more in amount) but a shorter squeezing duration (i.e., to squeeze less in time). We find that the former (positive) effect is proportional to $\pi_s$ because the tuition
amount \(-v\) is linear in \(\pi_s\), whereas the latter (negative) effect is proportional to \((1 - \pi_b)\), which is the buyer’s marginal loss per time unit due to the supplier’s sooner entry. Since \((1 - \pi_b) > \pi_s\), the negative effect always dominates the positive effect, and therefore the buyer overall obtains less from squeezing as \(B\) increases.

Therefore, as \(B\) or \(\bar{B}\) increases, accommodating becomes more attractive than squeezing, and hence \(\pi_s^{(12)}\) increases. As \(\bar{B}\) increases, accommodating becomes more attractive than dumping, and hence \(\pi_s^{(13)}\) increases. As \(B\) increases, dumping becomes more attractive than squeezing, and hence \(\pi_s^{(32)}\) increases. However, as \(\bar{B}\) increases, the buyer finds both squeezing and dumping less attractive, and so her preference between the two options is not straightforward. Equation (1) suggests that the benefit of squeezing diminishes faster than the direct cost as \(\bar{B}\) increases, which implies that, relatively, dumping is less preferable to squeezing, namely, \(\pi_s^{(32)}\) decreases.

In a nutshell, as shown in Figure 1, when \(B\) increases, the squeezing region shrinks – it is better to preempt the supplier’s entry or to simply “fire” the supplier. In contrast, when the speed of self-development \(\bar{B}\) increases, the dumping region shrinks – dumping becomes less effective, because the supplier can independently develop his capabilities.

### 3.2.2 Product market competitiveness and value distribution

Firms exhibit various degrees of product market competitiveness in different contexts. For example, \(\pi_s\) is higher in industries where customers are price sensitive and prone to poaching by supplier-turned competitors with low-priced offerings. In particular, when competition resides in domestic markets in China or India, \(\pi_s\) can increase significantly because domestic suppliers are more familiar with the local consumer tastes and distribution channels, and they may even receive government support. The following corollary characterizes an interesting non-linear relationship between product market competitiveness and value distribution.

**Corollary 2.** As \(\pi_s\) increases, the offered value \(v\) increases if \((\pi_b, \pi_s)\) is in the accommodation region, and it decreases if \((\pi_b, \pi_s)\) is in the squeezing region.

In Figure 2, as \(\pi_s\) increases, the supplier’s value share \(v\) will first increase, if \((\pi_b, \pi_s)\) is in the accommodating region, because the buyer needs to pay more to retain a more competitive supplier. However, once \((\pi_b, \pi_s)\) moves out of the accommodating region and into the squeezing region, \(v\)
will first drop and then decease with $\pi_s$, because the buyer wants to squeeze more to make up the future loss due to a very competitive supplier-turned entrant. In other words, this non-linearity is driven jointly by a switch in regime and by the marginal impact of product market competitiveness on value distribution within the same regime. Empirically, as shown in Figure 2, we should expect an (approximated) inverted U shape between the value the supplier appropriates and the supplier’s competitiveness.\footnote{This is analogous to some legendary stories about a king and his general in the history of the middle kingdom. The more competitive the general is, the better the king will treat him to retain him, thus the increasing part of the curve. But this holds only up to a certain point. Once the regime shifts, the king might treat the general badly, or exile or even kill the general.}

### 3.3 Squeezing: interpretations and necessary conditions

Our discussion thus far on the squeezing relationship can be summarized as follows. When the buyer engages in a squeezing relationship with the supplier, both firms are aware of the seemingly negative consequences: The supplier knows that the buyer is exploiting him, while the buyer knows that retaining the supplier helps him develop necessary capabilities and he will rebel the moment he succeeds in gaining the desired capabilities. Regardless, both firms choose to stay in such a relationship across a wide range of parameter space. Despite its interesting implications, the existence of the squeezing regime has several necessary conditions. Examining these conditions can help deepen our understanding of the channels through which the squeezing relationship works.
Figure 3: The buyer’s optimal strategy when $c \leq r$.

3.3.1 Necessary condition due to value creation potential

The condition $c > r$ in Proposition 1 is a necessary condition for the squeezing region to exist. Without the condition, namely, if $c \leq r$, the buyer always prefers dumping to squeezing and only chooses between accommodating and dumping, as described in Proposition 2 and illustrated by Figure 3.

**Proposition 2.** If $c \leq r$, $\pi_s^{(32)}(\pi_b)$ exceeds $1 - \pi_b$. As a result, it is never optimal for the buyer to squeeze. In particular, it is optimal to accommodate when $\pi_b \leq \pi_s^{(13)}(r) = 1 - c - \frac{r - c}{1 - \tau + \tau B}$ and $\pi_s \leq \pi_s^{(13)}(\pi_b)$, and it is optimal to dump, otherwise.

To see why dumping always dominates squeezing when $c \leq r$, we rearrange equation (1) and obtain:

$$ (1 - \beta)u_b^{(3)} - (1 - \beta)u_b^{(2)} = \tau[(B - \tilde{B})(1 - \pi_b - \pi_s) - (1 - \tilde{B})(c - r)]. $$

(2)

As opposed to equation (1), which focuses on the cost-benefit analysis from the buyer’s perspective, equation (2) offers a different view, which focuses on the value creation potential of the value-chain system formed by the two firms. In particular, if squeezing occurs, the value system enters the duopoly status earlier by a period $(B - \tilde{B})$, during which the system creates the sum of duopoly value $(\pi_b + \pi_s)$ as opposed to the monopoly value 1. Therefore, the term $(B - \tilde{B})(1 - \pi_b - \pi_s)$ can be interpreted as the value loss due to earlier competition resulting from the squeezing relationship.
By contrast, if dumping occurs, both firms turn to their outside options: The buyer incurs cost $(1 - \tilde{B})c$ and the supplier earns revenue $(1 - \tilde{B})r$ prior to the supplier’s entry. Therefore, the term $(1 - \tilde{B})(c - r)$ can be interpreted as the gain arising from cost savings if the two firms can form a squeezing relationship. The squeezing regime can exist only if the value system can create some positive value $(1 - \tilde{B})(c - r)$; namely, $c$ needs to be greater than $r$. Otherwise, the squeezing regime is always dominated by the dumping regime.

### 3.3.2 Necessary conditions due to financial constraints

The key element of the squeezing relationship is that the buyer offers a value $v$ lower than the supplier’s outside option $r$ and the incapable supplier accepts the offer to stay in the supply chain relationship because of his expectation of high value from sooner entry (i.e., $(B - \tilde{B})\pi_s$). As previously discussed, when $\pi_s$ is sufficiently high, the allocated value $v$ is lower than the supplier’s cost, meaning that the supplier needs to operate at a loss prior to his entry. In practice, however, suppliers in emerging markets are often subject to financial constraints that limit their ability to operate at a loss. For example, it is often difficult for private firms in China to obtain credit lines and bank loans from state-owned banks. Such financial constraints discourage the supplier from accepting a deep squeezing offer, and therefore limit the value that the buyer can squeeze from the supplier. We are interested in examining how the existence of such financial constraints affect the buyer’s optimal choice among the three types of relationships. Our analysis yields additional necessary conditions for the existence of the squeezing relationship.

Formally, let $F$ denote the minimum value that the supplier can accept; namely, an incapable supplier accepts the buyer’s supply-chain relationship offer $v$ if and only if $v \geq \max\{v, F\}$. The parameter $F$ increases as financial constraints become more stringent. All previous analysis remains valid if $F < v$. Proposition 3 below extends the results to the case with higher $F$. Let $\tilde{\pi}_b \equiv 1 - \frac{(1-\tilde{B})c-(1-B)F}{B-B}$, let $\tilde{\pi}_b \equiv 1 - \frac{(1-\tilde{B})r-(1-B)F(1-\tau\tilde{B}+\tau B)}{(B-B)(1-\tau+\tau B)}$ and let $\tilde{\pi}_s^{(12)} \equiv (1-\tau+B)(1-\pi_b)+\tau(1-B)F$.

**Proposition 3.** If $c \leq r$, $F$ does not affect the buyer’s optimal strategy. If $c > r$, as $F$ increases, the dumping region expands, the squeezing region shrinks, and the accommodating region may expand. In particular,

- If $F$ is medium (namely, $\frac{(1+B-2\tilde{B})c-(B-\tilde{B})}{1-B} < F < c - \frac{c-r}{(1-B)\tau}$), the buyer’s optimal strategy
Figure 4: The buyer’s optimal strategy as $F$ increases when $c > r$. The left panel plots with medium $F$ and the right panel plots with high $F$.

is the same as when $F$ is sufficiently low (namely, $F \leq \frac{1 + B - 2\hat{B}}{1 - B}c - (B - \hat{B})$), except that it is optimal to dump when $\pi_b \leq \hat{\pi}_b$ and $\pi_s > \pi_s^{(13)}(\pi_b)$;

- If $F$ is high (namely, $F \geq c - \frac{c - r}{(1-B)r}$), the buyer’s optimal strategy is characterized as follows: When $\pi_b > \hat{\pi}_b$, it is optimal to accommodate if $\pi_s \leq \pi_s^{(12)}(\pi_b)$, and it is optimal to squeeze, otherwise; when $\hat{\pi}_b \leq \pi_b < \hat{\pi}_b$, it is optimal to accommodate if $\pi_s \leq \pi_s^{(12)}(\pi_b)$, and it is optimal to squeeze, otherwise; when $\pi_b \leq \hat{\pi}_b$, it is optimal to accommodate if $\pi_s \leq \pi_s^{(13)}(\pi_b)$, and it is optimal to dump, otherwise.

When $c \leq r$, squeezing is never optimal and therefore financial constraints do not affect the buyer’s optimal strategy. When $c > r$, intuitively, financial constraints make the squeezing option less attractive to the buyer and hence the squeezing region shrinks as financial constraints become more stringent. However, which of the other two options should replace squeezing?

Proposition 3 provides the answer. Figure 4 illustrates Proposition 3, and shows how the dumping region expands as $F$ increases. In particular, when $F$ is medium (left panel of Figure 4), the accommodating region remains the same as in Figure 1, and the dumping region invades the original squeezing region (in Figure 1) where $\pi_b$ is sufficiently low ($\pi_b \leq \tilde{\pi}_b$ such that the benefit term of dumping over squeezing in equation (1) is sufficiently high) and $\pi_s$ is sufficiently high (such that $v < F$ and therefore the financial constraints are effective). As $F$ increases, the threshold $\tilde{\pi}_b$ increases, and so the squeezing region expands upward, as shown in Figure 4. During the process,
the accommodating region expands by a relatively small amount, as illustrated by the right panel of Figure 4. In sum, financial constraints mainly affect the buyer’s choice between squeezing and dumping, making the latter more preferable.

4 Inter-temporal Analysis

The one-stage setup of the base model focuses on the buyer’s choice of the vertical relationship at a single point in time. It helps identify three types of dominant relationship and analyze the buyer’s tradeoffs and optimal choice, yielding rich cross-sectional predictions about the vertical relationship characteristics. However, what happens if the buyer can intertemporally adjust the relationship? To explore this question, we extend the base model to a two-stage one. Our analysis shows that the characterizations of the dominant relationships are robust, and furthermore, our results shed light on how the vertical relationships evolve over time.

Consider the following two-stage model with the time horizon starting at $t = 0$. Its second stage starts at $t = 1$ and is the same as the base model. Its first stage spans $t = 0$ to $t = 1$. Similar to the base model, at time $t = 0$ the buyer proposes a supply chain relationship that offers the supplier a value stream $v_1$. We assume the parameters $r, c, \pi_b$, and $\pi_s$ are the same in both stages. For simplicity, we assume the supplier is incapable of entering the market at $t = 0$ and he cannot develop capabilities on his own if he rejects the buyer’s offer at $t = 0$. We assume that the supplier would be capable at $t = 1$ with probability $1 - \alpha$ if he engages in the supply chain relationship with the buyer in the first stage.

Similar to the base model, Lemma 2 shows that there are only three undominated options regarding $v_1$. Let $U_i^{(j)}$ denote the two-stage expected total value (discounted to $t = 0$) of firm $i = b, s$, under each of the buyer’s three options $j = 1, 2, 3$. Let $u_i^*(\tau)$ denote firm $i$’s expected net value discounted to $t = 1$ when the buyer uses the optimal strategy at $t = 1$ given the belief probability $\tau$; namely, $u_i^*(\tau) = u_i^{(k^*)}$, where $k^*$ denotes the optimal strategy and $u_i^{(k)}$ is defined in Lemma 1.

**Lemma 2.** At time $t = 0$, the buyer chooses among three options regarding $v_1$, which dominate all other options.

- Option $j = 1$: accommodating; i.e., $v_1 = \pi_s$. In equilibrium, the supplier does not enter by
the end of stage 1 and hence $\tau = \alpha$. We have $(1 - \beta)U_b^{(1)} = (1 - \beta)(1 - \pi_s) + \beta(1 - \beta)u_b^*(\alpha)$, and $(1 - \beta)U_s^{(1)} = (1 - \beta)\pi_s + \beta(1 - \beta)u_s^*(\alpha)$.

- Option $j = 2$: squeezing; i.e., $v_1 = v_1$. In equilibrium, the supplier accepts the offer but enters if capable at the end of stage 1. In this case, if the supplier does not enter by time $t = 1$, then he must be incapable at $t = 1$, namely, $\tau = 1$. We have $(1 - \beta)U_b^{(2)} = (1 - \beta)(1 - v_1) + \beta[\alpha(1 - \beta)u_b^*(1) + (1 - \alpha)\pi_b]$, and $(1 - \beta)U_s^{(2)} = (1 - \beta)v_1 + \beta[\alpha(1 - \beta)u_s^*(1) + (1 - \alpha)\pi_s]$. By the definition, $v_1$ is such that the supplier is indifferent to rejecting the offer, namely, $(1 - \beta)v_1 + \beta[\alpha(1 - \beta)u_s^*(1) + (1 - \alpha)\pi_s] = r$.

- Option $j = 3$: dumping; i.e., $v_1 < v_1$. In equilibrium, the supplier rejects the offer, and the two firms turn to their outside opportunities. We have $(1 - \beta)U_b^{(3)} = 1 - c$, and $(1 - \beta)U_s^{(3)} = r$.

The results in Lemma 2 are similar to those in Lemma 1, and so are the buyer’s tradeoffs at time $t = 0$ and time $t = 1$. Of course, the buyer’s choice at $t = 0$ affects the belief probability $\tau$, as described in Lemma 2, and therefore affects her choice at $t = 1$. In the following analysis, we examine how the buyer’s choice of the vertical relationship may vary over time. In this inter-temporal analysis, we exclude the dumping option in stage 1 by assuming that the buyer’s outside option cost $c$ is sufficiently high, which means that she must engage the supplier in stage 1; otherwise, the game ends at $t = 0$ and there is no evolution in the relationship to study.

We now consider two possible relationship types (i.e., accommodating and squeezing) in the first stage and three possible types in the second stage, making a total of six possible inter-temporal patterns across the two stages. Are all of them viable? Under what conditions does a particular pattern appear? The following lemma and proposition pave the route to answer these questions.

**Lemma 3.** If it is optimal to squeeze or dump in the second stage, it is optimal to squeeze in the first stage. In other words, if it is optimal to accommodate in the first stage, it is optimal to accommodate in the second stage.

[See appendix for proof.]

Lemma 3 highlights a key feature of the relationship dynamics, namely, two types of inter-temporal patterns — accommodating followed by squeezing (henceforth denoted by A→S), and accommodating followed by dumping (henceforth denoted by A→D) — cannot emerge in the buyer’s
optimal choices. The intuition is as follows. By choosing to accommodate the supplier at time $t = 0$, the buyer foregoes the value that she can squeeze from the supplier within the first stage, in exchange for preempting the supplier’s entry at time $t = 1$ in case he becomes capable. This makes sense only if the buyer expects high value by retaining the capable supplier in the second stage, namely, only if she plans to choose accommodating in the second stage. In other words, if the buyer does not plan to retain the capable supplier in the second stage (namely, chooses squeezing or dumping at time $t = 1$), she will opt to squeeze the supplier in the first stage for higher first-stage value and let the supplier enter by choice should he become capable. Proposition 4 characterizes the buyer’s optimal choice in the first stage, shows that all the other four types of inter-temporal patterns are possible, and describes the conditions necessary for each pattern. Let $v_1$ and $v_2$ denote the value allocated to the supplier in stages 1 and 2, respectively.

**Proposition 4.** In the first stage, the buyer’s strategy depends on $\pi_b$ and $\pi_s$. Given $\pi_b$, there exists $\pi_s(\pi_b)$ such that it is optimal to accommodate if $\pi_s \leq \pi_s(\pi_b)$, and it is optimal to squeeze, otherwise. We have $r < \pi_s(\pi_b) \leq \min\{\pi_s^{(12)}(\pi_b), \pi_s^{(13)}(\pi_b)\}$.

If $\pi_s \leq \pi_s(\pi_b)$, then it is optimal to accommodate in both stages, namely, we have $v_1 = v_2 = \pi_s$. Otherwise, if it is optimal to accommodate in the second stage, then $v_1 = v_2 < \pi_s$; if it is optimal to squeeze in the second stage, then $v_1 = v_2 = \max\{r - \frac{\beta(1-\alpha+\alpha\tilde{B})(\pi_s-r)}{1-\beta}, F\} \geq v_2 = v = \max\{\frac{(1-B)r-(B-\tilde{B})\pi_s}{1-B}, F\}$ if and only if $\frac{B-\tilde{B}}{1-B} \geq \frac{\beta(1-\alpha+\alpha\tilde{B})}{1-\beta}$.

[See appendix for proof.]

Figure 5 illustrates the inter-temporal patterns and their conditions that Proposition 4 implies. When the supplier’s competitiveness $\pi_s$ is sufficiently low ($\pi_s \leq \pi_s(\pi_b)$), it is optimal for the buyer
to accommodate the supplier in each stage (denoted by A→A) because it costs little to do so. In contrast, when the supplier’s competitiveness $\pi_s$ is sufficiently high ($\pi_s > \max\{\pi_s^{(12)}(\pi_b), \pi_s^{(32)}(\pi_b)\}$), it is optimal for the buyer to squeeze the supplier in each stage (denoted by S→S) because the supplier can afford a very high tuition extraction. In other words, the basic insights from Proposition 1 apply in these two extreme cases, where the cross-sectional tradeoffs within each stage are so salient that they dominate the inter-temporal considerations. This result offers a simple rule to assess the persistence of relationships: If the buyer starts with accommodating, she should not subsequently change; if she does change, then her choice in the first stage was wrong.

When the supplier’s competitiveness $\pi_s$ is intermediate ($\pi_s < \pi_s < \max\{\pi_s^{(12)}(\pi_b), \pi_s^{(32)}(\pi_b)\}$), however, the buyer finds it optimal to switch between relationship types over time. In particular, she switches from squeezing to either accommodating (denoted by S→A) or dumping (denoted by S→D), depending on her optimal second-stage choice, as described in Propositions 1 and 2. For example, if $c > r$, $\pi_b > \pi_b$, and $\pi_s^{(13)}(\pi_b) < \pi_s^{(32)}(\pi_b)$, Proposition 1 suggests that the pattern (S→A) occurs if $\pi_s < \pi_s < \pi_s^{(13)}(\pi_b)$ and the pattern (S→D) occurs if $\pi_s^{(13)}(\pi_b) < \pi_s < \pi_s^{(32)}(\pi_b)$; Figure 5 illustrates both patterns. In this example, the buyer squeezes the supplier in the first stage, when he is mostly likely to lack the capabilities needed to enter the market, and in the second stage, when he is more likely to possess those capabilities, the buyer switches to either preempting the supplier’s entry by accommodating him or to delaying his entry by dumping him.

Finally, Proposition 4 describes the value distribution ($v_1$ and $v_2$) in each stage, as $\pi_s$ varies with a fixed $\pi_b$. Consistent with the inverted U shape relation between value distribution and competitiveness as shown in Figure 2, Figure 5 shows that a similar inverted U shape exists in the first stage. Furthermore, Figure 5 shows that the supplier’s value share in the first stage $v_1$ is smaller than that in the second stage $v_2$ in patterns (S→A) and (S→S). The inverted U shape in the second stage will reach a higher peak, and the peak moves to the right. Such inter-temporal patterns can be examined in empirical research.

5 Conclusion and Discussion

In this paper, we study a phenomenon of value chain climbing in the context of offshore outsourcing. While offshore outsourcing is a key strategy to lower production costs among western firms, this
strategy may also enable the suppliers to climb the value chain. Suppliers from emerging markets may accumulate technological and marketing capabilities by supplying, with aspirations to compete with buyers in the product market. This shadow of future competition opens a new set of issues regarding how firms manage their value chain activities. Our paper represents an initial attempt to explore the implications of these issues, highlighting the complexity of buyer-supplier relationships in the value chain.

Specifically, our study provides one of the first analytical models to investigate how value chain climbing can affect vertical relationships. We identify three types of dominant relationships – accommodating, dumping, and squeezing – in equilibrium. In particular, our analysis highlights squeezing as a novel relationship in the presence of value chain climbing, while recognizing firms’ relative outside options and financial constraints as necessary conditions for the existence of the squeezing relationship. Cross-sectionally, we examine how the choice among these types of relationships is influenced by the speed of capability development, and how the share of value distribution is influenced by firms’ product market competitiveness. Inter-temporally, we show the results are robust in a dynamic setting, and further demonstrate how the vertical relationships may evolve over time.

Our study contributes to a capabilities-based understanding of vertical relationships (Mayer, 2006; Kang et al., 2009; Argyres and Zenger, 2012), highlighting how capability development by supplying can influence the optimal choice of relationship structure. In addition, this work contributes to our understanding of how market competition affects value distribution (MacDonald and Ryall, 2004), a topic that has drawn increasing attention in the strategy literature (Chatain and Zemsky, 2007; Chatain, 2011; de Fontenay and Gans, 2008; Jia, 2013). Finally, our study contributes to work on the competitive interaction between new entrants and industry incumbents (Gans and Stern, 2000; Cabral, 2002; Zhu and Iansit, 2011), modeling an emerging possibility that the supplier may become a new entrant.

As a further implication of our study, the squeezing relationship can shed new light on how firms can appropriate value from their tacit knowhow. The most direct approach of value appropriation is to manufacture products in-house applying the knowhow, but this approach may entail undesirably high manufacturing costs. A second approach is to sell the knowhow on the market for technologies, realizing value up front; yet, the market for technologies is well known to be imperfect (Arora, Fosfuri, and Gambardella, 2001). Given these constraints, when in-house manufacturing costs are
high, and when no market is available to price the transaction of knowhow, our model suggests an alternative approach: The buyer can “sell” its *intangible* knowledge by entering a buyer-supplier transaction relationship based on *tangible* products. In effect the buyer permits its tacit knowledge to spill over to the supplier; in return for this spillover, however, the buyer can appropriate value by squeezing the supplier.

Our study can also provide insights into a broader set of issues. Governments in some emerging markets, such as China, intentionally adopt a policy of "using markets to exchange for technologies," encouraging local firms to acquire advanced knowledge by working for foreign firms. Despite their awareness of this intention, foreign firms typically accept the deal. One explanation for foreign firms' acceptance could be dynamic capabilities – foreign firms can keep innovating for the next generation of products, thus are less concerned with imitation. Our study reveals the existence of the squeezing relationship as an alternative explanation to this paradoxical phenomenon. Future research can empirically tease apart these two alternative explanations, dynamic capabilities vs. the squeezing relationship, and find conditions (e.g., different industry life cycles or institutional environments) under which different explanations work better.

Our analysis also suggests that the government can support squeezing as a value creating arrangement. By providing a means to maintain their relationship, squeezing allows the buyer and the supplier to create more value together than they can if they break up. But this requires the supplier to bear short-term loss, a requirement that may be hard to satisfy due to financial constraints. Given that financial constraints are typical for suppliers in emerging markets, governments could consider relaxing financial constraints through subsidy, thus avoiding the replacement of the squeezing relationship by a dumping one.

The existence of a squeezing relationship suggests that we need to carefully analyze when dumping is preferred. This analysis can help evaluate the wisdom of the common suggestion that the Chinese suppliers should be dropped (or dumped), when their value chain climbing threatens the buyer, who should then bring its manufacturing back on shore or switch to suppliers in other emerging markets. While this suggestion appears to be an intuitive solution, our model shows that it is valid only under certain conditions. For instance, when the buyer’s alternative sourcing cost is higher than the supplier’s alternative value stream, dumping is never optimal when the buyer’s competitiveness is sufficiently high; dumping is optimal only when the buyer’s own competitiveness
is low and the supplier’s competitiveness is intermediate. Of course, when the buyer’s alternative sourcing cost is lower than the supplier’s alternative value stream, dumping is always preferable to squeezing. In light of the different conditions in which one option is more beneficial than the other, buyers or policy makers need to assess firms’ relative outside options before considering the dumping strategy. In particular, it might be difficult to find sourcing alternatives with lower costs than current Chinese suppliers. Low cost advantages associated with Chinese manufacturing result not only from cheap labor, but more fundamentally from the skills embodied in experienced workers and a reliable public infrastructure (e.g., utilities and transportation). Because a long period of time may be needed to accumulate these low cost advantages, it may be difficult for alternative sources to catch up immediately.

On the empirical front, future work can follow the approach of the Yale or Carnegie Mellon Surveys on industrial R&D in the US manufacturing industries (Levin, Kleverick, Nelson, and Winter, 1987; Cohen, Nelson, and Walsh, 2000), to classify different industries or institutional environments in emerging markets, based on characteristics that determine value chain climbing, such as the speed of capability development and product market competitiveness. Research can also conduct firm-level surveys to obtain more detailed data on relationship types, value distribution, and market entry. Given such data are more concerned with changing conditions in the global context, they expand the focus of prior work on issues related to value appropriation in advanced economies (Levin et al., 1987; Cohen et al., 2000). Such an empirical effort can not only test the predictions made by the current model, but also facilitate the design and evolution of the global value chain. Equipped with information on the key parameters in various contexts, firms can better design appropriate relationship arrangements, and, as industries and institutions evolve, adapt these arrangements.

To make our analytical model tractable, we make several simplifying assumptions. Relaxing these assumptions may lead to fruitful research opportunities. The first assumption is best explained by how our approach relates to, but differs from, the existing strategy literature on buyer-supplier relationships. The existing literature takes the role of suppliers as given, and uses formal models of bargaining to study how strategic interactions among multiple buyers and suppliers (e.g., one buyer and multiple suppliers) endogenize firms’ value appropriation ability (Chatain and Zemsky, 2007; de Fontenay and Gans, 2008; Chatain, 2011; Jia, 2013). In contrast, we endogenize the
supplier’s switch from the existing role of a supplier to one of a competitor in the product market, to highlight the possibility that the supplier can climb the value chain. To this end, we make the simplifying assumption that there is one buyer and one supplier, and the buyer can make a take-it-or-leave-it offer and hence extract most of the surplus. Whereas this setup is grounded in the specific empirical context where global buyers tend to possess disproportionally high bargaining power (Moran, 2001; Harrison and Scorse, 2010), helping us focus on certain key mechanisms, future research can generalize the analysis by endogenizing both the value appropriation ability of various firms and the potential change of their existing roles.

In addition, we do not explicitly consider the choice between specialization and vertical integration. We take as a starting point that it is very costly to do manufacturing in-house, given that cost considerations are the primary reason for contract manufacturing. We do, however, recognize vertical integration as an alternative, incorporating it as a type of outside option and examining its implications. Future research could examine in greater detail the role of integration or re-integration. Furthermore, the current study focuses on the situation where capability development by supplying is inevitable and uncontrollable, as long as firms stay in their relationship. Future research could also examine the case where the buyer can endogenously influence the extent of capability development (Pacheco-de-Almeida and Zemsky, 2012).

Appendix

Proof of Proposition 3

Proof. It is easy to verify that the buyer prefers dumping to squeezing when \( \pi_b \leq \tilde{\pi}_b \) or \( \pi_s \leq \pi_s^{(32)}(\pi_b) \). Note that when \( F \leq \frac{(1+B-2\tilde{\beta})c-(B-\tilde{\beta})}{1-B} \), we have \( \tilde{\pi}_b \leq c \) and therefore \( F \) does not have any effect on the buyer’s optimal choice. The results in the first bullet point of the proposition follow because \( \tilde{\pi}_b < \pi_b \) when \( F < c - \frac{c-r}{(1-B)^2} \). See the left panel of Figure 4.

When \( F \geq c - \frac{c-r}{(1-B)^2} \), we have \( \tilde{\pi}_b \geq \pi_b \). Therefore, when \( \pi_b \leq \tilde{\pi}_b \), the buyer chooses between accommodating and dumping; since the buyer’s payoff does not depend on \( F \) under both strategies, the threshold remains to be \( \pi_s^{(13)} \). By contrast, when \( \pi_b > \tilde{\pi}_b \), the buyer chooses between accommodating and squeezing. Although the buyer’s payoff under accommodating is invariant to \( F \), her payoff under squeezing depends on \( F \) if \( \tilde{\nu} \leq F \) (i.e., if \( \pi_s \geq \frac{(1-\tilde{\beta})r-(1-B)F}{B-B} \)). Note that \( \pi_s^{(12)}(\pi_b) = \frac{(1-\tilde{\beta})r-(1-B)F}{B-B} \).
Therefore, the threshold remains to be $\pi_s^{(12)}$ when $\pi_b > \pi_b$. However, when $\hat{\pi}_b \leq \pi_b < \pi_b$, the buyer compares $1 - \pi_s$ (under accommodating) with $\tau[(1 - B)(1 - F) + B\pi_b] + (1 - \tau)\pi_b$ (under squeezing), which yields the threshold $\hat{\pi}_s^{(12)}$ as defined in the paper. 

**Proof of Lemma 3**

*Proof.* The term $(1 - \beta)(1 - \pi_s)$ in $(1 - \beta)U_b^{(1)}$ is always smaller than the term $(1 - \beta)(1 - v_1)$ in $(1 - \beta)U_b^{(2)}$, so squeezing is optimal if the term $(1 - \beta)u_b^*(\alpha)$ in $(1 - \beta)U_b^{(1)}$ is no greater than $\alpha(1 - \beta)u_b^*(1) + (1 - \alpha)\pi_b$ in $(1 - \beta)U_b^{(2)}$. Note that if the optimal second-stage strategy is the same across the two cases $\tau = \alpha$ and $\tau = 1$, we have $(1 - \beta)u_b^*(\alpha) = \alpha(1 - \beta)u_b^*(1) + (1 - \alpha)\pi_b$. Thus, if the optimal second-stage strategy is the same across the two cases, $\tau = \alpha$ and $\tau = 1$, then it is optimal to squeeze in the first stage.

It is easy to verify that both $\pi_s^{(12)}(\pi_b)$ and $\pi_s^{(13)}(\pi_b)$ decrease as $\tau$ increases and $\pi_s^{(32)}$ is invariant to changing $\tau$; this implies that if it is optimal to squeeze given $\tau = \alpha$, then it is optimal to squeeze given $\tau = 1$, and if it is optimal to dump given $\tau = \alpha$, then it is optimal to dump given $\tau = 1$. Therefore, if the optimal second-stage strategy is squeezing or dumping given $\tau = \alpha$, then it is optimal to squeeze in the first stage. 

**Proof of Proposition 4**

*Proof.* The buyer compares

$$(1 - \beta)(v - \pi_s) + \beta(1 - \beta)u_b^*(\alpha)$$

with $(1 - \beta)(1 - v_1) + \beta[\alpha(1 - \beta)u_b^*(1) + (1 - \alpha)\pi_b]$. 

By Lemma 3, it suffices to consider $(1 - \beta)u_b^*(\alpha) = (1 - \beta)u_b^{(1)}(\alpha) = 1 - \pi_s$ in expression(3). Depending on the parameters, in expression (4) we may have $u_b^*(1) = u_b^{(1)}(1), u_b^*(1) = u_b^{(2)}(1), \text{or} u_b^{(3)}(1).$

If $u_b^*(1) = u_b^{(1)}(1)$ in expression (4), expression (3) minus expression (4) gives the difference $(1 - \beta)v_1 - (1 - \beta)\pi_s + \beta(1 - \alpha)(1 - \pi_s - \pi_b)$, where $(1 - \beta)v_1 + \beta[\alpha\pi_s + (1 - \alpha)\pi_s] = r$. It is easy to check the difference is positive when $\pi_s = r$ and decreases in $\pi_s$. We have the proof.

If $u_b^*(1) = u_b^{(2)}(1)$ in expression (4), $v_1$ is such that $(1 - \beta)v_1 + \beta\{[(1 - B)v + B\pi_s] + (1 - \alpha)\pi_s\} = r$. 

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Expression (3) minus expression (4) gives the difference $\beta(1 - \alpha + \alpha\tilde{B})(1 - \pi_s - \pi_b) - \pi_s + r$. It is easy to check the difference is positive when $\pi_s = r$ and decreases in $\pi_s$. We have the proof.

If $u_b^*(1) = u_b^{(3)}(1)$ in expression (4), $v_1$ is such that $(1 - \beta) v_1 + \beta \{ \alpha \{ (1 - \tilde{B}) r + \tilde{B} \pi_s \} + (1 - \alpha) \pi_b \} = r$. Expression (3) minus expression (4) gives the difference $\beta(1 - \alpha + \alpha\tilde{B})(1 - \pi_s - \pi_b) + \beta \alpha (1 - \tilde{B})(c - r) - \pi_s + r$. It is easy to check the difference is positive when $\pi_s = r$ and decreases in $\pi_s$. We have the proof. \qed
References


