Research Report

Buyer-Supplier Coordination Mechanisms in Business to Business Transactions

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First Version: May 15, 2001

Summary

This is the first of two research reports examining the role of dynamic pricing and B2B e-marketplaces in the supply chain. In this report, we set the stage for our analysis of e-marketplaces by characterizing the mechanisms by which buyers and suppliers in Business-to-Business (B2B) relationships agree on transaction terms and conditions such as prices and order quantities. We focus on two particular mechanisms: relationship-based contract coordination and market-based price coordination. This survey describes the essential characteristics of each mechanism, underscoring its advantages and disadvantages. We also briefly discuss the industry and market conditions for which each mechanism is best suited.

There are a number of reasons why a thorough understanding of B2B coordination mechanisms is important. One of the greatest advantages of e-marketplaces is that they create an opportunity to exploit market-based coordination in a B2B setting. However, the introduction of market mechanisms can be risky, since it can undermine the benefits of long-standing supply chain relationships. Moreover, there are a number of fundamental differences between market-based and relationship-based coordination mechanisms that can be extremely difficult to reconcile. Understanding the strengths and weaknesses of each mechanism is an essential prerequisite to the formulation of an e-marketplaces strategy, since it provides a basis for ascertaining when and how each mechanism can be applied to maximum advantage.

The titles of the two reports are:

- *Buyer-Supplier Coordination Mechanisms in Business to Business Transactions*
- *The Role of E-Marketplaces in Supply Chain Coordination*

Introduction

In a modern multi-echelon supply chain, business transactions can be extraordinarily complex. Multiple firms, each with unique and competing objectives, must coordinate production processes to respond to rapidly shifting patterns in customer demand. Decisions must be made quickly, and often with imperfect knowledge about future supply and demand. Overall supply chain performance benefits from the sharing of information, but in many cases the competing interests and incentives of supply chain partners prevent the unfettered flow of information.

Business transactions involve an explicit or implicit agreement between buyers and sellers on many terms and conditions. We refer to the means by which transaction terms are determined as the *coordination mechanism*. For example, transaction prices may be announced, negotiated, or determined by a market mechanism. Transaction quantities may be stipulated contractually, or determined by demand and availability. Coordination mechanisms vary from market to market, depending on factors such as the importance of buyer-supplier relationships, the degree of buyer and supplier concentration, the uniqueness of the product or service, and the frequency of transactions.

This report surveys mechanisms by which buyers and suppliers agree on transaction terms and conditions. The structure of the report is as follows. Part 1 analyzes relationship-based contract coordination, describing the essential characteristics of this mechanism, and highlighting its advantages and disadvantages. Part 2 provides a similar analysis of market-based price coordination, discussing different dynamic pricing mechanisms, and the industry and market conditions for which each mechanism is best suited.

1. Relationship-Based Contract Coordination

The most common means of buyer-supplier coordination in B2B markets is through long-term relationships and supply contracts. In a B2B setting, prices often vary by customer,

reflecting differences in product characteristics, purchasing volumes, and service requirements. Coordination is based on one-to-one negotiations. Often the outcome of these negotiations is influenced by the nature and perceived value of the long-term relationship between the buyer and supplier.

1.1 Long-term Relationships and Sticky Prices

Despite the high visibility of anonymous, arm's length transactions in consumer and commodity markets, the majority of economic transactions involve long-term relationships. Based on a survey of about two hundred U.S. companies representative of non-government GDP, Blinder et al. (1998) report on the widespread use of contracts. According to their data, about 38 percent of private-sector GDP is covered by explicit contracts, of which about three-quarters set prices for a stated period of time. About two-thirds of all U.S. companies have implicit contracts for prices, or implicit understandings with their customers that they will not "take advantage of the situation by raising prices when the market is tight." Perhaps most impressive is that on average 85 percent of sales go to regular customers. More than half the sample reported that over 90 percent of their sales represent repeated business. The evidence is overwhelming that long-term relationships are very important for many firms, and that use of supply contracts is far more prevalent than the use of dynamic or strategic pricing.

Given the widespread use of contracts, it is not surprising that prices are "sticky", i.e., price changes lag supply and demand shocks. Even in the absence of explicit price contracts, firms are very sensitive about antagonizing regular customers by raising price. Blinder et al. reports that fully 78 percent of GDP is re-priced quarterly at best. About three months typically pass between a supply or demand shock and firms' price response.

Blinder's survey also tested twelve economic theories of price stickiness by asking price setters in firms to rank each theory's relative importance. The highest overall ranked explanation of price stickiness was the theory of *coordination failure*. According to this theory, price setting involves an element of "following the crowd." When there is no

clear price leader, firms are reluctant to raise prices for fear that the competition will not follow suit, and the price increase will be perceived as unjustified or inappropriate.

Two other highly ranked explanations pointed to a direct link between sticky prices and long-term relationships. One explanation was *explicit contracts*, which fix about 28 percent of all prices in the U.S. economy. The related notion of *implicit contracts* was also a top contender. Price stickiness related to implicit contracts is also known as the "invisible handshake" theory, attributed to Okun (1981). Buyers and sellers who value long-term relationships essentially agree not to change prices in tight or slack markets. An exception occurs when there are clearly visible cost increases, in which case price increases are perceived as "fair."

Neither Blinder nor Okun offers a single decisive reason why buyers and sellers prefer price stability. Possible explanations include a desire for risk sharing, and the difficulty of agreeing to a "fair market" price in the presence of asymmetric information about cost structures and competitor prices. Okun argues that stable prices promote customer loyalty, since customers are more likely to shop around when prices change. Another important explanation is that in practice firms engage in *non-price competition*, seeking to balance supply and demand by changing quality or service levels, instead of price.

1.2 The Value of Relationships

Supply chain participants benefit from relationship-based contract coordination in several ways. As discussed earlier, price stickiness increases customer loyalty, facilitates risk sharing, and reduces the cost of agreeing on "fair" prices. The "invisible handshake" theory of implicit contracts suggests that sticky prices represent a sort of *quid pro quo* over time, which benefits the seller in times of oversupply, and buyers during shortages. Long-term relationships also provide opportunities for customized pricing, reductions in transaction and agency costs, and improved information sharing for production coordination. In this section, we discuss these three sources of value in greater detail.

Customized pricing allows a supplier to set a price based on the true cost and benefit that a customer brings to the firm. For example, a regular customer with substantial purchasing volumes and predictable sales patterns allows the supplier to plan production and capacity better. The customer imposes a lower cost on the firm, which should be reflected in its price. Similarly, different prices may be justified based on the levels of technical support required, effort required from sales, potential for future business, and benefits from strategic partnering. Implicit and explicit contracts are an important prerequisite for customized pricing, since contract prices are closely guarded information, and therefore allow suppliers to practice price discrimination.[1] One perspective is that this allows the supplier to extract a price as high as the customer is willing to pay. However, in practice, the profit balance between suppliers and buyers depends on their relative market power, and on the nature of their implicit contracts.

The importance of customized pricing and relationship-specific contracts underscores the difficulty of using e-marketplaces to bring dynamic pricing into the world of contracts. A concise way to articulate the advantages and disadvantages of each transaction mechanism is through the economic framework of transaction costs. In markets where relationships emerge, the cost of doing business through contracts and relationships is presumably lower than the cost of using market transactions. Long-term relationships can be a more efficient way to maintain ongoing business relations, and by sharing information, firms can improve production planning, and reduce inventory and order fulfillment costs. The economics literature on transaction costs (e.g., Williamson 1971, 1985) emphasizes the importance of agency costs, suggesting that a concern for the future often provides incentives for cooperative long-term relationships that avoid the opportunistic behavior associated with short-term planning. Agency costs are particularly important when relationship-specific assets are involved, such as capital investments made on behalf of a specific customer, or jointly developed intellectual property. Long-term partners are less likely to "hold up" one another for short-term gain.

[1] Price discrimination is the practice of charging different prices to different customers for the same good or service.

Short of vertical integration, the next best option to reduce agency costs is to develop long-term relationships. Other reasons for long-term relationships include the presence of strategic synergies, like joint technological capabilities, reductions in product development cycle time through collaboration, and learning effects.

The importance of *information sharing* in relationships has received particular attention in the supply chain management literature. Sharing sales information has been viewed as a major strategy to counter the bullwhip effect, in which the variability of orders is amplified as it moves upstream in the supply chain (Lee et al., 1997). This information distortion causes problems such as inaccurate forecasts, low capacity utilization, excessive inventory and poor customer service (Lee et al., 1999). Providing suppliers direct information about final customer demand can reduce by the bullwhip effect. Demand sharing between downstream operators and suppliers is the driving force behind collaborative relationships such as Vendor-Managed Inventory and Continuous Replenishment Programs, as well as recent industry initiatives such as Quick Response and Efficient Consumer Response.

1.3 Supply Contracts and Channel Coordination

Although contracts and long-term relationships provide many advantages, they are far from perfect. In some cases, explicit or implicit contracts do not provide appropriate information flows or incentives. Although slowly changing prices may provide incentives for long-term investment decisions, they provide little help for short-term production and allocation decisions. The difficulty is magnified if capacity is constrained in the short-term, since efficient capacity utilization and allocation may also become an issue. Without futures markets, suppliers depend on buyers for forecasts of future demand, and buyers depend on suppliers to ensure availability of supply.

The supply chain management (SCM) literature has focused on creating the right incentives for efficient information and material flows and effective production planning.

An emerging body of SCM research, reviewed by Tsay et al. (1999), evaluates supply contract design for channel coordination. Such contracts are designed to assign the true economic costs to fill an order, and to provide economic incentives to coordinate interactions between buyers and suppliers to increase supply chain value. A commonly studied SCM incentive problem is establishing the optimal capacity reservation (typically levels of finished goods inventories) under decentralized control.[2] Buyers prefer to order with short lead times so they can better respond to changes in their own demand, and therefore like to avoid attaching commitments to demand forecasts. On the other hand, suppliers need to plan production and capacity (i.e. finished goods inventory) in advance of end-customer demand realization, but depend on the buyers for demand forecasts.

Two capacity planning problems result from these conflicting incentives. First, buyers have an incentive to inflate their forecasts as a form of insurance. Second, even with unbiased forecasts, suppliers may not be willing to stock a system optimal level of inventory, since the supplier assumes all the inventory risk if the demand is short of expectation, but receives only a fraction of the system profits.[3] Whether the buyer or supplier has more flexibility is a consequence of their relative market power. Regardless, the outcome does not maximize total profits of both the buyer and the supplier, and there are opportunities to redesign contract structures so that both parties are better off (Tsay, 1999).

The performance objective for most of the SCM contract research is the minimization of system inventory costs (storage and shortage costs), and the typical goal is to create incentives for buyers to provide unbiased forecasts, and for suppliers to carry enough inventory. A number of frameworks have been proposed that use a combination of quantity commitments and pre-specified price discounts or penalties for variations from

[2] Decentralized control is the case in which both buyer and supplier act as independent profit-maximizing agents. In contrast, the system optimal would be guaranteed in a centralized system.

[3] This is known as the "double marginalization" problem. It occurs because inventory risk is disproportionately born by the supplier, and stocking levels may not be system optimal. In build to stock contexts, it is often observed to lead to underproduction of finished goods inventory (Tsay, 1999).

those commitments. For example, the simplest mechanism is *minimum purchase commitments* (Bassok & Anupindi, 1997), in which the buyer agrees to periodic deliveries of a minimum quantity to smooth demand for the supplier.

Two of the most studied industries are electronics and apparel, both characterized by short product cycles and highly uncertain demand. The value of coordination is high in these industries, since product obsolescence quickly erodes the value of inventory. In electronics, capacity is not flexible and responsive enough to keep up with highly volatile market demand. In apparel, suppliers must build up inventory in anticipation of seasonal demand, but have limited capacity to respond to demand once it is observed. Excess inventory must be salvaged at significant markdowns. For the apparel industry, Eppen & Iyer (1997) study *backup agreements* in which the buyer is allowed a certain backup quantity in excess of its initial order commitments at no premium, but pays a penalty for any of these units not purchased. Barnes-Schuster et al. (1998) provides a generic options framework for studying the role of flexibility in a buyer-supplier system for short life-cycle products, again focusing on the apparel industry. In the electronics industry among others, constraints on order quantities are provided under arrangements known as *quantity flexible contracts* (Tsay & Lovejoy, 1999). Quantity flexible contracts attach a degree of commitment to buyer forecasts by imposing constraints on the buyer's ability to revise the forecasts over time. Tsay & Lovejoy (1999) review references to the use of quantity flexible contracts in the electronics industry, including Sun Microsystems for the purchase of workstation components, contract manufacturer Solectron for both its customers and materials suppliers, as well as computer manufacturers IBM, HP, and Compaq.

Though the focus of most SCM contract research is inventory costs and quantity commitments, some papers consider broader issues. Brown & Lee (1998) study *options* on manufacturing capacity. In the semiconductor industry, under agreements known as *pay-to-delay* capacity reservation, suppliers offer reservation of wafer fabrication capacity in return for a fixed up-front payment. Brown & Lee study options on capacity that involve lower up-front payments to purchase the options, but include exercise prices.

However, their approach is still very much in the spirit of quantity flexible contract research, since they do not consider explicit capacity constraints, only price premiums paid for unreserved capacity. Other coordination papers focus on double marginalization, in which the first-best outcome is not reached because each party fails to internalize the effects that its production and pricing decision has on its counterparty. [4] For example, Pasternak (1985) and Donohue (1996) study *buyback contracts* in the apparel industry, where the supplier commits to buy back excess inventory at a lower cost. Another niche in the SCM contracts literature considers long-term contracts as an alternative to dynamic market prices, but the focus is on *risk-sharing* when buyers are risk averse, not on channel coordination (Cohen & Agrawal, 1999; Li & Kouvelis, 1999).

1.4 The Limitations of Contracts for Channel Coordination

Despite research efforts in modifying contract structures to better coordinate the supply chain, the inflexibility of contracts can limit their effectiveness for channel coordination. Once written, contracts are difficult and costly to renegotiate, making them unresponsive to changing market conditions. Furthermore, contracts are created through negotiations between individual buyers and suppliers. Even if they are renegotiated, they reflect only the changing beliefs and expectations of the individual parties involved, rather than those of the market as a whole.

Another drawback of many of the contract structures proposed in the SCM literature is that they are difficult to apply to multiple buyers. For example, quantity flexible contracts may be useful when a supplier is only dealing with one or two major buyers. When applied to a broader set of buyers, however, the supplier must collect forecasts from multiple buyers, and seek to create an optimal portfolio of contracts. As the number of buyers grows larger, contracting becomes an increasingly inefficient means of exchanging information and coordinating production. In addition to the complexities of

[4] For a more complete definition of double marginalization, see footnote 3.

portfolio management, the cost of negotiating and maintaining multiple contracts with terms contingent on demand and quantity may be prohibitive.

Portfolios of supply contracts do offer potential advantages, though. They may provide some risk-pooling effects with respect to the supplier's materials management, although it is unclear how to assess the correlation of different buyers' demands. Portfolio effects are especially important with regard to supplier capacity, since capacity must be allocated across multiple buyers. We are unaware of any research into the design of optimal supply contract portfolios.

Although supply contracts are usually an efficient mechanism for coordinating inventory and production planning, their effectiveness can be limited during short-term supply shortages. When demand exceeds supply, relationship-based contracts can actually exacerbate supply shortfalls, since fixed contract prices are sometimes too low to induce suppliers to utilize inefficient existing capacity, or to invest in additional, costly capacity.

2. Market-based Price Coordination

At the opposite end of the spectrum from relationships is pure market-based price coordination. If price varies dynamically in response to market conditions, then supply and demand can be brought into equilibrium. Prices can be determined using a many-to-many exchange, a one-to-many auction, or a seller dynamically pricing based on demand-supply balance.

2.1 Exchanges

A many-to-many exchange represents the ideal form of a pure market mechanism. An exchange can be broadly defined as a trading network enabling the buying and selling of goods and services in markets where prices are free to move in response to supply and

demand. Classic examples are commodities and securities markets, in which the price is determined by market makers who interact with a critical mass of buyers and sellers bidding for a fixed supply of standardized products. Price movements are a natural consequence of the dynamics leading to equilibrium between supply and demand.

Market mechanisms can result in the most efficient means to produce and allocate goods, provide proper incentives, and convey information. The prices offered for goods and services convey information about buyers' valuations, and prices asked by producers convey information about production costs. The market mechanism provides incentives to allocate resources to buyers who value them most, and to satisfy wants from low-cost producers. Perfectly efficient markets can only be realized in many-to-many market transactions with perfect competition and no externalities or transaction costs. [5]

Financial economics offers additional lessons about efficient markets. When a product is a storable commodity with common value to everyone, efficient spot markets will result in a price based on the collective beliefs of all the market participants. In a similar fashion, prices in futures markets represent a consensus market forecast for future prices. Another key cornerstone of financial economics -- the no arbitrage condition – essentially states that the same good should have the same price in all markets. The no arbitrage condition implies that derivative instruments will be fairly priced according to market expectations, allowing for the possibility of risk management. Furthermore, the market mechanism offers the potential for all these efficiencies *without explicit negotiation* between every buyer and seller.

2.2 Auctions

It is less obvious how market pricing can effectively be used outside of the perfectly competitive markets of classical economics. Except for pure commodity markets, where

[5] A number of factors can prevent markets from functioning properly. Instances of *market failures* include public goods, monopolies, network externalities, and information asymmetries.

price is dictated by industry-level dynamics, firms compete on attributes other than price. The farther a market moves from the ideal world of perfect competition, the more likely it is that the selling firm is a price-setter rather than a price-taker. The market mechanism then becomes one of many options a seller can use to manage demand.

One market mechanism that does not require perfectly competitive markets is the one-to-many regime of auctions, where economics offers a rapidly growing body of research. Klemperer (1999) provides an extensive review of the auction literature. Single-unit auctions maximize revenue for the seller and are generally an efficient means to allocate an item to the bidder with the highest valuation. The Vickrey (second price) auction is always efficient, even in the multi-unit context, when bidders have private values (Dasgupta and Maskin, 2000).[6] The multi-unit Vickrey auction sets a price just high enough so that the demand matches the quantity up for auction. Barring collusion, buyers should bid their truthful valuation, and allocation is efficient. Sellers also have reason to favor auctions. It is intuitive that an auction with a reserve price will always generate at least as much revenue as fixed-price sales, since there is a chance that the auction price will be bid above the reserve price. Also, auction prices provide instant information about demand as a function of price, so firms can make more informed resource allocation or investment decisions.

2.3 Revenue Management and Other Dynamic Pricing Practices

The phrase "dynamic pricing" is used to describe many different things. It is frequently employed as a synonym for market mechanisms like spot markets. In the retail industry, it is used to refer to price discrimination -- setting different prices for the same item based on shoppers' income levels or buying habits. In the marketing and operations management literature it refers to optimal pricing policies over a specified time horizon.

[6] Private values are a function of individual preferences and willingness-to-pay, whereas common values occur when valuation is a function of privately held information about the market value of a good.

Common examples of dynamic pricing practice include revenue management, priority pricing of capacity, and dynamic pricing of inventories. The rest of this section explains each of these in greater depth.

2.3.1 Revenue management

Revenue management is a widely studied and practiced means to ration perishable assets. Previously known as yield management in the airline industry, revenue management is defined by Weatherford (1998) as "the optimal revenue management of perishable assets through price segmentation." Though prices are typically pre-set, sellers effectively have price flexibility, since they can respond to uncertain demand by restricting sales to price-conscious customers in favor of anticipated sales to customers willing to pay more. Weatherford provides an overview of revenue management problems and models, and defines three characteristics that are essential to the success of revenue management:

- *There is a date on which the product or service becomes available after which it is either not available or ages.* The product or service cannot be stored, at least without significant cost or depreciation in value. If storage were cost effective, inventory management approaches would apply instead. Examples include seats for transportation or entertainment events; hotel bookings or apartment rentals; fashion or high-tech goods; services such as auto repair; broadcast advertising periods; and capacity on telecommunications channels.
- *Essentially only a fixed number of units available, since the number of units can only be increased with some time lag and at a high cost of adding incremental capacity*. Typically high fixed costs are accompanied by relatively low variable costs, so that a wide range of prices are still profitable. Airlines, for example, may have a variable cost of $20 per seat, so they might be willing to significantly discount a $300 airfare rather than letting a seat go empty.
- *Customers can be segmented according to price-sensitivity.* There must be some mechanisms (like Saturday stay-overs and seat classes in the airline industry) to segment customers as a means of price discrimination. Customers do not necessarily

need to be segmented into distinct populations, since time of purchase is a natural segmentation mechanism. People who make their reservations early tend to be more price-sensitive and more flexible. Willingness to pay for flexibility is a sufficient criterion for segmentation.

Sophisticated revenue management systems are now widely used by airlines, hotels, car rental companies, and commercial shippers. Adoption is increasing in other industries. Suppliers benefit in several ways from revenue management, including third-degree price discrimination,[7] and efficient inventory control for coping with uncertain demand and a perishable asset.[8]

Revenue management has been successfully applied primarily in industries where firms have both market power, and a relatively anonymous relationship with their customers. As a result, customers commonly perceive revenue management as the actions of a monopolist striving to increase profits by practicing price discrimination. Despite this perception, revenue management does offer a means of efficient coordination when demand is uncertain and supply is rigid, and can bring significant system-wide efficiency.

In the airline industry, for example, business travelers benefit from incremental ticket sales to leisure travelers, which help the airlines defray their fixed costs. Research has shown that in the airline industry there is an inverse correlation between market concentration and price dispersion -- the degree of difference in prices offered. Dana (1999a), citing this data, develops an economic model which shows that demand uncertainty, and the perishable nature of the assets, are sufficient to explain different prices for the same good in a competitive equilibrium. Dana (1999b) provides another

[7] Third-degree price discrimination occurs when sellers can identify different groups of customers and offer each group different prices. For example, airlines charge more when travel does not involve weekend stays, effectively discriminating between business and leisure customers.

[8] A recent review of revenue management research by McGill and van Ryzin (1999) highlights the discipline's primary focus on managing inventories of non-storable assets. A related line of research introduced by Veinott (1965) considers inventory rationing with multiple demand classes. Rather than focusing on maximizing revenue, though, the focus is on deriving optimal order policies for raw materials and providing minimum service levels to high priority contractual customers. Melchiors et al. (2000) is a recent example of this research. Peak-load pricing, a variant of revenue management, is discussed in the next section.

model to show that revenue management is a virtual means of achieving the same system-wide efficiency as peak-load pricing. Even if firms do not know when demand peaks will occur, they can shift demand from peak to off-peak times by setting multiple prices, and rationing availability at lower prices. Dana shows that this pricing strategy is the unique competitive equilibrium when firms have no market power.

Properly structured supply contracts are better than revenue management for optimal capacity and production planning, since they not only alleviate double marginalization, but also induce truthful order commitments.[9] Revenue management, however, is a more efficient coordination mechanism in the face of short-term supply shortages. When prices adjust dynamically to accurately reflect market conditions, suppliers have an incentive to more efficiently utilize scarce production capacity, and buyers have an incentive to provide early order commitments. Revenue management also simplifies the process of efficiently handling multiple buyers, since it avoids the difficulties associated with managing a complex portfolio of supply contracts

Revenue management will face challenges gaining acceptance in relationship-based B2B supply chains. Its value proposition is clear for suppliers seeking to maximize their revenue. However customers – especially those paying higher prices -- will find it difficult to believe that they benefit from improved capacity utilization and product availability. Although revenue management has been successfully applied to anonymous transactions in consumer environments, it is not yet proven in B2B environments, where relationships are critical. Nevertheless, applications of revenue management that preserve the value of relationships, and provide clear benefits to both buyers and sellers, could bring the efficiency of price-based allocation into relationship-based supply chains.

2.3.2 Priority and Peak-load Pricing

[9] Dynamic pricing worsens the double-marginalization problem, because suppliers may deliberately produce less in the hope of driving up spot market prices.

Wilson (1993) describes forms of nonlinear tariffs that are used to constrain demand in industries with highly rigid supply. In the power industry, *priority pricing* is used to allow suppliers to curtail or interrupt service to lower-paying customers who voluntarily select less reliability in exchange for lower rates. This works when some customers have consistently lower valuations for reliability than others. Capacity pricing, or *peak-load pricing*, is another variant of nonlinear pricing used in the power, telecommunications, and transport industries. Higher prices are charged during peak load periods, based on a previously announced schedule. This form of pricing works well when suppliers have prior information about when peak demand occurs. In general, nonlinear pricing is limited to contexts in which demand follows predictable patterns, or where customers can be segmented in advance by their price sensitivity.

2.3.3 Dynamic Pricing of Inventories

Gallego & van Ryzin (1994) and Zhao & Zheng (2000) have analyzed policies to maximize revenue from inventory that is to be sold over a given time horizon. The problem arises for service offerings like flight seats and hotel rooms, and in industries such as fashion retailing in which manufactured goods have a limited shelf life. At any particular time, the optimal price typically decreases with inventory, and for a given inventory level the optimal price decreases with time. In short, this research addresses optimal mark-downs as the date of expiration grows closer, when there is no customer segmentation, and when customer valuations are independent of purchase time.

3. Conclusion

This research report surveyed buyer-supplier coordination mechanisms in B2B transactions.

In Part 1, we discussed relationship-based contract coordination mechanisms. The section covered the nature of contract pricing, the value of long-term relationships, and the structuring of contractual terms and conditions. We also surveyed the supply chain management literature on supply contracts and channel coordination, and discussed some of the difficulties created by conflicting objectives and information asymmetries in the extended supply chain.

In Part 2, we discussed market-based price coordination. Topics included the role of marketplaces and auctions in supply chain coordination, and an analysis of a number of dynamic pricing mechanisms, including revenue management, priority pricing of capacity, and dynamic pricing of inventories.

This is the first of two research reports examining the role of dynamic pricing and B2B e-marketplaces in supply chain coordination. The next report, entitled *The Role of E-Marketplaces in Supply Chain Coordination*, analyzes application of dynamic pricing in greater depth. It also reviews a number of ways that e-marketplaces and dynamic pricing approaches can create value for buyers and suppliers, while still preserving long-term supply chain relationships.

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