

Market Microstructure and Intermediation

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Classical economics poses three questions: what shall be produced, how shall it be produced, and for whom. Stiglitz (1994, pp. 5–6) observes that in addition to these three questions, one should add a fourth: “How should these decisions be made, and who should make them?” In a market economy, the practical answer to this question is that *firms* decide what, how and for whom. Many markets are guided by the “visible hand” of firms, as observed by Alfred D. Chandler (1977), while in others, firms are guided by the “invisible hand” of the market, as emphasized by Adam Smith. Firms establish and operate most markets by setting prices, carrying out transactions, forming and monitoring contracts, and producing and distributing information.

Firms create and manage markets by acting as intermediaries between buyers and sellers. An *intermediary* is an economic agent that purchases from suppliers for resale to buyers or that helps buyers and sellers meet and transact. Intermediaries seek out suppliers, find and encourage buyers, select buy and sell prices, define the terms of transactions, manage the payments and record keeping for transactions, and hold inventories to provide liquidity or availability of goods and services. In finance, the study of intermediation and the institutions of exchange is called *market microstructure*. I apply the term market microstructure to markets in general. Rather than focusing on aggregation of buyer and seller decisions about prices and quantities, I emphasize transactions and the activities of firms that structure these decisions.

When acting as intermediaries, firms answer the three classical questions by

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making decisions about the mix of products they will purchase from suppliers, the types of suppliers that they will contract with, and the allocation of goods and services to be offered to their customers. The distinction between merchants and manufacturers need not be clear cut. In combination with managing transactions, intermediaries often transform products to add value: transporting, storing, repackaging, assembling, preparing for final use, and adding information and guarantees. Conversely, manufacturers carry out many market-making activities, intermediating between sellers of raw materials or product components, and buyers of manufactured goods.

Many economists will recognize this analysis as having roots in the work of Ronald Coase (1937) and Oliver Williamson (1975), who have identified the importance of transaction costs in shaping the organization of firms. Yet, the insight that transactions are costly yields additional implications about the organization of *market* institutions. Just as producing goods and services consumes resources, so does the establishment and operation of markets to allocate those goods and services.

Companies incur costs in adjusting prices and communicating price information to buyers and sellers. The types of information imperfections that are present determine the intermediation activities of firms. When demand and supply have an element of randomness, intermediaries provide liquidity or “immediacy” by standing ready to buy and sell. Given uncertainty about the willingness to pay or opportunity costs of trading partners, intermediaries coordinate transactions by match-making and brokering activities. When the characteristics of buyers or sellers are unobservable, intermediaries generate market information and provide guarantees for product quality. When the actions of buyers or sellers are costly to observe, intermediaries provide monitoring and contracting services.

The main function of market intermediaries is to figure out ways of clearing the market: that is, pricing to match purchases to sales. This crucial price-setting activity provides an explanation for a main puzzle of neoclassical economics: how are the market equilibrium prices attained? The market institutions that provide intermediation have not been given the attention they deserve.

The purpose of this paper is to emphasize the important economic role played by firms as intermediaries. I begin by highlighting the importance of intermediary firms: it seems likely that intermediation comprises over a quarter of the U.S. economy! Then, drawing on models of market microstructure and financial intermediation, I focus attention on four of the most important actions of economic intermediaries: setting prices and clearing markets; providing liquidity and immediacy; coordinating buyers and sellers; and guaranteeing quality and monitoring performance. I also consider the significant implications of economic and financial models of intermediation for microeconomic analysis.

Intermediation in the U.S. Economy

In thinking about the role of intermediaries in an economy, it is analytically useful to recognize three types of agents: consumers, market-taking firms and

market-making firms. Market-taking firms take price signals and market institutions as givens. In contrast, market-making firms are intermediaries that create and operate markets. Market makers include not only price-making firms but also other market institutions such as organized exchanges for securities, options, futures and other financial assets. They coordinate transactions between consumers, between market-taking firms, between consumers and market-taking firms, and between other intermediaries. Consumers send expenditures to intermediaries in return for goods demanded, and receive incomes from intermediaries in return for inputs supplied. Similarly, market-taking firms receive revenues from intermediaries in return for goods supplied and make factor payments to intermediaries in return for goods received. Thus, the presence of intermediaries in the economy modifies the familiar "circular flow" of economic activity.

These intermediaries, or market-making firms, make a significant contribution in the U.S. economy. The exact amount is difficult to assess, since it requires estimating the contribution of market-making activities to value added in sectors like manufacturing, agriculture, mining, construction, transportation, or public utilities. But as a rough estimate of shares of gross domestic product, one might begin with the idea that intermediation includes retail trade (9.3 percent of GDP), wholesale trade (6.5 percent), finance and insurance (7.3 percent), and some business services and other services (1.9 percent). On this conservative estimate, assuming that market-making activities in all other sectors are zero, intermediation activities would still account for about one-quarter of gross domestic product.¹ Table 1 offers some broad measures of these intermediation-oriented industries. It may also be useful to specify more closely what these two million firms do, and what intermediation activities they carry out.

Retailers include supermarkets, discount stores, department stores, general merchandise stores, specialty apparel stores, warehouse clubs, drug stores, convenience stores and variety stores. Some sell durable goods, some sell nondurables, and some sell both. The retail sector performs a wide variety of intermediation functions including pricing, marketing, inventory holding, selection of suppliers, setting bid prices offered to suppliers, quality certification and management of transactions. Retailers have enhanced their market-making activities through Electronic Data Interchange (EDI) with their suppliers, which lowers costs and increases speed in exchanging data on sales, inventory and marketing as well as expediting billing and invoicing. Retailers are generating improved data through bar coding of merchandise, point-of-sale scanners, and computerized inventory tracking and reordering. This increases information about sales and allows a rapid response to changing market conditions.

Wholesalers act as intermediaries for transactions between businesses. Like retailers, they distribute goods, manage inventories, communicate price and product information, certify quality and provide credit. Wholesalers market to retailers,

¹ An industry's general product by origin (GPO) or value added equals its gross output (sales or receipts and other operating income plus inventory change) minus its intermediate inputs (consumption of goods and services purchased from other industries or imported); see Yuskavage (1994).

Table 1
Intermediation in the U.S. Economy

	<i>Value Added to GDP (1993 current dollars, billions^a)</i>	<i>Share of GDP</i>	<i>Number of Firms^b</i>
Retail Trade	\$592.4	9.33%	1,066,358
Wholesale Trade	\$413.1	6.51%	386,609
Finance, Insurance ^c	\$462.1	7.28%	404,243
Selected Services	\$220	1.89%	142,095
Total	\$1,687.6	25.01%	1,999,305

^a Source: Survey of Current Business, April 1995, Table 1, p. 47.

^b Source: 1992 Census (Retail Trade; Wholesale Trade; Finance, Insurance and Real Estate Industries, Services). Number of firms for finance, insurance includes real estate agents and developers.

^c Excludes nonfarm housing service and other real estate.

search for suppliers and handle interbusiness transactions. In addition, as noted by the U.S. Department of Commerce's (1994) *U.S. Industrial Outlook 1994*, they increasingly provide "value-added services" such as packaging, labeling, bar coding, electronic data interchange, product lot tracking, inventory controls and faster delivery.

About 90 percent of firms in the wholesale sector, holding 60 percent of the market, are merchant wholesalers (U.S. Department of Commerce, 1994, p. 38.1).² Their business is split about 50–50 between durable and nondurable goods. The other 40 percent of the wholesale sector is split between a number of other intermediation arrangements. The most important of these alternative distribution arrangements includes direct manufacturer-retailer transactions (retail chain stores, warehouse clubs, discount stores and home center stores), mail order, catalog sales, manufacturer-industrial user transactions and retail sales to industrial users (U.S. Department of Commerce, 1994, p. 38.2).³ Wholesalers also include manufacturers' sales branches, agents, brokers and commission merchants.

Financial intermediaries perform a wide array of services including pricing of some financial assets, providing liquidity, allocating risk, allocating financial assets

² While many people can name retailers, the largest wholesalers are less well known. The 10 largest wholesalers in 1994 were Supervalu, Fleming, McKesson, Sysco, Alco Standard, Bergen Brunswig, Cardinal Health, Foxmeyer Health, Merisel and Genuine Parts (*Fortune*, May 15, 1995).

³ Measuring the wholesale trade industry can be difficult. As noted by *U.S. Industrial Outlook 1994* (U.S. Department of Commerce, 1994, p. 38.2), retail sales to industry are no longer included in the Census Bureau's sales totals for wholesale establishments. However, manufacturers' sales branches, agents, brokers and commission merchants, continue to be included in the GDP figures. It quotes an industry survey for 1992 in which total wholesale was divided as follows: 45 percent through merchant wholesalers, 7 percent through agents, brokers and commission merchants, 26 percent through alternative channels, and manufacturers' sales branches distributed 23 percent. Clearly, some of the wholesalers' traditional activities are being carried out by retailers and are reflected in value added of the retail trade. Also, some of the strategic alliances between retailers and manufacturers appear to reflect increased wholesaling responsibilities for manufacturers, which show as a contribution to manufacturing value added.

over time, combining assets to reduce the transaction costs of diversification, supplying information and managing transactions. Depository institutions intermediate between borrowers and lenders, setting rates of interest for loans and deposits, screening borrowers for creditworthiness and monitoring their repayment performance. Securities and commodity brokers provide a range of intermediation services managing complex financial transactions, carrying out trades on the organized exchanges and supplying investors with information. Insurance companies manage transactions, allocate risk and intermediate between investors and buyers of insurance contracts.

Finally, many business services can be classified as intermediation, including advertising, credit agencies, direct mail advertising services, personnel supply services and computer rental and leasing.⁴ The gross sales in these particular areas amount to about half of business services. This is the basis for the earlier estimate that intermediation activities contribute about half of the value added of business services, or approximately 1.9 percent of GDP.

Some activities in the retail and wholesale sector may be closer to production than to intermediation. Conversely, intermediation activities are present that can be difficult to discern in aggregate data on the manufacturing, agriculture, mining, construction, transportation or public utilities sectors. Manufacturers do expend a substantial effort on marketing and sales, purchasing, personnel recruitment, financing and technology procurement, and surely such activities account for some share of the value added by the manufacturing sector. However, the aggregate manufacturing data are focused on units of output, employees, total costs, inventories, and receipts, and do not separate out the value added by the retail, wholesale, marketing, and sales activities carried out internally by manufacturers. Many of the companies in manufacturing, mining, construction, transportation and public utilities sectors are vertically integrated. These companies carry out many intermediation functions that are difficult to identify from company data, including pricing, marketing, inventory management and ordering from suppliers. This shortcoming in the manufacturing data reflects the traditional economics perspective that the firm is a manufacturer and that market allocation decisions are handled by an exogenous price system.

In addition, manufacturers have significant finance and personnel requirements. They devote effort to raising capital on financial markets, communicating with investors and issuing debt and equity. Manufacturers also invest in hiring personnel, learning about the labor market and managing the employment relationship. Such labor market activities are explicitly recognized contributions to GDP as part of business services when they are outsourced to temporary help firms.

⁴ Such services made up \$1.264 trillion in value added, or 20 percent of GDP, in 1993. It is difficult to determine the extent to which services represent intermediation activities. For example, due to data limitations, I choose to exclude accounting services even though some of these services are directed to information gathering by firms for provision of information to the financial markets. Also, I exclude legal services even though there are some legal aspects to intermediation, particularly in forming contracts with customers and suppliers.

Similar considerations apply to companies in the mining, construction, transportation and public utilities sector. For example, Exxon, which is the largest industrial corporation with \$97 billion in sales, not only carries out mining and refining, but makes a complex set of decisions about purchases, supplies, inventories and pricing. In construction, a company such as Fluor (almost \$9 billion in sales) acts as a general contractor, coordinating a segment of the market for a variety of construction services. Large transportation companies, such as the United Parcel Service (\$17.7 billion in sales), manage a vast transportation market intermediating between customers mailing packages and transportation suppliers. The trucking company J.B. Hunt Transport (\$1 billion in sales) performs intermediation services by coordinating transfers of shipments with rail and shipping companies. Large utilities, such as Commonwealth Edison, operate large-scale wholesale and retail power markets, contracting with suppliers of fuel and residential, commercial and industrial customers.

Thus, companies combine manufacturing with merchant activities, operating markets for goods and services and factors of production. Carrying out such transactions is costly, and these costs would not be incurred in the absence of corresponding benefits. Using the aggregate data, along with case-by-case examples such as those given here, it is possible to gather a rather rough idea of the contribution of intermediation activities to value added in these other sectors.

One indicator of market-related activities is that one-third of the nation's 18 million manufacturing employees are not classified as production workers. These include sales, delivery, advertising, credit, installation and servicing, clerical, executive, purchasing, financing, legal, personnel, factory supervisors (above line-supervisor level) and professional and technical employees.⁵ Some of these nonproduction employees are engaged in intermediation activities like sales, purchasing and advertising; others are not. It is not evident how to relate this information to value added by manufacturing, although it is known that the total manufacturing payroll (of \$529 billion) is split almost evenly between nonproduction employees (\$263 billion) and the wages of production workers (\$266 billion).

A second clue is that the proportion of nonproduction employees varies considerably across and within industry groups. While the overall number of nonproduction workers in food and kindred products is 27 percent, it is very high in those categories of food that have considerable marketing activities. For example, the proportion of employees in nonproduction activities is 62 percent in bottled and canned soft drinks, 43 percent in flavoring extracts and syrups, 35 percent in wet corn milling, and 32 percent in potato chips and similar snacks. Printing and publishing has 47 percent of its employees in nonproduction, reflecting marketing, management and editorial activities. Primary product industries that might be expected to engage in relatively less marketing and purchasing have a lower share of

⁵ The Census Bureau does not collect data on the relative numbers of these nonproduction employees. This also includes employees engaged in on-site construction. See U.S. Bureau of the Census (1991), *Annual Survey of Manufactures, Statistics for Industry Groups and Industries*.

employees not in production: for example, only 16 percent of employees in lumber and wood products are not production workers.

Overall, manufacturing, mining, construction, transportation and public utilities contribute about 31.5 percent of GDP. I believe that a conservative estimate of intermediation activities in these sectors would be a tenth of their value added. Adding this figure to the explicit intermediation activities already described implies that intermediation contributes about 28 percent of GDP.

The preceding discussion emphasizes the significance and diversity of intermediation in the U.S. economy. These market-based functions are fundamentally different from the production-based model of the neoclassical firm, but they can be addressed using models from finance and industrial organization. To examine the implications of intermediation for economic analysis it is useful to group these activities into four broad categories that cover pricing, inventory holding, coordinating transactions and monitoring performance.

Price Setting and Market Clearing

How do prices adjust to clear markets? In the perfectly competitive market model, of course, firms simply react to prices. But in practice, many companies have at least some power over prices, due to a variety of factors such as product differentiation, transportation costs, consumer switching costs, transaction costs, barriers to entry and incomplete information about prices.

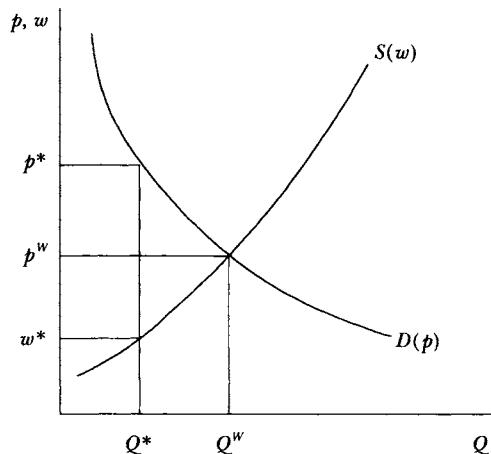
However, setting prices can be costly. Companies need to gather demand or supply information and monitor competitors' prices. They need to perform computations to determine the profit-maximizing prices. They need to communicate prices to their customers and suppliers. In many industries, companies may incur "menu costs" in changing prices by printing new catalogs or issuing price lists. Price rigidities are observed in a wide range of industries (Carlton, 1986; Cecchetti, 1986), which also suggests that changing prices is costly (Barro, 1972).⁶

When companies act as intermediaries, they not only arbitrage between buyers and sellers, but they also coordinate their transactions through price signals. The traditional supply and demand model can be applied to understanding the market clearing actions of intermediaries.

Consider a retail or wholesale intermediary that has market power in both its customer and supplier markets. For example, the firm may be the primary purchaser and reseller of a differentiated product. Thus, the intermediary has some power to set both bid and ask prices for its product and make profits from the markup between the two.

Figure 1 illustrates the situation of an intermediary with this kind of market power. The demand curve represents the residual demand of the firm's customers.

⁶ Stahl (1988) examines competitive "market making" by price-setting firms as the Nash equilibrium of a two-stage game.

*Figure 1***The Bid-Ask Spread and the Supply and Demand Model**

The supply curve represents the residual amount that the company's suppliers are willing to provide at various factor prices. The firm chooses its profit maximizing buy and sell prices given its best estimate of these supply and demand functions. There is a bid price w that is offered to sellers and an ask price p that is proposed to buyers. The sellers' supply function is $S(w)$ and the buyers' demand is $D(p)$.

The profit-maximizing firm sets prices to equate its marginal revenue to its marginal factor cost. The profit-maximizing bid and ask prices are w^* and p^* , and Q^* is the amount traded. The intermediary's profit is the rectangle in Figure 1 whose area equals $(p^* - w^*)Q^*$. In equilibrium, the firm chooses the buy and sell prices to clear the market, $Q^* = D(p^*) = S(w^*)$. The sell and buy prices straddle the Walrasian price p^W , and output is below the Walrasian output Q^W . The bid-ask spread depends on the elasticity of supply and demand, the company's transaction costs and the alternatives available to buyers and sellers.

How do firms adjust prices to clear markets? In markets where there are intermediaries with market power, the simple framework depicted in Figure 1 provides an answer. The firm will adjust both its buy and sell prices in response to changes in supply or demand. Suppose for example that the firm observes a rise in demand that shifts the demand curve to the right. The firm generally increases the sell price to ration demand and increases the buy price to encourage supply. Thus, the intermediary adjusts prices so that the market clears at a higher output.

Providing Liquidity and Immediacy

In addition to price setting, intermediaries hold inventories of goods on hand and stand ready to sell to customers, and hold cash on hand and stand ready to

buy from suppliers. This avoids the problem of the double coincidence of wants, in which a buyer and a seller need to want to transact with each other at the same time. This function is familiar in securities markets, where financial intermediaries provide liquidity by standing ready to buy and sell stocks. In retail and wholesale markets, intermediaries provide similar immediacy services by standing ready to buy and sell commodities. The cost of carrying inventories serves to create a bid-ask spread. The dynamic path of prices responds to the intermediary's inventory level and associated risks.

The inventories of firms help to clear markets, smooth the patterns of demand and supply fluctuations and reduce the risks of exchange. Quantity rationing of buyers and sellers is complementary to the firm's price-setting activities.⁷ As market makers, firms allocate goods and services across buyers and adjust purchases from suppliers to reduce the costs of carrying inventories while providing availability to customers.

Liquidity in Financial Markets

In securities markets, intermediaries like stock specialists smooth the pattern of exchange, creating market liquidity by holding inventories.⁸ Demsetz (1968, pp. 35–36) investigates the effects of trading volume on transaction costs at the New York Stock Exchange (NYSE) and observes that "the ask-bid spread is the markup that is paid for predictable immediacy of exchange in organized markets; in other markets it is the inventory markup of retailer and wholesaler." Specialists on the NYSE are compensated for managing orders and assuming risk by standing ready to carry out trades on their own account.

The basic model in Figure 1 can be used to study a dealership market for securities. In a model due to Garman (1976), buy and sell orders arrive randomly.⁹ The rates at which orders arrive can be interpreted as stationary demand and supply functions that depend on the ask and bid prices. The firm with market power maximizes expected profit per unit of time, subject to the restriction that the stock inventory does not drift upward or downward, which means that the market clears at each date.

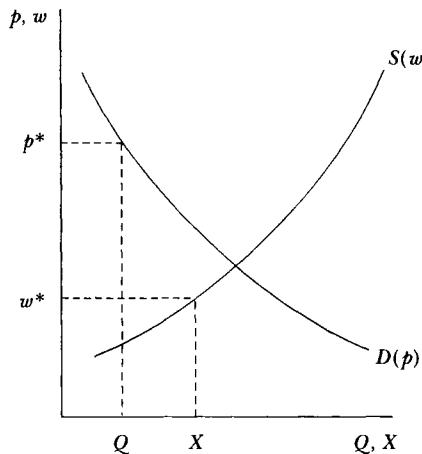
Since profits and inventories of the stock follow random walks, the intermediary with finite inventories will almost certainly go bankrupt at some point.

⁷ Carlton (1991) observes that, with random demand, there are costs to using the price system, since a price that is too high will reduce sales and result in excess inventories, while a price that is too low will require rationing customers and foregoing sales. He suggests that many firms use nonprice rationing methods and that "firms and organized markets are competitors in production 'allocations'" (p. 257). Carlton notes that rationing the firm's customers essentially allocates products across those customers. He concludes that "one reason for a firm's existence is to facilitate trade among its customers" (p. 258).

⁸ Baumol (1965) examines market makers and stability in the stock market. Stoll (1985) surveys alternative views of financial market making, examining the market maker as auctioneer, price stabilizer, information processor and supplier of immediacy. He observes that only the latter two roles are based on maximizing behavior by the market maker.

⁹ On the determinants of the bid-ask spread, the interested reader might begin with West and Tinic (1971), Tinic (1972), Benston and Hagerman (1974), Logue (1975), Stoll (1978a,b), Ho and Stoll (1980, 1981) and Cohen, Maier, Schwartz and Whitcomb (1981).

Figure 2
Inventory Holding by a Market Intermediary



However, Garman (1976) avoids this issue by considering the case where the intermediary has infinite inventories of both cash and stock. Ho and Stoll (1980, 1981) and Stoll (1978b) extend Garman's work by modeling the price setting of a risk-averse securities dealer facing stochastic demand and supply. In Ho and Stoll (1981), for example, the eventual bid-ask spread reflects the elasticity of demand and supply and the dealer's degree of risk aversion. In addition, the bid-ask spread tends to increase the longer is the dealer's planning horizon. Adding more periods provides the dealer with more opportunities for price adjustment, but increases the dealer's risk, thus requiring greater compensation and widening the bid-ask spread.

Intermediaries provide immediacy by holding inventories and cash. Price-setting intermediaries will adjust prices to maintain inventories. For example, the intermediary might choose to reduce inventories either by increasing the ask price above the level shown in Figure 1, thus reducing consumer demand, or by raising the bid price shown in the figure, thus bringing forth additional supplies. In this way, the bid and ask prices will vary depending on inventory levels observed after demand and supply are realized. Figure 2 shows the price spread with purchases X exceeding sales Q . Amihud and Mendelson (1980) consider a specialist who adjusts prices based on inventory levels to maximize average profit per unit of time.

In financial markets, the market maker must deal with informed and uninformed traders. The informed traders may have better information than the intermediary about the value of the asset. Thus, the informed traders may know that the value of the asset is above the ask price or below the bid price. In this case, trading with informed traders results in losses for the intermediary. Uninformed traders trade for liquidity and purchase at the ask price or sell at the bid price, depending upon their estimates of the asset value of liquidity requirements. The intermediary sets bid and ask prices to recover losses from trades with informed agents through

trades with uninformed agents (Copeland and Galai, 1983; Glosten and Milgrom, 1985).

Immediacy in Product Markets

Firms in product markets provide analogous market-making services. Clower and Leijonhufvud (1975) observe that intermediaries provide "availability" of products. They note that since consumers and firms face fixed transaction costs, they produce or sell at discrete time intervals, which can create problems of the double coincidence of timing. Intermediaries hold inventories to provide immediacy or availability to buyers and sellers. This happens both when retailers and wholesalers purchase goods from suppliers and hold the inventories needed to serve buyers, and when manufacturers keep inventories of parts on hand and create product inventories. Just-in-time inventory management is a means of providing immediacy while lowering inventory costs.

By holding inventories, firms acting as intermediaries reduce the risk of market transactions when demand fluctuates randomly. Retail and wholesale intermediaries diversify by purchasing and reselling a variety of products, thus pooling supplier risk (Lim, 1981). Manufacturers and wholesalers enter into financial risk-sharing arrangements with retailers and pool inventories in central warehouses to smooth out differences in demand across stores (Spulber, 1985).¹⁰ Large retail chains achieve important advantages through diversification of demand risk across individual stores.

Matching and Searching

Market intermediaries coordinate the actions of buyers and sellers. Marketers—including retailers, wholesalers, used car dealers and energy marketers—purchase and resell goods. Brokers—including travel agents, real estate agents, insurance agents and stock brokers—provide coordination services without buying and selling goods.¹¹ Intermediaries improve the welfare of consumers and suppliers by reducing or eliminating the uncertainty associated with making a satisfactory match. Intermediaries also add to the number of potential trading partners, thereby increasing the likelihood of encountering a trading partner and reducing search costs. Transactions with recognized centralized intermediaries can supplant decentralized search and bargaining, so that customers and suppliers avoid the costs of decentralized search.

¹⁰ The member firms of the National Association of Service Merchandising provide a large proportion of their products on a risk-sharing basis.

¹¹ Real estate brokers set housing prices in Yinger (1981). In his model, brokers fix commissions and invest in search for buyers and sellers of houses. Yinger's model explains the value of shared listings such as the Multiple Listings Service.

Matching

Intermediaries must compete with decentralized exchange, in which consumers and suppliers seek each other out and negotiate prices directly (Rubinstein and Wolinsky, 1987; Bhattacharya and Hagerty, 1987; Yavas, 1992; Yanelle, 1989; Gehrig, 1993). Sometimes both forms of exchange exist side by side. For example, an organized used car market operated by automobile dealers coexists with a decentralized market in which buyers and sellers meet informally, often through newspaper advertising. What are the advantages of transacting with an intermediary?

Consider first the matching market. Consumers have diverse levels of willingness to pay, and suppliers have different opportunity costs. If consumers and suppliers are matched randomly, in a highly decentralized fashion, the terms of the exchange become uncertain, and the risk of not completing a trade rises. After all, when consumers and suppliers bargain directly, the buyer has an incentive to underestimate willingness to pay and the seller to overstate opportunity costs. Asymmetric information about willingness to pay and opportunity costs causes efficiency distortions in the amount traded or even the breakdown of trade. An intermediary can eliminate this uncertainty by posting bid and ask prices, and thus offer an advantage over a decentralized matching market.

Buyers and sellers can choose between using intermediaries to trade at a known price and the risky option of the decentralized market. Gehrig (1993) models this choice and shows the profitability of intermediation. The result can be illustrated using the supply and demand framework in Figure 1. Suppose that each consumer purchases at most one unit of the good, and suppliers sell at most one unit. Then, the market demand and supply functions represent the distribution of buyer willingness-to-pay levels and opportunity costs, respectively. The intermediary chooses a profit-maximizing bid-ask spread given the value to buyers and sellers of the matching market option. At the market equilibrium, consumers with a willingness to pay above a critical level (greater than the ask price) purchase from the intermediary. Suppliers with opportunity costs below a critical level (less than the bid price) sell to the intermediary. Consumers and suppliers with values between these two critical levels enter the matching market.

Brokered exchange differs from trade between a buyer and seller in a subtle way. In direct trade, the buyer's payment must equal the seller's receipt, which constrains the possibilities for bargaining. A broker introduces many other possibilities for bargaining since the broker can effectively tax or subsidize the transaction. By "taxing" the transaction, a broker can capture some of the gains from trade by improving the chance that trade takes place (Myerson and Satterthwaite, 1983; Spulber, 1989; Mookherjee and Reichelstein, 1992). The broker designs a trading rule that elicits offers from the buyer and seller, and earns a return by creating a spread between the buyer payments and the seller receipts.

Searching

When consumers search for a product, they face costs of travel and costs of learning about prices and comparing product features. When suppliers search for a willing buyer, they incur costs of travel and of communicating information about

their products. As noted earlier, intermediaries reduce transaction costs by centralizing exchange.

However, in a world with multiple intermediaries, consumers and suppliers continue to incur search costs from visiting multiple intermediaries. Spulber (1995) models a search market with many intermediaries. Consumers and suppliers discount future net benefits, so that the time spent searching is costly. As before, consumers have diverse willingness-to-pay levels, and suppliers have different opportunity costs. Moreover, firms that intermediate have different transaction costs. Firms set both bid and ask prices, as in Figure 1. Consumers search across firms to obtain a lower ask price and suppliers search across firms to obtain a higher bid price. As a result of heterogeneity and costly search, the market equilibrium is a distribution of bid prices and a distribution of ask prices. The equilibrium depends on the discount rate of consumers and suppliers, where a higher rate of discount lowers the number of active consumers and suppliers and raises the number of active firms. The intuition behind this result is that a higher discount rate increases the cost of time-consuming search for consumers and suppliers. This allows firms to raise ask prices and lower bid prices, since consumers and suppliers are willing to pay a premium to avoid further search, thus raising the returns to intermediation by firms. The number of intermediary firms that are active in equilibrium increases.

The discount rate determines the costs of search. As the discount rate falls to zero, the costs of search are eliminated, which shows the relationship between the size of the bid-ask spread and transaction costs. In such a model, the Walrasian equilibrium is the limiting case of an intermediated market as transaction costs diminish (Spulber, 1995). The supply and demand model can thus be viewed as an ideal case that is consistent with an underlying market with search costs and price-setting firms.

Guaranteeing and Monitoring

Buyers and sellers usually have asymmetric information. Sellers do not know customer characteristics, and buyers are uncertain about product features. Intermediaries can help to fill this gap by collecting and supplying information to their customers and suppliers, often bundled with products and other services. Retailers describe product characteristics to their customers. Wholesalers report on market demand and customer requirements to their suppliers. Consolidating transactions through intermediaries can yield returns to scale in producing and distributing this information. Intermediaries can capture gains from trade that would be lost due to information asymmetries.

Lemons and Guaranties

Product characteristics frequently are difficult for consumers to observe: consumers are uncertain about the efficacy of pharmaceuticals, the durability of appliances and the quality of automobiles. If consumers are less informed than suppliers about product quality, the market can fail to exist as bad suppliers drive out

good. In Akerlof's (1970) well-known "lemons" model, low-quality used cars drive out high-quality used cars, since consumers are only willing to pay an "average" price for cars of unknown quality, and only sellers of low-quality cars can trade at that price.

The market for lemons fails to realize potential gains from trade. Customers would be willing to pay for a good car if they could observe its quality. An intermediary can capture some of these foregone returns by certifying the quality of the product. Biglaiser (1993) shows that introducing a monopoly intermediary into a market with adverse selection enhances efficiency. The intermediary has a greater incentive to invest in monitoring quality than does an individual buyer, since the intermediary buys more goods. Thus, intermediaries are better able to distinguish higher-quality suppliers from those with lower quality. In addition, the intermediary's incentive to report accurately the quality of goods stems from the returns to building a good reputation. These returns can be greater for intermediaries since they carry out more transactions than individual suppliers. Buyers and sellers decide whether to transact directly with each other or to buy and sell through the intermediary. In equilibrium, all high-quality goods are sold through the intermediary, and most low-quality goods sold directly to buyers. As a result of this separation, the lemons problem is alleviated at the intermediated market equilibrium.

A retail or wholesale intermediary can offer many different products for sale, and consumers can rely on the reputation of the intermediary without having to investigate the many product suppliers. In particular, intermediaries can serve as guarantors of the product quality of their suppliers through warranties and contract terms, as in Biglaiser and Friedman (1993). A manufacturer's brand name often conveys information to customers who then do not need to know the quality of components purchased by the manufacturer. Since intermediaries handle the products of two or more suppliers, their incentives to sell a lower quality good differ from those of individual suppliers. The intermediary that sells a low-quality product suffers a loss of reputation and thus loses customers for all other products. Intermediation lowers the threshold prices that are required to sustain high-quality production.

Delegated Monitoring

Monitoring the efforts of trading partners is costly, leading to moral hazard problems. It can be costly for consumers to observe whether service providers, from auto mechanics to attorneys, are working in their interests. Intermediaries can earn returns through "delegated monitoring," by supervising suppliers for their customers. In building a house, a consumer hires a contractor, who subcontracts with electricians, plumbers, masons and carpenters. The contractor takes on the transaction costs of locating skilled tradespeople, writing contracts and monitoring their performance. The contractor gains skills at these tasks, thus lowering the costs of supervision. Specialized intermediaries thus reduce the problem of moral hazard in markets.

The role of the firm as a monitor of its own personnel is well known. For example, Alchian and Demsetz (1972) emphasized the role of the firm as a

“specialist” who monitors team production efforts, designs incentives and receives the residual rewards: in their words (p. 793), “the firm serves as a highly specialized surrogate market,” since the firm collects and “sells” information to employees by organizing their production activities. What I am emphasizing, in contrast, is that the firm also is a monitor of its suppliers and distributors, making sure that suppliers deliver high-quality parts on time, or requiring distributors to improve customer service.

Financial intermediation can provide economic advantages over direct lending since lenders delegate monitoring of borrowers to intermediaries who diversify risks.¹² In other words, monitoring costs creates an opportunity for intermediaries, where intermediaries incur debt from lenders and in return make loans to borrowers. The structure of the debt contracts results in more effective monitoring than would occur without intermediaries. As an example of thinking along these lines, Diamond (1984) offers a model in which bankruptcy penalties are incurred by the borrower and are not transferred to the other party in the transaction. The intermediary has a cost advantage in collecting information about borrowers, since lenders would duplicate their efforts if they were to monitor borrowers individually. Also, the intermediary avoids the free rider problem, which occurs if all lenders fail to monitor, since they rely on the efforts of other lenders. Lenders still incur costs of delegation since they must monitor the intermediary. However, the intermediary maintains a *net* cost advantage over direct monitoring because the returns to centralized monitoring of borrowers exceed the cost of delegation to the intermediary.

Conclusion

Intermediaries, by setting prices, purchasing and sales decisions, managing inventories, supplying information and coordinating transactions, provide the underlying microstructure of most markets. The finance literature has extensively examined the market-making activities of stock market specialists and other financial intermediaries. Because of its significant contribution to many nonfinancial sectors of the economy, economists should incorporate the subject of intermediation within the basic framework of mainstream economics. In microeconomics, intermediation provides an explanation for how the market attains an equilibrium and how the market adjusts to changes in demand and supply. Analysis of market microstructure also has potential implications for macroeconomics. Price rigidities due to menu costs and other factors and variation in inventories play a critical role in business cycles. Understanding the pricing actions and inventory adjustment behavior of intermediaries thus may yield insights in business cycles.

¹² Boyd and Prescott (1986) allow intermediation by multiagent coalitions. Diamond (1984), Williamson (1986) and Krasa and Villamil (1992) have single agents acting as financial intermediaries and derive optimal incentive contracts for borrowers and intermediaries. In these three models, borrowers observe the realization of returns to an investment project, but intermediaries and lenders do not. See also Chan (1983).

Since intermediation provides over a quarter of value added in the U.S. economy, it should be included along with production in the theory of the firm. The activities of retail, wholesale and financial intermediaries account for a host of significant economic developments including the rise of discount superstores (Walmart, K-Mart, Target), the emergence of "category killers" (Toys-R-Us, Home Depot, Circuit City), upheavals and consolidation in banking, and the growth of discount brokerage. In addition, new forms of intermediation are flourishing including mail order and electronic commerce on the Internet. Manufacturers are increasingly outsourcing functions, creating supplier and distributor networks and "virtual" corporations. To the extent that economists are interested in these observed market institutions, they should reorient their attention to thinking about how markets are established and then evolve.

The market microstructure framework raises fundamental public policy questions. Among these questions is whether or not the market power of intermediaries represents market failure. It is clear that the centrality of intermediation activity in the market microstructure setting stands in contrast with the exogenous market clearing assumed in traditional economics. In models of industrial organization, market power of firms is sometimes interpreted as "imperfect" competition. However, market microstructure models make the point that price setting by firms is the way in which the market mechanism normally functions. Price setting by firms is not only consistent with competition, it is the means by which markets clear. The equilibrium bid-ask spread, which separates buyer willingness to pay and supplier costs, is a consequence of transaction costs, asymmetric information and the returns to intermediation activities. Establishing the existence of market failure would still require a showing of insurmountable barriers to entry or some demonstration of improper behavior such as collusion. Therefore, price setting does not provide *prima facie* evidence of market failure.

Moreover, the departure of output and prices from the Walrasian equilibrium does not mean that there is a role for government in improving the allocation of goods and services. Establishing and operating markets is costly and difficult, and there are many reasons to believe that the government would have substantially higher transaction costs if it attempted this task. Market microstructure analysis does suggest that public policy should not be designed to favor production of goods over market allocation activities. Since intermediation contributes significantly to the economy's value added, there should not be taxes and other incentives that promote investment in manufacturing facilities over expenditures for creating and operating markets. In addition, regulators should avoid price controls and other restrictions that impair or attempt to supplant the functioning of private intermediaries. Finally, policymakers should avoid the presumption that market making and pricing activities indicate insufficient competition. Instead, these activities are ways that firms intermediate economic transactions and make markets work.

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