Chapter 11: Multi-Product Firms

I. Multi-Product Firms

The logic of specialization worked out in Chapter 9 seems to imply that firms should all specialize and produce only a single product—as most of the models developed to this point have assumed. Firms that master the production of particular goods or services can often provide them at a lower cost than those who try to be "jacks of all trades." Many firms do specialize in providing a single service or narrow range of services, as with plumbers, carpenters, computer programmers, cell-network providers, and airlines. However, we also observe many firms that provide a variety of services or produce many different products. Indeed, even the specialized firms listed generally provide more than one service or sell more than one type of their product. Neither plumbing services nor cell phones are all the same, even when produced by the same plumber, sold by the same shop, or produced by the same firm. A coach seat on an airplane is not the same as a first class seat.

This chapter explains why multi-product firms exist, given the informational and training advantages of specialization.

There are several possible explanations for multi-product firms. (1) Diversification can reduce risks in settings in which demand or production costs are influenced by random factors. In such cases, diversification produces a steadier flow of profits than specialization can. The simplest case of diversification is a conglomerate. Conglomerates own a variety of previously independent firms that are held in a portfolio. Such conglomerates benefit from diversification and also may more efficiently allocate capital among the firms held, because of their greater "inside" knowledge of the profitability of the firms held in their portfolios. Examples of the latter include Warren Buffet's Berkshire-Hathaway Company or Richard Branson's Virgin Group, as well as corporations such as Sony and General Electric (in the past).[1]

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[1] The assumption that every firm aims to maximize risk adjusted profits continues to be applied in this chapter. The possibility that a firm owners or managers have other goals is taken up in

A second reason why a firm may produce more than one product or service is that complementarities among the products and services produced may increase the overall demand for a firm's services or products. For example, computer manufacturers often provide repair and maintenance services for their computers (but not others) because their customers will purchase more of each when they are produced by the same firm. Such firms are likely to be better at maintaining their own products than unaffiliated repairmen are because of their greater knowledge of and experience with their own products. Customers may also benefit from reduced transaction costs when purchasing combinations of complementary services from a single seller rather than contracting with many separate firms. Negotiations with a single firm for a variety of services may take less time and effort than negotiations with a large number of single service providers.

A third possible benefit is that economies of scale may be realized by making use of specialized equipment that can be used to produce several similar products. Recall that products are various combinations of attributes. Attributes can often be varied without significant changes in equipment, personnel, or assembly lines. For example, different paint colors can be applied in the same painting facility (although not simultaneously, and often with some intermediate steps required as one changes color). In such cases, the combined demand for minor variations in very similar products may support cost-reducing specialized production facilities that would otherwise be too expensive to employ. The associated economies of scale allow prices to be reduced while increasing profits for firm owners. In such cases, smaller specialized firms have higher production costs than more diversified large firms. Examples include bicycle, automobile, aircraft, television, and cellphone manufacturing.

Similar economies from multi-product production can also be realized by companies that have greater expertise in flexible manufacturing than by other more narrowly focused firms in the same industry. Such flexible firms can produce a variety of products at a lower cost or achieve profits with less risk than less flexible producers. They may produce more types of products and be able to adjust more rapidly to fluctuations in demand among their products.

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chapter 17 of part III of the textbook. All the firms modelled in this chapter are profit maximizers, none are empire builders or motivated by other goals beyond profit maximization. Although not perfectly accurate, this assumption is the norm in microeconomics, because it is a useful first approximation of the motivations that a typical firm's owners and managers have. Although not perfectly accurate, it simplifies and sharpens the models developed, without significant loss of accuracy in most cases. Every firm requires profits to sustain itself in the long run.

Lastly, firms may attempt to dominate a sector of the economy by producing all of the profitable variations of a general type of product. Such strategies can reduce the elasticity of consumer demand for its overall portfolio of products relative to other firms in the industry by increasing brand loyalty. In some cases, economies of scale may also allow them to sell their products at a lower price. Such multi-product firms benefit from increased profits because of the reduced price-elasticities of the demand functions and lower production costs for its various products.

The first parts of this chapter show how these possibilities can be modeled and uses the models developed to determine the limits of these strategies. The last parts show the limits of multi-product firms. It is the limits of multiproduct firms that make such firms compatible with competitive markets, although there are cases in which natural monopolies may arise.

II. Risk Aversion and the Appeal of Passive Conglomerates and Holding Companies

There are several reasons why a formeteur may form a firm that is intended to own other previously stand-alone firms. The simplest rationale is diversification. As a point of departure, assume an environment in which there are a large number of firms each earning a randomly distributed rate of profit on its assets as would be associated with stochastic phenomena such as stock market values, the weather, and variation in regulatory policies. Suppose that every firm's rate of profit is drawn from the same distribution, with firm j's profit in period t, $\pi_{jt} \sim f(\mu, \sigma^2, t)$. In this setting, one cannot know the profit rate of firm j in year t, but does know that it's profits and those of all other firms is generated from a random process that varies year to year. If a formeteur owns a single firm or holds stock in a single firm, the observed profit rate, π, would have mean μ and variance σ^2, the distribution is in a steady state and the effect of time, t, is zero. In other cases, average profits and their variance would vary year by year as with μ_t and σ_t^2.

In either case, a portfolio of stocks in different companies or ownership of a cross-section of diverse firms across industries would have a lower variance than that associated with any single firm. Recall that the simple formula for the variance of a sample average calculated from a sample of size N is $var(\pi) = \frac{\sigma^2}{N}$, where N is the sample size, here the number of firms held in a formeteur's diversified conglomerate's portfolio of firms. Note that the variance of the mean rate of return of diversified portfolios and conglomerates converges to zero—e.g. complete certainty—as N becomes large.

The rate of return of a portfolio of N diverse firms in year t is essentially μ_t, the average rate of return of firms in the entire market in that year. That rate can be regarded as the risk-free rate of return on investment in the year of interest. Risk-averse investors can do no better in this environment than to own a diverse assortment of firms. And, it makes no difference whether they do this by owning firms outright or by holding a broad portfolio of stocks.

This is not to say that no conglomerate or investor occasionally earns an above-average rate of return in such settings, but it is to say that on average they do not, and also that smaller portfolios of firms tend to have rates of return with higher variation year-to-year than larger more diversified portfolios. Some investors with small portfolios may get lucky and earn higher than average returns while others will be unlucky and earn below average returns. The existence of multiple conglomerates is compatible with the Marshallian competitive equilibrium, where individual firms or industries are subject to a variety of demand and cost shocks that cannot be known beforehand. It is also consistent with Ricardian competitive markets in settings where each firm's share price or purchase price is the present value of expected future profits.

As long as buyer estimates of future firm net revenues are unbiased, any purchaser of a firm's shares or the entire firm will earn approximately the average rate of return on his, her, or their investments, μ_t, but the variance of that return tends to be greater than zero, $\sigma_t^2 > 0$, and hence the attraction of diversification for risk averse (passive) investors. Although the net revenues of firms may vary, the present discounted value of each firm's future profits is capitalized into its share prices and take-over cost, and so the distribution of returns for a portfolio of firms acquired at time t tends to be more narrow and stable than the net revenues of individual firms. All this implies that large diversified conglomerates and holding companies tend to realize the average rate of return of their portfolios, μ_t, with a very low variance in their annual rates of return.[2]

[2] If company net revenues are not drawn from the same distribution of returns, or if the average estimate of returns is more biased for some firms than others, then it is possible that better than average "stock pickers" or return estimators can realize above average rates of return from their superior ability to recognize firms that are "under valued." That very few actively managed portfolios do better than diversified portfolios such as the S&P five hundred index funds suggests that superior stock pickers are, at best, quite rare—although claims to be one of them are commonplace.

III. Producing Goods and Services with Complementary Demands

A second reason why a firm may produce more than one product is that the products may be complements for one another. Consumers may find it more convenient to purchase both products from the same company than to purchase them from two or more separate companies. An extreme example is the production of left and right shoes, which are normally purchased in pairs from the same company or brand rather than purchased from separate right shoe and left shoe companies. Other examples include the maintenance of consumer capital goods such as automobiles and large computer systems. In addition to benefiting from convenience, consumers may believe that the maintenance services provided by producers are of higher quality than those provided by others. After all, the firm knows its own products inside out.

Complementarities on the demand side of the market, creating unique profit opportunities for firms because a subset of its consumers are willing to pay a premium for various combinations of products only when they are produced by a single firm.

To model this choice, we'll assume that there are two products that a firm can produce, each with its own market demand and production cost function. Customers are willing to pay a premium, V, for the complementary service. We'll refer to the products as good A and service B. The inverse demand function for goods A and B are:

$$P^A = f(Q^A, Q^{\boldsymbol{B}}, Y, P^O) \quad (11.1a)$$

$$P^B = g(Q^{\boldsymbol{B}}, Q^A, Y, P^R + V) \quad (11.1b)$$

Note that connections between the two markets exist because of the complementarity between the product and its complementary service. $Q^{\boldsymbol{B}}$and Q^A are arguments in both inverse demand functions. We'll assume, however, that service B is purchased only if it sold at a price less than $P^R + V$, the price of a rival service plus the additional value of service B over its rival, or its lower transaction cost, as denoted by value V. Their cost functions have the usual form:

$$C^A = c^A(Q^A, w, r) \quad (11.2a)$$

$$C^B = c^B(Q^B, w, r) \quad (11.2b)$$

In such cases, the firm's profit functions for the two potential lines of business are:

$$\pi^A = P^A Q^A - C^A = f(Q^A, Q^{\boldsymbol{B}}, Y, P^O)Q^A - c^A(Q^A, w, r) \quad (11.3a)$$

$$\pi^B = P^B Q^B - C^B = g(Q^{\boldsymbol{B}}, Q^A, Y, P^R + V)Q^B - c^B(Q^B, w, r) \quad (11.3b)$$

Maximizing profits requires taking account of the complementarity whenever each line of products can realize profits, $\pi = \pi^A + \pi^B$. The output of each of the two products can be characterized by examining the first-order conditions for maximizing overall profits:

$$\pi_{Q^A} = P^A_{Q^A} Q^A + P^A + P^B_{Q^A} Q^B - C^A_{Q^A} = 0 \quad (11.4a)$$

$$\pi_{Q^B} = P^B_{Q^B} Q^B + P^B + P^A_{Q^B} Q^A - C^B_{Q^B} = 0 \quad (11.4b)$$

Several points of interest are implied by the two first-order conditions, both of which will hold simultaneously when the firm decides to produce both products. In the most straightforward case, where profits for each line are greater than zero and the optimal output of service B is such that its associated market price is less than $P^R + V$, the firm will produce and sell both products because both contribute to its overall profits. It is simply more profitable to be a two-product firm than a one-product firm in that case.

Note that complementarities are not always necessary in such cases, although complementarity makes the production of both products more likely to be profitable than the case in which there are no complementarities. That is to say, both lines may be profitable even if $P^B_{Q^A} Q^B = 0 = P^A_{Q^B} Q^A$. However, both product lines are more likely to be profitable when $P^B_{Q^A} Q^B > 0$ and $P^A_{Q^B} Q^A > 0$. Marginal revenues from each line are increased by the effects of the demand complementarities. It is also true that the larger V is, the more likely the second line is to be profitable, although it may still be profitable even when $V = 0$.

There are also cases in which the firm may choose to produce only one of the products. For example, if $\pi_{Q^A} > 0$ for quantities below Q^{A*} and $\pi_{Q^B} + P^B_{Q^A} Q^B < 0$. In that case, the firm will produce good A but not good B. Such conditions must be commonplace if there are a large number of one-product firms. Note that the second inequality, $\pi_{Q^B} + P^B_{Q^A} Q^B < 0$, takes account of the complementarity between the two goods. Producing service B has direct effects on profits (the first term) and indirect effects (the second term) through effects on the demand for product A.

Note also that if the second term is large enough, B will be produced even when it is directly unprofitable to do so, $\pi_{Q^B} < 0$, because of its effects on the demand for the firm's product A. The effect on sales of good B on the demand for good A can be sufficient to justify the production of service B as a "loss leader." A commonplace example of this is the customer service departments of

many producers and merchants, which rarely make a profit themselves, but sufficiently increase the demand for their other products to be worth providing (normally customer service is freely provided).

IV. Producing Products with Complementarities in Production

There are also cases in which producing several similar products is less costly than producing any single product. Often these entail variations in the attributes of a single type of product, for which the same or very similar production processes can be used. For example, several models of an automobile may be assembled on the same assembly line by changing seats, colors, user interface, wheels, and motors without changing the organization of the line, personnel, or equipment. Indeed, the broader array of products produced often yields the scale required to justify the assembly line and its specialized personnel and equipment.

The mathematics of this case are very similar to that associated with complementarities in demand. We'll again assume that just two products are involved to simplify the mathematics and narrative without significant loss of generality. We'll again refer to the products as goods A and B. The inverse demand function for goods A and B are:

$$P^A = f(Q^A, Y, P^O) \tag{11.5a}$$

$$P^B = g(Q^{\boldsymbol{B}}, Y, P^R) \tag{11.5b}$$

In this case, there are no connections between the two market demand functions. Instead, the complementarities arise through the cost functions, where additional production of good B lowers the marginal cost of good A and vice versa.

$$C^A = c^A(Q^A, Q^B, w, r) \tag{11.6a}$$

$$C^B = c^B(Q^B, Q^A, w, r) \tag{11.6b}$$

In such cases, the firm's profit functions for the two potential lines of business are:

$$\pi^A = P^A Q^A - C^A = f(Q^A, Y, P^O)Q^A - c^A(Q^A, Q^{\boldsymbol{B}}, w, r) \tag{11.7a}$$

$$\pi^B = P^B Q^B - C^B = g(Q^{\boldsymbol{B}}, Y, P^R + V)Q^B - c^B(Q^B, Q^A, w, r) \tag{11.7b}$$

Maximizing profits requires taking account of the complementarity if profits can be realized by both product lines, $\pi = \pi^A + \pi^B$. The output of each of the two products can again be determined by analyzing the first-order conditions for maximizing overall profits:

$$\pi_{Q^A} = P^A_{Q^A} Q^A + P^A - C^A_{Q^A} - C^B_{Q^A} = 0 \quad (11.8a)$$

$$\pi_{Q^B} = P^B_{Q^B} Q^B + P^B - C^B_{Q^B} - C^A_{Q^B} = 0 \quad (11.8b)$$

Several points of interest arise from the two first-order conditions, both of which will hold simultaneously in the cases where the firm decides to produce both products. In the most straightforward case, where profits for each line are greater than zero, the optimal output of A and B are jointly characterized by equations 11.8a and 11.8b. It is simply more profitable to be a two-product firm than a one-product firm in that case.

Note that complementarities are not always necessary in such cases, although complementarity makes the production of both products more likely to be profitable than the case in which there are no complementarities. That is to say, both lines may be profitable even if $C^A_{Q^B} = 0 = C^B_{Q^A}$. However, both product lines are more likely to be profitable when $C^B_{Q^A} < 0$ and $C^A_{Q^B} < 0$. Marginal costs for each product line are decreased by the effects of the production complementarities, which implies that both products are produced at greater levels than they otherwise would be and that their profitabilities are both higher.

There are also cases in which the firm may choose to produce only one of the products, because demand for one or the other of the products is too low to support its production. For example, if $\pi_{Q^A} - C^A_{Q^B} < 0$ for all output levels, the firm will produce good A but not good B. Such conditions must be commonplace if there are a large number of one-product firms. Note that the second term in the inequality takes account of the cost savings that producing good B provides for good A. Producing service B has direct effects on profits (the first term) and indirect effects (the second term) by reducing the marginal cost of producing good A.

If the second term is large enough, B will be produced even when it is directly unprofitable to do so, $\pi_{Q^B} < 0$, because of its effects on the marginal cost of product A. This effect can be sufficient to justify the production of service B as a "loss leader." Commonplace examples include the "stripped down" versions of automobile models and cell phones. Selling those goods helps to justify more specialized equipment that reduce average and marginal costs only when used at a relatively large scale.

V. Coase's Theory of the Firm and the Size of a Multi-Product Firm

All the above suggest that most firms will produce multiple products whenever diversification reduces risks, or there are complementarities among the demands or production of their products, or some combination of the three rationales. In at least some cases, all three factors will play a role in firm decisions. Firms, for example, may invest in flexible manufacturing techniques to reduce losses from fluctuations in demand or production costs while facilitating the production of multiple products or types of the same or similar products. Flexible manufacturing in such cases is a form of self-insurance.

The remainder of this chapter explores limitations on the number of products that a firm can profitably produce.

Without those limitations, it is not clear why a handful of firms do not produce all the products sold in the world's markets. For example, in the simplest Marshallian models, all producers have access to the same constant return to scale production methods, input costs, and face the same prices for their outputs. In such cases, there is no obvious limit to a conglomerate's size—and they may expand to the point where they jointly produce all the products sold in markets. Several large rival conglomerates would exist if diseconomies of scale existed for each of the products produced.

If that is the case, then why are not all firms massive conglomerates? They can potentially realize advantages from diversification and in at least a subset of cases, also benefit from demand and production complementarities.

Ronald Coase (1937) suggests that, in broad terms, the size of a firm is determined by the cost of managing the firm (e.g., determining and allocating resources to tasks within the firm) compared to conducting them through contract and market prices. Towards the end of his famous article on the nature of the firm, he states that:

> At the margin, the costs of organizing within the firm will be equal either to the costs of organizing in another firm or to the costs involved in leaving the transaction to be "organized" by the price mechanism. Businessmen will be constantly experimenting, controlling more or less, and in this way, equilibrium will be maintained. This gives the position of equilibrium for static analysis. But it is clear that the dynamic factors are also of considerable importance, and an investigation of the effect changes have on the cost of organizing within the firm and on marketing costs generally will enable one to explain why firms get larger and smaller; We thus have a theory of moving equilibrium.

Students of Coase would argue that what he has in mind is the effects of two kinds of transaction costs: those within the firm and those in dealings with persons outside the firm through contracts. Both types of transaction costs rise as the size, number, and complexity of the transactions undertaken increase. The marginal transaction costs within firms gradually rise until they reach and surpass those associated with contracting with outsiders through the price system—except in cases where natural monopolies occur. If firms use technologies that exhibit constant returns to scale in production, then scale and the number of products sold are ultimately determined in the manner posited by Coase—by rising intra-firm transactions costs that are neglected in the models developed above. Firms will grow to the point where their marginal intra-firm managerial costs equal the marginal cost of contracting costs with outside firms, contractors, and laborers.

The remainder of this chapter explores some of the considerations that cause marginal managerial costs to rise as conglomerates and firms increase in size—some of which have been mentioned in passing in the first part of this chapter and also in previous chapters. To do so, we'll depart from the simplified Marshallian model by assuming that information problems of various kinds are commonplace within both single firms and conglomerates, and that managerial diligence can moderate those problems, although it cannot eliminate them.

VI. Active Management of Conglomerates and their Optimal Size

Activist Conglomerate Founders as Knightian Decision Makers

The conglomerates analyzed in the beginning of this chapter were passive investors. They would buy firms but not manage them. They would simply leave in place the management of the firms purchased and assume that the firms would not significantly change their production or marketing strategies in response to changes in ownership. Such investors are analogous to those holding stock in a number of companies, except that they own the entirety of each company in their portfolios rather than some part of each (as with shareholdings).

Conglomerates that are active investors, in contrast, attempt to alter the production or marketing strategies of the firms held. They believe that the current management is not truly maximizing their firm's profits. In order for activist investments in or management of the firms making up a conglomerate to be potentially more profitable than average, some investors must be able to better estimate the profits from alternative business strategies better than other investors and also better than the current managers of the subset of firms they will attempt to acquire control of.

In the former case, investors are looking for unusually profitable opportunities as well as reductions in risk from diversification. In the latter case, rather than seeking to diversify as a method of reducing risks, they are looking for opportunities to manage the companies—e.g. change the firm's investment strategies—that they acquire and thereby increase the returns from those firms over what they would otherwise have been.

Doing so requires more information and more talent on the part of investors than passive investing does. It also requires many judgments about the strategies of rival firms in the market. For an average investor, the initial model is a reasonable first approximation. For what might be termed Kiznerian investors, superior insight and/or information would allow their average returns to be higher than those of ordinary investors. For what might be termed Knightian investors, over-confidence in the possibility of larger-than-average profits would imply long-term below-average profits or greater-than-average risk than that associated with a more diverse portfolio for reasons developed below.

Conglomerates have been subjected to a good deal of empirical research. There are cases of what appears to be Kirznerian firm pickers, as with the Berkshire-Hathaway (Warren Buffett) collection of firms that remain largely independent after purchase and General Electric's successful managerial period (under Jack Welch) of a large diverse conglomerate. However, the bulk of the evidence demonstrates that conglomerates are generally worth less than the value of their constituent parts. Active management of diverse conglomerates is more difficult than expected by the leaders of such conglomerates. There are cases in which a relatively narrow range of firms are actively managed by conglomerates that realize higher than normal returns. Together these cases suggest that it is possible to acquire better information and exercise better judgment in relatively narrow subsets of industries than in broader ones. However, on average, conglomerate leaders are more likely to be Knightian entrepreneurs than Kirznerian ones.[3]

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[3] See Berger and Ofek (1995) for a general overview of the relative performance of conglomerates versus more specialized firms. See Schmid and Walter (2009) for a study of conglomerates in the financial sector. Both note stock valuation losses in actively managed diversified firms. They also note lower value losses and occasionally above-average profits in more focused conglomerates. In the latter cases, superior information and judgment are more likely to be acquired by the conglomerate's management team. The more markets one is participating in, the higher information costs tend to be, because more market conditions and production methods have

Not all conglomerates are formed by Knightian plungers or salary-maximizing empire builders. However, a belief that a holding firm's own ability to identify firms that can benefit from their abilities at managing firms is a prerequisite. Whether these reflect Knightian risk taking or Kirznerian insight, the calculations behind those decisions are similar.

Active Conglomerate Management and their Optimal Size

Within a conglomerate, there are two basic levels of decisionmaking. The first concerns which firms to acquire, which to continue holding, and which to sell. The second concerns decisions associated with active management strategies. They include hiring decisions for the leadership of the firms held, allocations of capital among them, and setting production goals. Some degree of activism is normal for conglomerates because the advantages of diversification can be more easily realized by holding portfolios of stocks rather than outright ownership of the firms in their portfolios. To make such managerial decisions, clearly more detailed knowledge about the internal operation of the firms held and about their respective markets is required than that required to assemble and manage a diverse stock portfolio.

To model this choice, we depart from the more or less Marshallian assumptions used in the first part of the chapter.

Kirznerian Formeteurs and Optimal Conglomerate Size

Suppose that every firm's average rate of profit is expected to increase with the conglomerate's managerial investments, M_j. In such cases, firm j's average rate of return in period t, is distributed as $\pi_{jt} \sim f\left(\mu_j(M_j), \sigma^2, t\right)$, with the effect of managerial effort on average profits varying among firms. If a passive investor owns a single firm or holds stock in a single firm, the observed profit rate, $\mu_j(0)$, would have mean μ_j and variance σ^2at time, t. In contrast, if an active investor holds the stock, its expected average rate of return is $\mu_j(M_j)$ when the managerial effort M_j is invested in firm *j*. In the case of a Kirznerian conglomerate, the conglomerate's management has a clear understanding of function $\mu_j(M_j)$, but in the case of a Knightian conglomerate, that function is, more or less, a guess—and thus error prone. Nonetheless, in both cases the calculus concerning which firms to purchase and how much managerial effort to invest is fundamentally similar. A firm

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to be assessed. General Electric and Berhkshire Hathaway are mentioned as exceptions to the general rule in (xxxx).

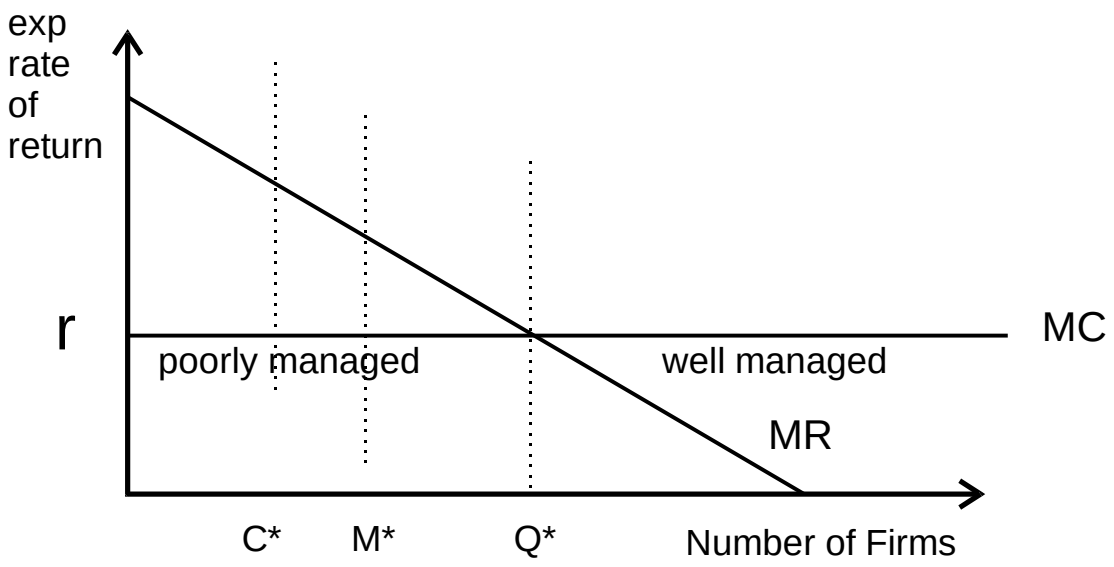
should distribute its managerial effort among firms and purchase the ones that generate the highest rate of return if its managerial efforts are undertaken. How many firms it will purchase, N, will vary with the effect of its managerial efforts on firm returns, the overall extent of managerial effort ($M = \sum_1^N M_j$) and its cost of capital, r.

In many cases, the expected effect of managerial effort on an existing firm's average rate of return is less than or equal to zero, because the firm is already very well managed. Such firms will not be a target for purchase. In other cases, purchasing control of a firm will cost C_j and $\mu_j(M_j)C_j < rC_j \; for \; M_j > 0$, which implies that control of such firms costs more than it is expected to return in profits. These are also cases in which a subset of existing firms are not of interest to the conglomerate. Such firms may also be regarded as well managed, if not perfectly so.

If a conglomerate's line of credit at interest rate r is unlimited and its managerial ability unbounded or freely available, a conglomerate would purchase all the remaining firms. However, if managerial talent is scarce, as assumed above, then it would purchase only the firms where its managerial resources, M, generate the greatest return. This would limit it to only a subset of the existing firms that are (relatively) poorly managed—even in cases in which it has an unbounded line of credit. When lines of credit are also bounded, this rather than managerial ability may be the constraining resource. However, in either case, the firm will purchase control of only a finite subset of the firms that it may potentially acquire—namely those that are poorly managed and in which its managerial talents are expected to be most productive. Figure 11.1 illustrates these possible breakdowns among firms that a Kirznerian conglomerate has under consideration. It accurately sees differences among firms that are missed by the average investor.

The MR curve assumes that the conglomerate's managerial efforts have been optimally invested in the firms and consequent rates of return ordered from high to low. In the case in which neither managerial resources nor capital are a constraint, the conglomerate will own or control Q* firms. In the case in which managerial resources are a limiting factor the number of firms is smaller, as with M*. In the case in which capital is the constraining factor, the conglomerate may well be smaller than M* as at quantity C*--although whether C* is smaller than M* or not would depend on the managerial and capital constraints faced by the conglomerate. Note that both C* and M* are likely to be much smaller than Q* in most market settings.

Figure 11.1 Conglomerate Size



C*, capital constrained, M* manager constrained, Q* unconstrained

Knightian Formeteurs

Knightian formeteurs of a conglomerate attempt to make the same sort of decisions as Kirznerian entrepreneurs but with far less information and insight. In effect, their decisions can be thought as over-confident ones in which the rank order of firms is based on guesses rather than good information about possibilities for managerial improvement. Thus, rather than having a systematic ranking of possibilities for improvements, the ordering of firms is more or less a random draw from the firms under consideration. Some of the firms will be well-managed, others more or less average, and some poorly managed. Intervening in the decisions of already well-managed firms will tend to reduce their net revenues. Intervening in the others may raise or lower them according to the decisions made—again because in Knightian circumstances, there is insufficient information to truly make optimal decisions. Thus, mistakes will be commonplace—and likely more commonplace than close to optimal decisions. Some will be very profitable, but most will be less so. Knightian entrepreneurs may realize extraordinary profits or losses.

A Possible Explanation for the Negative Effects of Conglomerates on Firm Value

There are several possible explanations for the negative returns (value reducing) of most conglomerates. The simplest explanation is that most conglomerates are run by Knightian

entrepreneurs and tend to base their decisions (possibly of necessity, but possibly because of not taking due diligence) on strong feelings that they can judge better than current managers of the firms acquired how best to deploy the resources of the firms acquired and held. In that case, most would be incorrect in their assessment, but a few would be correct and earn above normal profits through the value added by their decisions. A second possible reason is the so-called winner's curse.

In cases in which two or more conglomerates bid for the same firm, the price tends to rise to firm with the most optimistic forecast of the returns from owning the firm. In most cases, this will be an outlier estimate and incorrect—thus producing losses for the winner of the bidding contest. Again, this is not always the case—well informed Kirznerian entrepreneurs also exist, and do occasionally win such bidding contests because they understand the opportunities available to the firms acquired better than their current management.

However, the evidence suggests that in most cases, rather than higher returns as implied by the model, the expected returns are overestimated, resulting in a lower rate of return on investment and lower valuation for the conglomerate as a whole.

VII. Time, Attention, and the Limits of Active Management

At the heart of the managerial decisions of a firm's leadership (formeteurs and top management) is information. If one knows everything that is relevant, and all the links between decisions of a firm's leadership and outcomes are deterministic, then one can truly optimize—which is to say make the decisions that maximize profits or otherwise systematically advance formeteur goals. Doing so requires adjusting one's "commands" to account for how others in the chain will implement them, but full information and determinism allow incentive systems that minimize such problems to be developed. This has been the underlying assumption for most of the models of the firm developed in this and other textbooks. Exceptions in this text have been decisions that involve non-deterministic processes such as those associated with risk management and innovation.

There are two aspects to management: (1) constructing the internal institutions of the firm, which will be dealt with in Chapter 17, and (2) responding to changing circumstances. With respect to the latter, the internal routines of a firm can easily address predictable changes and modest shocks that can be coped with using standing routines (e.g. conditional plans). For example, an employee may unexpectedly call in sick, and the routine may call for a substitute to be employed by the

department in which it occurs or a temporary shift in the responsibilities of other employees in the department.

It is only shocks that are out of the ordinary that need to be addressed by a firm's leadership. Others would be routine responses worked out or learned from others over the years. Unusual shocks must first be recognized—often at lower levels in the firm's hierarchy—the relevant information transmitted to the firm's leadership, analyzed, a decision made, and instructions transmitted to the relevant managers and employees. These are the sorts of "transactions" that Coase evidently had in mind in his classic paper. These creative managerial efforts (including mistakes) have to be modeled to appreciate how dealing with surprise events constrains the size of even well-managed and designed firms.

Time Allocation by Senior Management

As a point of departure, suppose that there is a single top manager, possibly the company's formeteur, who makes all the adjustments to major surprise events. Suppose also that the extent to which a surprise needs to be addressed is not obvious. The time required varies with the quality of the data, I, provided by lower management. High-quality data (high I) makes this relatively obvious and low-quality data (Low I) makes it less so, making time spent less effective at reducing the probability of wrong conclusions, P, towards zero. Deciding what to do after drawing conclusions about the true nature of the problem confronted takes additional time. The larger the challenge, the more time spent analyzing the problem, t_2, tends to reduce the reduction in profits associated with the unpleasant surprise. The less time allocated to understanding the problem and planning a response the more errors are made—in the sense that one overreacts to small surprises or underreacts to major ones, and thus profits are lower than those that would have been achieved with a better allocation of time to the specific problem at hand.

$$P = f(t_1, I) \tag{11.9a}$$

$$\Pi^{Hr} = \pi^{H}(H, t_2) \tag{11.9b}$$

$$\Pi^{Hw} = \pi^{L}(L', t_2) \quad \text{with} \quad \Pi^{Hw} < \Pi^{Hr} \tag{11.9c}$$

$$\Pi^{Lr} = \pi^{L}(L, t_2) \tag{11.9d}$$

$$\Pi^{Lw} = \pi^{H}(H', t_2) \quad \text{with} \quad \Pi^{Lw} < \Pi^{Lr} \tag{11.9e}$$

If the event is actually a large surprise, H, the expected profit associated with spending time investigating which case has occurred is, Π^{HE}:

$$\Pi^{HE} = P\Pi^{Hw} + (1-P)\Pi^{Hr} = \quad (11.10a)$$

If the event is actually a modest surprise, L, the expected profit, Π^{LE}, is:

$$\Pi^{LE} = P\Pi^{Lw} + (1-P)\Pi^{Lr} > P\Pi^{Hw} + (1-P)\Pi^{Hr} \quad (11.10.b)$$

The CEO first determines how much time, t_1, to spend investigating whether the event is of type H or type Y, and then uses the residual of the time available, $t_2 = T - t_1$, to plan the response to whichever is thought to be more likely or most profitable (depending on his or her strategy for dealing with risks). The choice of t_1 thus determines the expected value of the surprise—although not the actual value, which is determined by the actual nature of the surprise and the efforts to cope with it.

There are four possibilities. The CEO may correctly determine the type, L or H. And, there are two types of possible mistakes—mistaking a type L for a type H, the L' case, and mistaking a type H as a type L, the H' case. Since the CEO does not initially know which type of surprise has occurred, an educated guess about the likelihood of the two types of errors is required. The two types of surprises may be regarded to be equally likely (e.g. the CEO may have diffuse priors), because he or she only deals with unusual surprises.[4]

In this case of diffuse priors, the effect on profits associated with investigating the nature of the surprise, t_1, can be characterized as:

$$\Pi^E = f(t_1, I)[(.5)\Pi^{Lw} + (.5)\Pi^{Hw}] + (1 - f(t_1, I))[(.5)\Pi^{Lr} + (.5)\Pi^{Hr}] \quad (11.11)$$

Or multiplying by 2 and substituting $T - t_1$ for t_2, as:

$$2\Pi^E = f(t_1, I)[\pi^H(H', T - t_1) + \pi^L(L', T - t_1)]$$

[4] The assumption of diffuse priors simplifies the math a bit. If instead of a diffuse prior, the CEO's experience suggests that the relative frequency of type H is $\propto$ and that of type L is $(1-\propto)$, equation 11.11 would be $\Pi^E = f(t_1, I)[(1-\propto)\Pi^{Lw} + (\propto)\Pi^{Hw}] + (1 - f(t_1, I))[(1-\propto)\Pi^{Lr} + (\propto)\Pi^{Hr}]$. In this case, $\propto$ would be an additional explanatory variable in equations 11.14a, 11.14b, and 11.14c. Note that the time spent determining which type of surprise has occurred does not affect the CEO's priors about surprise events in general, but does affect the probability of making mistakes in this specific case.

$$+(1-f(t_1,I))[\pi^L(L,T-t_1)+\pi^H(H,T-t_1)] \quad (11.12)$$

Differentiating with respect to t_1 characterizes the CEO's decision about how much time to spend investigating the nature of the surprise, t_1^*, and how much to spend planning the response, $T-t_1^*$.

$$\Pi_{t_1}^E = f_{t_1}\left[\Pi^{Lw}+\Pi^{Hw}\right]+P(-\Pi_{t_2}^{Lw}-\Pi_{t_2}^{Hw} +(1-P))[-\Pi_{t_2}^{Lr}-\Pi_{t_2}^{Hr}]=0 \quad (11.13)$$

The implicit function theorem implies that:

$$t_1^* = t(H,L,H',L',I,T) \quad (11.14a)$$

$$t_2^* = T-t_1^* \quad (11.14b)$$

$$P^* = f(t_1^*,I) \quad (11.14c)$$

The profits realized in the four cases are jointly determined by the event, H or L, whether a mistake is made or not, and the time spent planning the response, given CEO's time allocation decision.

$$\Pi^{Hr} = \pi^H(H,t_2^*) \quad (11.15a)$$

$$\Pi^{Hw} = \pi^L(L',t_2^*) \quad \text{with} \quad \Pi^{Hw}<\Pi^{Hr} \quad (11.15b)$$

$$\Pi^{Lr} = \pi^L(L,t_2^*) \quad (11.15c)$$

$$\Pi^{Lw} = \pi^H(H',t_2^*) \quad \text{with} \quad \Pi^{Lw}<\Pi^{Lr} \quad (11.15d)$$

The profit consequences of the two types of surprises determine the marginal effects of the CEO's time allocation problem on its expected future profits. These effects, together with the information and time available for dealing with the surprise of interest, determine the probability of mistakes and their associated lower profits for the firm. What the model does in this case is illustrate all of the factors that need to be taken into account to address crises as they emerge for a firm's various lines of products.

For the purposes of this part of the chapter, it is variable T that is of most interest. As the amount of time available for analysis per and planning per surprise diminishes, mistakes necessarily increase and the quality of the response to the surprise diminishes. The more markets that a CEO has to keep track of, the more surprises are likely, and the more mistakes in identification, and the weaker the average responses tend to be. It is the effects of increases in mistakes and diminutions in the quality of the responses that limit the scope of an actively managed multiproduct firm. Both

these effects tend to reduce a firm's profits and thereby its likelihood of survival in the long run. This effect also accounts for the inverse relationship between the breadth of a multi-product firm and its valuation in the stock market. It is also consistent with Coase's hypothesis about firm size—although it stresses a particular type of transaction—namely those requiring creative interventions by a firm's senior management.

Institutions to Address the CEO's Time Constraint

The institutions of a firm can be adjusted to account for the CEO's time constraints, but these do not eliminate the fundamental problems. Most of these, in effect, transform a multi-product firm into a series of single or narrow product sub-firms, making the CEO in effect a passive investor. For example, a firm can create divisions for each of its product lines with a COO (chief operating officer) for each with broad discretion of its division policies. Such COOs resemble CEOs in all but name, and the actual CEO has less and less to manage—and thus comes to resemble the leader of a conglomerate that passively invests in a number of firms. The breadths of the divisions resemble either narrow conglomerates or single good firms with fewer markets to be informed about and fewer surprise events to assess and respond to.

VIII. Conclusions

Multiproduct firms are natural consequences of efforts to reduce the variance in a firm's returns, to take advantage of complementarities among the demands for their products, reduce unit costs by exploiting complementarities in production methods, equipment, and personnel. Nonetheless, there are limits to those economic advantages and also in senior management's ability to respond to surprise events. These limits imply that multi-product firms tend to be of limited size although they may be quite large relative to many other firms. Whether this diminishes competition or not varies with the size of the markets served. When markets are large enough to support a wide variety of firms, the usual competitive models are applicable, although some adjustments are necessary to take account of the various complementarities among markets noted in this chapter. And the Ricardian approach allows for a greater variety of firms serving particular product markets than the Marshallian approach.

When markets are relatively small and only a few such firms can be supported, other models of pricing and production are necessary—as developed in the analysis of duopoly and oligopolistic markets reviewed earlier in this textbook. In such settings, every firm's strategies is partly based on

anticipated responses of other firms, rather than being independent profit or expected profit maximizing decisions.

When economies of scale are extensive or markets are very small, mulit-product firms may have significant monopoly power—as in the classic case of a single general store that serves a small town or village. In such cases, a firm may have significant monopoly power (e.g. be able to price well above marginal cost) in several markets simultaneously. Nonetheless, the residents of such places benefit from every trade that takes place and from the convenience of shopping locally rather than making a long journey to a town with more merchants to choose from, but they pay somewhat higher prices for their goods and services than typical of larger more competitive markets.

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