Business Organization as a Coordination Problem: Toward a Dynamic Theory of the Boundaries of the Firm

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Introduction

Many writers have noted that, since 1873, the main thrust of mainstream theory has shifted away from the concerns of Adam Smith and the classicals [12]. This "marginalist" or neoclassical theory was designed not to understand the springs of economic growth and the sources of wealth but rather to analyze the allocation of known and given resources. In his *Theory of Political Economy*, William Stanley Jevons [11, p. 267] put the matter this way. "The problem of economics," he wrote, "may, as it seems to me, be stated thus: — Given, a certain population, with various needs and powers of production, in possession of certain lands and other sources of material: required, the mode of employing their labour which will maximize the utility of the produce." Even at the start, however, marginalist theory was far from homogeneous in its concerns [10], and both the Austrian and Marshallian streams retained, albeit in slightly different ways, many of the classical preoccupations.

In any case, neoclassical economics grew to encompass a number of distinct variations, each arguably pointing at a different set of concerns. The Walrasian system poses an answer to an abstract logical problem whose general relevance one may question. But "Marshallian" comparative statics — itself only one aspect of Marshall's opus — was designed to answer some quite important questions: how in the short run do exogenous changes in boundary conditions affect the direction of change in price and quantity (supplied and demanded) in relatively isolated markets [26]?

Is this the set of questions that interest business historians? Arguably, business historians are at least as interested in the sorts of issues that animated Smith: what are the sources of economic growth and industrial competitiveness? How do the organization of production and the institutions of society affect economic growth and competitiveness? To the extent that business historians have been interested in such questions, then, mainstream

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theory has been of limited usefulness. Indeed, in the areas in which the concerns of business historians and economic theorists have overlapped — namely so-called Industrial Organization theory — neoclassical models have been strained well beyond their limits, leading to inappropriate applications of theory and, as in the area of antitrust policy, often absurd and harmful policy conclusions.

Attacks on mainstream theory are in abundant supply these days, and such a blanket criticism is not our goal here. Rather, we want to suggest that the appropriate theory for business historians ought to be animated by the questions with which business historians concern themselves. These are surely historical questions. More abstractly, however, they are questions, not only of allocation and welfare, but also very importantly of growth and development: how is new value created? They are, moreover, institutional questions: how do social institutions and forms of business organization lead to growth and competitiveness? And how are these institutions shaped in turn by growth and competition? Confronting such questions analytically may not mean abandoning mainstream ideas so much as abandoning those assumptions that were designed for other purposes and are inappropriate for the historian's questions.

The "why" of Organizations.

The formal neoclassical theory of the firm takes "the firm" as a fundamental building block in the construction of a theory of the industry. This building block is a simplified and anthropomorphized ideal type — a "monobrain," as Fritz Machlup [30] put it. Especially in its true Marshallian formulation, such an approach has proven extremely valuable for the questions of partial-equilibrium comparative statics for which it was intended. But, not surprisingly, that theory has not proven very useful in analyzing what goes on inside the firm or, more importantly, how production is actually organized within the economy. In Axel Leijonhufvud's irreverent image [29, p. 203], the formal neoclassical conception of the firm "is more like a recipe for bouillabaisse where all the ingredients are dumped in a pot, (K, L), heated up, f(•), and the output, X, is ready." It provides no insight into organizational structure or the sequencing of tasks.

More generally, economists tend to center their theories around the premise that firms exist to provide profits for their owners. This assumption holds both for the relationship of the firm to its external environment — what the firm chooses to do itself and what it purchases and sells to others — and for the internal organization of the firm — how it goes about producing whatever goods or services it has decided belong within its proper sphere of activity.

From the perspective of business history, this approach begs some of the most important questions. It essentially relegates to second place, or even assumes away altogether, the activities that the people working for the firm are actually engaged in. These include deciding what to produce and how to produce it and then actually producing it in the way that best rewards the firm's owners. Hence, success derives from the firm providing goods and

services that meet the needs of potential customers in a way that generates the highest possible returns to its owners. In short, firms, and those who would understand them, must keep an eye on both blades of the Marshallian scissors [27].

If this is true (and we think it is), then we should conceive of firms as organizations that need to tackle a variety of goals. These goals are interdependent in the sense that, while all of them are important, many may be in conflict if they are not coordinated or "managed." This holds even if we leave aside questions of opportunism and shirking. If the firm is to survive, let alone prosper, it must make sure that it produces something that customers desire, which means that it must acquire and accurately use information, or knowledge, about products and production processes.

In fact, a firm must be organized to undertake one, several, or all of the following activities associated with the profitable production of a good or service: conception, design and development, manufacturing, provision of inputs, marketing and distribution, and many others. A design that is outstanding in the sense that it meets the performance attributes [15] that potential purchasers desire, however, may for that very reason cost more to produce than those same purchasers are willing to pay; or it may be impossible to produce at all. Thus, one reason for organizing such diverse activities is to provide coordination between aspects of production so that a plausible outcome results in the form of a good or service that can be produced (a) with non-cost attributes attractive to potential buyers; (b) at a price that is also acceptable to those buyers; and (c) that allows for an acceptable return on the productive resources involved.

Whether the proper vehicle for generating such a plausible outcome is a vertically integrated firm, or several firms specializing in different links in the productive train, or a group of independent and unattached workers is a separate question. The answer depends, *inter alia*, on levels of transaction costs and the relative strengths and relevance of the capabilities of the possible participants in the production process.

Transaction-cost Approaches

Recently, of course, a new set of theories has emerged to focus more clearly on issues of organization. In one way or another, these strands have taken their inspiration from the work of Ronald Coase [6]. Here the firm is by no means the sort of black box it is in traditional IO theory. Moreover, these approaches do not "take the firm as a unit of analysis." In Oliver Williamson' formulation of transaction-cost analysis [44], for example, it is the "transaction" — which may occur within the firm or across markets — that becomes the fundamental unit of analysis. This approach is able to ask questions that are somewhat different from those of traditional IO theory. Principal among these is the matter of the boundary of the firm: why are some activities organized across markets and some organized within firms. As a consequence, the transaction-cost approach has also proven able to provide

some answers that are not only different from but arguably richer and more sensible than those of traditional IO.[1]

Salutary as these innovations have been, it nonetheless remains the case that transaction-cost analysis retains fundamentally the neoclassical conceptual apparatus. This is so in a couple of respects. First, transaction-cost analysis in all its principal forms is concerned with the allocation of known and given resources. Now, it is certainly true that imperfections in information figure prominently in this tradition. We might even say that the assumption of imperfections in information lie at the very heart of all transaction-cost approaches. But it remains the case that the "imperfections" allowed are of a rather particular and limited sort. Imperfect information or knowledge in these approaches is always of a "parametric" or purely quantitative kind [16]. For example, it may be costly to monitor levels of effort, or it may be costly for one party to know whether a product is a "lemon." But there is never any "structural" or qualitative uncertainty. There is never any disagreement between parties about the fundamental categories of action: all know what it would mean to provide a certain level of effort; all know what it means for a product to be a "lemon"; all know and agree on the game they are playing. To put it another way, there is never in these models any possibility for surprise, genuine innovation, or differing perceptions of reality.[2]

Another respect in which the Coasean traditions remain neoclassical is their near-exclusive focus on exchange to the neglect of production. Almost by definition, problems of transaction abound; but there is seldom in these models any fundamental differences in or ignorance about productive information.[3] As Demsetz [7, p. 148; see also p. 144] complains, "although information is treated as being costly for transaction or management purposes, it is implicitly presumed to be free for production purposes." Transaction-cost economics follows neoclassical theory in repressing, as Richard Nelson [32] puts it, the differences among firms in productive ability.

But business history is vitally concerned with both structural uncertainty and differences in production knowledge (and in the sources of production knowledge). The transaction-cost theories emanating from Coase ask useful

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[1]A prominent example of this would be the area of what Williamson [44] calls "non-standard contracting," including especially vertical arrangements like resale price maintenance or tying contracts.

[2]It is the case, however, that a number of writers have pointed in this direction, albeit unconsciously in many cases. The most explicit was Frank Knight, who was nonetheless misunderstood on the matter [25]. One can also see glimmers in Coase's discussion of incomplete contracts [6]. Some present-day writers may also be seen as edging toward something like this view: Hart [8] from formal modeling, Barzel [3] from moral-hazard theory, and perhaps even Klein [14]. All take productive capabilities as given, but they do appeal in the end to fundamental kinds of uncertainty that make complete contracts costly, requiring unified ownership by a residual claimant.

[3]On this point see also Winter [45].

and important questions, but without some substantial modifications in orientation and perspective, they cannot properly frame, and therefore cannot reliably answer, the questions of uncertainty that are central to business history. What we need, to put it simply, is a dynamic or entrepreneurial theory that allows finer distinctions between the proper spheres of firm and market.

The Theory of Economic Capabilities

There does exist a current of thought today that addresses clearly the issue of the creation of production knowledge. The fountainhead of this approach is arguably Edith Penrose's 1959 book, *The Theory of the Growth of the Firm* [35]. Penrose saw the firm as possessing various productive resources, including intangible managerial resources, that are often lumpy and indivisible. As a result, the firm tends to find itself with excess capacity in some resource, which leads it to grow and to diversify into areas in which the excess resources might be put to good use.

Although her terminology differs, Penrose anticipated many of the most important ideas later elaborated by other writers. Among these is G. B. Richardson, who introduced the useful term *capabilities* to refer to the skills, experience, and knowledge that a firm possesses. He concludes that firms "would find it expedient, for the most part, to concentrate on similar activities," that is, on those activities that require common capabilities [37, p. 895]. More recently, David Teece [41, 42] has developed a similar account of the scope of the firm. Teece explicitly draws on the evolutionary theory of Nelson and Winter, who have formulated a more microanalytic account of the nature of capabilities: namely, the habits and routines that individuals and organizations acquire through practice. "Routines," as they put it [34, p. 124], "are the skills of an organization." In the course of its development, a firm acquires a repertoire of routines that derives from its activities over the years. Note that *routines* refer to what an organization actually does, while *capabilities* also include what it may do if its resources are reallocated. Thus a firm's routines are a subset of its capabilities that influence but do not fully determine what the firm is competent to achieve. In essence, capabilities and routines are forms of knowledge about how to carry out productive tasks. Some of this knowledge may be tacit [36] and not easily articulated or transferred to others, but other capabilities may be generally available to those willing to make the investment necessary to acquire them.

Unlike neoclassical theory in most of its forms, this capabilities approach — as we may call it — shares the concerns of Smith and the classicals: the nature and sources of productive knowledge. But, also like the economics of the classicals, this approach does not by itself tell us everything we need to know about how productive knowledge is allocated between firm and market [22]. When connected with transaction-cost theory, however, the capabilities approach can provide dynamic or entrepreneurial theory of the firm — or, more correctly, of business institutions. The result is a theory of the boundaries of the firm that is quite different from what one finds in the mainstream literature of transaction costs.

Dynamic Transaction-cost Theory of Firm Boundaries

As Alchian and Woodward [2] suggest, present-day transaction-cost economics comes in two basic flavors: asset specificity [13, 44] or moral hazard [1, 3]. What both of these approaches have in common is that they see business institutions — and the firm in particular — as optimal responses to incentive problems. In terms of the new institutional economics [17, 24], we might say that mainstream transaction-cost theory explains the firm as the solution of a prisoners'-dilemma-like game.[4] In a prisoner's dilemma, information is certainly imperfect. But the fundamental problem the players face is less one of information than one of incentives. And the measure of a governance structure (to use Williamson's terminology) lies in its ability to align incentives and overcome "opportunism" (another term from Williamson). In this formulation, the *raison d'être* of the firm does not lie in coordination.

Most economists understand that markets are important institutions of coordination, even if the Walrasian apparatus severely handicaps their understanding of the nature of that coordination.[5] What few have noticed, however, is that other kinds of economic institutions — firms prominently among them — can also serve a coordination function as well as (or perhaps rather than) merely an incentive-alignment function. To put it another way, business institutions may also arise as solutions to coordination games. In a world of fundamental uncertainty, in which capabilities and knowledge differ among actors, this, rather than incentive questions, may be the central role of such institutions.

To see why this may be so, let us return to the notion of capabilities. The capabilities that exist in an economy are, as we saw, the evolved rules, habits, conventions that constitute productive abilities. Those business institutions tend to do better that can create and utilize superior capabilities. As Schumpeter [39] maintained, this process in which new capabilities emerge and are tested *is* the competitive process.[6] Such a process is necessarily complex and historically contingent. But there are a few theoretical generalizations one can make about which types of business institutions will likely be most successful under various circumstances.

As we have already suggested, one of the principal factors that business institutions must deal with is structural uncertainty. Thus, one of the principal determinants of the appropriate form of business institution will be the nature of the uncertainty — or, if you prefer, the innovation — involved. The second critical factor is the existing structure of relevant capabilities, including both the substantive content of those capabilities and the organizational structure under which they are deployed in the economy.

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[4]On the functionalist character of this kind of explanation, see Langlois [16, 18].

[5]But see Hayek [9].

[6]For an argument that Schumpeter was attacking the neoclassical conception of competition rather than defending "monopoly" in the neoclassical sense, see Langlois [19].

One pattern typical in the history of business institutions emerges when a *systemic* innovation would yield significant gains in one or more of the three areas we listed above: an improvement in the non-price characteristics of a product (which may sometimes mean a "new" product); a reduction in price; or an increase in the return to the input suppliers. To be successful, a systemic innovation requires simultaneous change in several stages of production.[7] This would likely render obsolete some existing assets and, at the same time, call for the use of capabilities not previously applied in the production of the product. If, in addition, the existing capabilities are under separate ownership — or, to put it loosely and somewhat inaccurately, the existing production system is coordinated through market mechanisms — then we arrive at one important rationale for the institution of the business firm. Under this scenario, the business firm arises because it can more cheaply redirect, coordinate, and where necessary create the capabilities necessary to make the innovation work. Because control of the necessary capabilities in the firm would be relatively more concentrated than in the existing organizational structure, such a firm could overcome not only the recalcitrance of asset-holders whose capital would have creatively to be destroyed but also the "dynamic" transaction costs[8] of informing and persuading new input-holders with necessary capabilities [40, 20, 22].

This scenario accurately describes the situation surrounding the creation and growth of many of the enterprises Alfred Chandler chronicled in *The Visible Hand* [4]. With the lowering of transportation and communications costs in the America of the nineteenth century, there arose profit opportunities for those who could create mass markets and take advantage of economies of scale in mass production. Examples range from steel and farm machinery to cigarettes and branded goods. In all these cases, profitable improvements in product attributes and costs[9] required the creative destruction of existing decentralized systems of production and distribution in favor of systems involving significantly different capabilities. Gustavus Swift's creation of the system of refrigerated meat-packing [4, pp. 299-302] was a systemic innovation that rendered obsolete the older network of live-animal distribution. Swift was forced to integrate into both refrigerated railroad cars and wholesale distribution in order to overcome the opposition of vested interests and to persuade others in the chain of production of the value of his innovation [40, pp. 28-29].

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[7]This usage follows Teece [43]. The opposite of a systemic innovation is an *autonomous* one, in which change can proceed in one stage of production without requiring coordination with other stages.

[8]More generally, dynamic transaction costs — or, more generally still, dynamic *governance* costs — are the costs of not having the capabilities you need when you need them [22].

[9]In many of these cases, the non-price attributes of the products may initially have deteriorated in consumer eyes as mass-produced items substituted for particularized or hand-made ones. But any such disadvantage was, of course, rapidly outweighed by reductions in product price.

This picture of the rationale for the firm is what we might legitimately call a strategic, entrepreneurial, or Schumpeterian theory of vertical integration. The superiority of centralized control of capabilities lies in the ability to redeploy those capabilities in the service of an entrepreneurial opportunity when such redeployment would otherwise be costly [28]. The firm overcomes the "dynamic" transaction costs of economic change. It is in this sense that we may say the firm solves a coordination problem: it enables complementary input-holders to agree on the basic nature of the system of production and distribution of the product. It provides the structure in a situation of structural uncertainty.

On Firms and Markets

A number of writers, with Schumpeter himself in the lead, have taken this picture of the firm to imply the superiority of the firm — especially the large vertically integrated firm — in most if not all times and places. In fact, however, the scenario we just depicted is by no means the only important one, let alone the only possible one. The superiority of the firm rested on its ability cheaply to redeploy, coordinate, and create necessary capabilities in a situation in which (1) the entrepreneurial opportunity involved required systemic change and (2) the necessary new capabilities were not cheaply available from an existing decentralized or market network. In situations, however, in which one or both of these conditions is missing, the benefits of the firm are attenuated, and its rationale slips away.

In many circumstances, for example, change — even sometimes rapid change — may proceed in autonomous fashion. A prime example of this occurs when the attributes buyers desire can be provided in the form not of a preset package but of a *modular system* [27]. Stereo systems and IBM-compatible personal computers are prominent examples, but there are many others as well, including cases in the realm of process technology [23]. For present purposes, the key feature of a modular system is that the connections or "interfaces" among components of an otherwise systemic product are fixed and publicly known. Such standardization creates what we might call *external economies of scope* [23] that substitute in large part for centralized coordination among the wielders of complementary capabilities. This allows the makers of components to concentrate their capabilities narrowly and deeply and thus to improve their piece of the system independently of others.

Moreover, in highly developed economies, a wide variety of capabilities may be available for purchase on ordinary markets, in the form either of contract inputs or finished products. At the same time, it may also be the case that the existing network of capabilities that must be creatively destroyed (at least in part) by entrepreneurial change is not in the hands of decentralized input suppliers but is in fact concentrated in existing large firms. The unavoidable flip-side of seeing firms as possessed of capabilities — and therefore as accretions of habits and routines — is that such firms are quite as susceptible to institutional inertia as is a system of decentralized economic capabilities. Even though firms may have a strategic decision-making function, they may yet be unable to reorient themselves in the face of rapid

change [27]. Economic change has in many circumstances come from small innovative firms relying on the capabilities available in the market rather than existing firms with ill-adapted internal capabilities.

Sometimes, of course, large firms are able to catch and overtake the innovators — or the innovators themselves become large firms, as in many of the nineteenth-century cases Chandler chronicles. But when the innovation involved is not systemic, innovation may actually proceed faster in a decentralized system because of its ability to utilize a more diverse set of information [33]. A case in point is the present-day microcomputer industry. Here technological change, volume production, and unit-cost reductions are proceeding at a pace to rival any Chandlerian industry in history. But these gains have come in the virtual absence of large firms integrated across the stages of microcomputer production. Although some of this advance is surely the result of internal economies in firms like Intel and Microsoft, even those firms are relatively narrowly focused. Large established firms, which have been able in other industries to overtake innovative first movers, have a record of dismal failure in this industry [21].[10] They have missed opportunities at every turn, and have shown themselves unable to compete with the more nimble independent marketer-assemblers. The Japanese have made few inroads. And IBM's record has been that of a technological follower living off its brand-name capital. Indeed, IBM's success with the original standard-setting PC in 1981 was based on a strategy of buying inputs on the market rather than according its internal divisions their accustomed privileged access to resources — a strategy the firm subsequently abandoned to its detriment.

Conclusions

What we are suggesting, once again, is the following. We ought to see markets not as merely allocating known and given resources but as providing the framework for the coordination of productive capabilities. Business institutions — including but not limited to firms — arise within that framework to take advantage of entrepreneurial opportunities. And we can study those institutions analytically by examining the nature of the coordination problem the entrepreneurial opportunity implies, both in the abstract and relative to the existing institutional configuration of capabilities in the economy.

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