



University of Connecticut

Department of Economics Working Paper Series

Transaction Costs, Production Costs, and the Passage of Time

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Working Paper 1995-03

August 1995

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Introduction.

A little more than 20 years ago, Ronald Coase (1972, p. 63) observed tartly that his 1937 essay “The Nature of the Firm” had been “much cited and little used.” The landscape of economic thought changed significantly in the years that followed, and a large body of literature quickly emerged that not only “used” but in many ways sprang from Coase’s paper. The basic insight is now well known. In addition to production costs of the usual sort, one must also consider “transaction costs” — as they later came to be called — in explaining institutions like the firm. Whether called transaction-cost economics (Williamson 1975, 1985) or the economics of organization more broadly (Milgrom and Roberts 1992), the Coasean literature of the last 20 years has indeed focused precisely on the comparative transaction costs of alternative organizational structures, including, paradigmatically, the choice between firms and markets.

Clearly, this recent blossom of interest in the economics of organization has been driven by a dynamic within present-day economic theory. At the same time, however, this modern literature also owes much to the way Coase originally formulated the problem of the boundaries of the firm. To put it another way, today’s economics of organization bears the imprint of the economics of the 1930s and Coase’s reaction to it.

The result of this “path-dependent” history of the economics of organization, I will argue, has been an odd partitioning of intellectual kingdoms. To price theory has been consigned all of production; and everyone seems to agree that the production function, with its attendant assumptions, tells us all we need to know about *production costs*. In this kingdom, knowledge remains explicit and freely

transmittable, and cognitive limits seldom if ever constrain. Modern-day economists of organization certainly do recognize (at least some) limits to knowledge and cognition; indeed, imperfect information is arguably the *raison d'être* of this literature. But, to an overwhelming extent, all imperfections — all deviations from the assumptions of the production-function formulation — are seen as falling exclusively under the jurisdiction of the kingdom of *transaction costs*. In today's economics of organization, transacting is fraught with hazards, and the problem of organization is one of creating governance structures to constrain unproductive rent-seeking behavior.

Seldom if ever do the two kingdoms converse within the mainstream literature of organization. Seldom if ever do economists in this tradition consider that knowledge may be imperfect in the realm of production, and that institutional forms may play the role not (only) of constraining unproductive rent-seeking behavior but (also) of creating the possibilities for *productive* rent-seeking behavior in the first place.

This essay is an attempt not only to document and criticize this intellectual partition but also to suggest that the partition is beginning to breakdown, even if the mainstream of the post-Coase literature has yet to take much notice. There is a new trend today toward a reconsideration of the importance of production costs — now recast in a new way — for understanding the problem of economic coordination.

Production costs I: Pigovian price theory.

As Loasby (1976), Moss (1984), and others have argued, what we think of as “Marshallian” theory today is in many ways more Pigovian than it is Marshallian.

Marshall thought in population terms, and constructed a “representative firm” that reflects the characteristics of the population of firms as a whole rather than the characteristics of any particular firm. By contrast, the “theory of the firm” of price theory, which Joan Robinson, Edward Chamberlin, and others built during the 1930s on a Pigovian foundation, begins with identical idealized firms and then builds up to the industry by simple addition. It is this later methodological standpoint, not any logical problem with Marshall’s own conception, that led to the famous controversy over increasing returns early in the century.

Thus does the “theory of the firm” in modern-day price theory start with firms as production functions, each one identical, and each one transforming homogeneous inputs into homogeneous outputs according to given technical “blueprints” known to all. One effect of these assumptions has been to reduce the margins on which firms operate to two only: price and quantity. This in turn has led to the notion of “perfect” competition, in which a technically desirable set of assumptions replaces the common-sense notion of competition (Hayek 1948; McNulty 1968).

Now, price theory — whether appreciative Marshallian or heavy-metal Pigovian — was never intended to be a theory of the firm as an organization or an institution. As Marshall understood, the firm in price theory is a theoretical link in the explanation of changes in price and quantity (supplied, demanded, or traded) in response to changes in exogenous factors (Langlois and Koppl 1991). It was never intended to explain industrial structure, let alone to serve as a guide to industrial policy. More to the point, using this sort of price theory to explain the boundaries of

¹ On the distinction between formal and appreciative theory, see Nelson and Winter (1982, p. 46).

the firm is just plain illogical, since the firm's boundaries in price theory are a matter of assumption.

The specter of illogic has not stopped a good many people from trying, however. Since Pigovian price theory rules out by assumption any qualitative elements, it must interpret all of industrial activity in terms of price and quantity. And, since these are purely quantitative variables, the only issue is whether they are of the right magnitude, that is, whether price and quantity are socially optimal (which is good) or not socially optimal (which is bad). Qualitative elements like distinctive knowledge, ongoing relationships, or exchanges of information do not appear on the radar screen of price theory — or, rather, when they do appear, they are often interpreted as unfriendly bogeys. In what Williamson (1985) calls the inhospitality tradition, the least hint of a non-impersonal relationship among firms is viewed with suspicion, since the only possible purpose of non-arm's-length arrangements (when seen through the price-theory lens) is collusion to raise price above the social optimum and to lower quantity below it.

The attempt to appraise institutions with an institution-free theory is an enterprise that has extended even to questions of the firm's boundaries. There exists a large literature attempting to explain vertical arrangements of various sorts, including vertical integration itself, using only the tools of price theory. One long-standing bit of inhospitality lore held, for example, that a firm could “leverage” its monopoly position at one stage in the chain of production into another stage by tying the sale of its product to the purchase of an input. This is, of course, a fuzzy-

² “Economic relationships are never perfectly competitive if they involve any ~~para~~do relationships between economic units.” (Stigler 1946, p. 24.)

headed idea, one that the Chicago School eventually cut to ribbon³. Posner (1979) has argued that the genius of the Chicago School in this respect lay in its rigorous and unflinching application of price theory⁴. And what price theory shows is that, in a world of pure neoclassical production costs alone, “market power” does not explain inter-firm contractual relationships (apart, perhaps, from simple collusion to raise prices) or the boundaries of the firm. This is, of course, quite to be expected, as it is a corollary of the proposition that, in a world of pure neoclassical production costs alone, *nothing* explains the boundaries of the firm.

Transaction costs.

Many economists, probably going as far back as Cantillon and Smith, have understood that the costs the firm faces are rather different in character from the fully known and purely technological costs of the production function. In this century, however, that recognition crystallized in a form that strongly challenged the price-theoretic formulation — while, in an odd way, simultaneously reinforcing it.

³ A firm cannot raise the price of a competitively supplied tied complement above competitive levels without thereby raising above the rent-maximizing level the effective price of the monopolized good to which the complement is tied. When the two tied goods are substitutes in production at the same horizontal level, it is possible to conjure up situations in which tying might in theory reduce welfare (Scherer and Ross 1990, p. 566). But those would not be vertical arrangements.

⁴ There is, however, another interpretation. Rather than applying price theory more rigorously, the Chicago School was arguably *broadening* price theory to include a wider range of phenomena. For example, the classic Chicago explanation for tying arrangements (Director and Levi 1956) is that they solve what is in effect a transaction-cost problem: tying allows a manufacturer to “meter” the output of a monopolized product in order to engage in price discrimination. The welfare implications of price discrimination are ambiguous, and such behavior is probably typically welfare enhancing. More to the present point, however, price discrimination (or, rather, the lack thereof) is a transaction-cost problem that tying helps mitigate.

In 1937, Ronald Coase enquired into the nature of the firm and observed that, in the world of price theory, firms have no reason to exist. According to the textbook, the decentralized price system is the ideal structure for carrying out economic coordination. Why then do we observe some transactions to be removed from the price system to the interior of organizations called firms? The answer, Coase reasoned, must be that there is a “cost to using the price mechanism” (Coase 1937, p. 390). Thus was born the idea of transaction costs: costs that stand separate from and in addition to ordinary production costs.

In a sense, Coase was reasserting Marshall against Pigou, but in a way already circumscribed and defined by Pigovian price theory. Rather than directly challenging the assumption of firm-as-production-function and the unproblematic nature of productive knowledge in price theory, Coase — or his intellectual legatees, at any rate — simply grafted onto price theory a second theory, namely a theory of transaction costs. It is transaction costs that explain, as it were, the institutional overlay of production. Production costs determine technical (substitution) choices, but transaction costs determine which stages of the productive process are assigned to the institution of the price system and which to the institution of the firm. The two kinds of costs are logically distinct; they are orthogonal to one another.

One salutary effect of the invention of the idea of transaction costs is that it made clear the extent to which the price-theory approach tends to sneak institutional judgments in the back door. This is true even of the basic idea of supracompetitive pricing applied to antitrust policy. As I enjoy pointing out to my students, the very idea of monopoly pricing, which seems so obviously a pure

⁵ Even though Coase did not actually use the term in the 1937 article.

artifact of price theory, is actually just a transaction-cost problem. The deadweight-loss triangle monopoly pricing creates is in fact an unexploited source of gains from trade, since, with an appropriate split of the rents, consumers could bribe the monopolist to produce at the social optimum in a way that is strictly Pareto improving. The reason that these gains are not exploited is that, in some institutional settings, it is costly for the consumers to organize and bargain with the monopolist: so costly, indeed, that these transaction costs — in the sense of Coase (1960) if not Coase (1937)⁶ — outweigh the costs of the deadweight loss. And, as Demsetz (1969) has pointed out in a related context, to pronounce an inefficiency and call for government intervention in such a case is in fact to propose replacing one institutional structure with another without having taken the trouble to examine the full costs of either.

Modern transaction-cost theory.

In Coase, the “costs of using the price mechanism” that give rise to the institution of the firm are the costs of writing contracts. The “most obvious cost of ‘organising’ production through the price mechanism is that of discovering what the relevant prices are” (Coase 1937, p. 390). A second type of cost is that of executing separate contracts for each of the multifold market transactions that would be necessary to coordinate some complex production activity.

In the end, however, it is a quite different type of contracting cost that attracts Coase’s attention. After pointing out that the nature of the firm consists largely in

⁶ It is in fact an interesting question whether the “costs of using the price system” in Coase (1937) are transaction costs in the same sense as the bargaining and other costs given the name transaction costs in Coase (1960). Although I will try below to shed some light on the “transaction costs” in Coase (1937), answering the comparative question is beyond the scope of this paper.

substituting an employment contract for a spot contract in output, Coase suggests that the real costs of contracts may lie in their inflexibility. “It may be desired to make a long-term contract for the supply of some article or service,” he writes.

Now, owing to the difficulty of forecasting, the longer the period of the contract is for the supply of the commodity or service, the less possible, and indeed, the less desirable it is for the person purchasing to specify what the other contracting party is expected to do. It may well be a matter of indifference to the person supplying the service or commodity which of several courses of action is taken, but not to the purchaser of that commodity or service. But the purchaser will not know which of these several courses he will want the supplier to take. Therefore, the service which is being provided is expressed in general terms, the exact details being left until a later date. ... The details of what the supplier is expected to do is not stated in the contract but is decided later by the purchaser. When the direction of resources (within the limits of the contract) becomes dependent on the buyer in this way, that relationship which I term a “firm” may be obtained. (Coase 1937, pp. 391-392.)

A close reading of this passage suggests that Coase’s explanation for the emergence of the firm is ultimately *acoordination* one. The firm is an institution that lowers the costs of qualitative coordination in a world of uncertainty, where *bycoordination* I mean the process of aligning the knowledge and expectations of the parties who need to cooperate in production, and by *qualitative* coordination I mean coordination involving the transmission of information beyond price and quantity.

Since Coase, the economics of transaction costs as applied to organization has burgeoned into a major subfield in the discipline. Largely in a quest to make Coase’s ideas more “operational,” this literature has arguably both narrowed his explanation for the firm and moved its focus away from issues of coordination,

⁷ As Herbert Simon (1957) explains the employment relation, the capitalist pays a wage for the right to choose which action $x \in \Omega$ the worker will perform at any time, where Ω is the “job description” or set of allowable actions to which the worker agrees.

⁸ Langlois and Cosgel (1993) argued that this was also ultimately Frank Knight’s explanation of the firm.

especially qualitative coordination. Oliver Williamson, the flagbearer of the field since the 1970s, cannot be accused of having a narrow conception of transaction-cost economics. But it was Williamson (1975) who introduced the idea of *opportunism* and made it coequal with *bounded rationality* as a pillar of the transaction-cost approach. The latter, which is Herbert Simon's famous term, leads naturally to a concern with coordination. Because economic agents have cognitive limits, in an uncertain world they cannot fully anticipate all future contingencies, which may make long-term contracting difficult. Relatedly, they may be afflicted with *information impactedness*, which means, more or less, that information important to a transaction can get stuck and not flow to where it is needed.⁹ Opportunism, however, is a behavioral (or quasi-behavioral) postulate rather than a strictly cognitive or informational one. In part, opportunism is just self-interested or rent-seeking behavior, something tacitly assumed at some level by Coase and most others. But Williamson embellishes the idea to become "self-interest seeking with guile" (Williamson 1975, p. 9). The "guile" part surreptitiously mixes in some information impactedness again. It also arguably both narrows and amplifies the presupposition of rent-seeking behavior, implying, if not necessarily requiring, that agents craftily seek to take advantage of others at every turn in a manner not typically constrained by wider or longer-run considerations.¹⁰

⁹ And it is, of course, cognition, not rationality, that is limited. That Simon labeled the problem a limitation of "rationality" says much about his own conception of rationality (Langlois 1990).

¹⁰ "Information impactedness is a derivative condition in the organizational failures framework. It is mainly attributable to the pairing of uncertainty with opportunism. It exists in circumstances in which one of the parties to an exchange is much better informed than is the other regarding underlying conditions germane to the trade, and the second party cannot achieve information parity except at great cost — because he cannot rely on the first party to disclose the information in a fully candid manner." (Williamson 1975, p. 14.)

¹¹ The assumption of opportunism has come under most violent attack by sociologists, who have usually offered to substitute their own excesses in the direction of communitarian postulates. A

In Williamson's work, especially his early work, opportunism and bounded rationality proved to be versatile tools that helped create a smorgasbord of explanations for organizational forms and features. Issues of coordination figured prominently in these explanations. For example, Williamson argued that internal organization may be a superior mode of coordination whenever boundedly rational transactors confront uncertainty.

If, in consideration of these [cognitive] limits, it is very costly or impossible to identify future contingencies and specify, *ex ante*, appropriate adaptations thereto, long-term contracts may be supplanted by internal organization. Recourse to the latter permits adaptations to uncertainty to be accomplished by administrative processes in a sequential fashion. Thus, rather than attempt to anticipate all possible contingencies from the outset, the future is permitted to unfold. Internal organization in this way economizes on the bounded rationality attributes of decision makers in circumstances in which prices are not "sufficient statistics" and uncertainty is substantial. (Williamson 1975, p. 9).

What Williamson here means by prices not being "sufficient statistics" — a reference to his interpretation of Hayek (1945) on the virtues of the price system — is that internal organization may be superior in situations requiring qualitative coordination, that is, the transmission and use of information beyond price and quantity.

The breadth of Williamson's approach was met, however, with impatience from the larger profession, now becoming increasingly interested in moving, albeit

sensible middle ground is Granovetter (1985), who argues that, although self-interested, behavior is "imbedded" in a network of relationships that go well beyond the boundaries of an individual transaction and that constrain in many cases the impulse to opportunism. I should add in Williamson's defense that he does mention trust and even atmosphere as important organizational variables. (See, for example, Williamson (1993).) As I will argue below, however, the postulate of opportunism, coupled with a comparative neglect of production-cost differences, has led transaction-cost economics to overemphasize the costliness of the price system (broadly understood).

gingerly, beyond the margins of price theory *strictu senso* into the economics of institutions. To most economists, even sympathetic ones, transaction-cost theory remained insufficiently “operational,” meaning that it was too rich to be crammed into a mathematical model. Williamson (1985) himself helped solve that problem when, along with Klein, Crawford, and Alchian (1978), he focused in on asset specificity as a variable first among (what had been) equals in explaining vertical integration.¹² Here was a variable that was quantifiable and whose relationship to the boundaries of the firm was clear: the greater the degree of asset specificity in a transaction, the higher the probability that the transaction would be internalized.

The logic is quite simple. Assets are highly specific when they have value within the context of a particular transaction but have relatively little value outside the transaction. This opens the door to opportunism. Once the contract is signed and the assets deployed, one of the parties may threaten to pull out of the arrangement — thereby reducing the value of the specific assets — unless a greater share of the quasirents of joint production find their way into the threat-maker’s pockets. Fear of such “hold up” *ex post* will affect investment choices *ex ante*. In the absence of appropriate contractual safeguards,¹³ the transacting parties may choose less specific — and therefore less specialized and less productive — technology. If, by contrast, the transacting parties were to pool their capital into a single enterprise in whose profits they jointly shared, the incentives for unproductive rent-seeking would be attenuated. And, because such unified organizations would choose the

¹² “The main factor to which transaction-cost economics appeals to explain vertical integration is asset specificity” (Williamson 1986, p. 189).

¹³ For example, a hostage. See Williamson (1985, chapters 7 and 8).

more productive specialized technology, they would win out in the competitive struggle against the contractual alternative¹⁴

As Williamson suggests, this logic depends as much on bounded rationality as it does on opportunism.¹⁵ “Guile” serves little when information is perfect. And, in a world of certainty and unrestricted cognitive ability (if one could imagine such a place), it would be easy to write and enforce long-term contracts that preempt *ante* unproductive rent-seeking behavior *ex post* and thus obviate internalization. This insight, indeed, has inspired one important formal strand of the literature. The work of Oliver Hart and others (Grossman and Hart 1986; Hart 1988, 1989; Moore 1992) — called the incomplete-contracts literature or, increasingly, the “property rights” approach¹⁶ — distinguishes two types of rights under contract: specific rights and residual rights. The latter are generic rights to make production decisions in circumstances not spelled out in the contract. In this literature, the choice between contract and internal organization reduces to a question of the efficient allocation of the residual rights of control when contracts are incomplete and assets highly specific. Suppose there are two parties cooperating in production, each bringing to the arrangement a bundle of assets. If none of the assets is highly specific,

¹⁴ This way of putting it gives an explicitly evolutionary spin to the functionalist argument more typical in transaction-cost economics.

¹⁵ Indeed, as I have long maintained, it is the bounded rationality part rather than the opportunism part that is the important factor in explaining internalization (Langlois 1984). Even if the parties were perfectly content always to split rents fairly and amicably, they would still be unable to write fully specified contracts in a world of what I call structural — that is, qualitative — uncertainty. Although the lack of opportunism would attenuate the need for internalization as a safeguard against intentional rent-seeking behavior, joint ownership may still have advantages in respect of flexibility and as a way of reconciling divergent visions of the uncertain future.

¹⁶ We might more properly call this literature the “new” property-rights approach to distinguish it from the older literature of property rights emerging directly from Coase (1960) and associated with such names as Alchian, Demsetz, Furubotn, and Pejovich. On this older literature see De Alessi (1983).

opportunism is impossible *ceteris paribus*, as either party can liquidate at no cost as soon as troublesome unforeseen contingencies arise. If, however, assets are specific, or if opportunism becomes possible for other reasons, it may be efficient to place the residual rights of control in the hands of only one of the parties by giving that party ownership of both sets of assets!¹⁷ In general, the owner ought to be the party whose possession of the residual right minimizes rent-seeking costs, which typically means the party whose contribution to the quasirents of cooperation is greater.

Another strand of the transaction-cost literature since Coase has reached a similar conclusion by a slightly different path. This strand has also emphasized opportunism and the hazards of contracting. In this case, however, the contractual hazards involved are not those of hold-up in the presence of highly specific assets but those arising from the costs of measuring the inputs to and monitoring the outputs of production!¹⁸ A well-known milestone along this path was Alchian-and-Demsetz's (1972) analysis of monitoring team production. When individual contributions to joint production cannot be distinguished, opportunistic contributors have the incentive to shirk, that is, to supply less effort than they contracted to supply. (Such shirking, and related problems in other formulations, are instances of

¹⁷ Hart and his colleagues hold that the possession of the residual rights of control necessitates ownership of the firm's capital assets, whether tangible or intangible. This allows them to do something few in the literature have been able to do: ~~to~~ *define* the boundaries of the firm crisply and consistently. For them, a firm is defined by the bundle of assets under common ownership. (This stands in contrast to the "nexus of contracts" view, which sees the firm as a far more fuzzy notion.) While I find Hart's approach appealing, I wonder, with Louis Putterman (1988), whether it is not in fact possible to possess the right to direct the production program (that is, the residual rights of control) without also possessing the firm's capital.

¹⁸ Williamson (1985, p. 24) distinguishes his *governance* approach to transaction-cost economics from the *measurement* approach. I would also lump agency theory in with the measurement-cost approach, since that literature is also driven by monitoring costs (which are a form of measurement costs, namely, the costs of measuring performance *post*, as distinct from the *ex ante* measurement costs of searching or sorting inputs).

moral hazard broadly understood.) Alchian and Demsetz propose that this problem be solved by assigning one party to be a specialist in monitoring — a boss — who possesses the rights to the residual income and is thus monitored by the market. *Voilà* the firm.

As Alchian and Woodward (1988) point out, transaction costs emanating from situations of moral hazard are ultimately related to those emanating from problems of hold up: both arise because cognitive limits create in contracts a certain “plasticity” that allows conduct *ex post* to deviate from what was agreed upon *ex ante*. In the hands of Barzel (1987), indeed, the moral-hazard approach tells a story quite similar to that of Hart, *et al.* Imagine again two parties cooperating in production. If the output of one of the parties is hard to monitor, that party is tempted to moral hazard. If in addition the shirking party’s contribution to the joint quasirents is large, it may be efficient to assign the residual rights to this hard-to-monitor partner, who is then effectively disciplined by the desire to maximize residual income.¹⁹ Although it is less clearly spelled out, Barzel’s story is also one of incomplete contracts. Routine tasks are generally easy to monitor. The less routine the agent’s actions— the larger the uncertainty in the tasks the agent may be called upon to execute — the harder to monitor the agent and the harder to specify in a contract what the agent is supposed to do.²⁰

¹⁹ Also like Hart, Barzel (1987) believes possession of the residual rights should involve ownership of capital, in this case because capital ownership serves as a bond to guarantee the fixed-income claims of the other parties.

²⁰ Barzel’s own example is of cooperation between a manufacturer and a “business expert.” Because the business expert is the harder to monitor, says Barzel, he or she ought to become the entrepreneur and possess the residual claim. But this is because the business expert is the one whose tasks involve greater uncertainty and are more difficult to specify in a contract. That the expert can disguise shirking as bad luck (as Barzel puts it) is a manifestation of contractual incompleteness, not its cause.

This is all well and good as far as it goes, which, I want to argue, is not nearly as far as the mainstream economics of organization seems to think. The emphasis on opportunism and moral hazard in the literature obscures, in my view, the fundamental role that institutions (including the firm) play in qualitative coordination, that is, in helping cooperating parties to align not their incentives but their knowledge and expectations.

John Roberts, one of the leaders of the formalist wing of the economics of organization, would seem to agree. In a recent book review, he faults his author for treating “organizational tasks and problems as being exclusively matters of incentives and motivation, with issues of communication, coordination and decision costs having no role. In fact, coordination — even in teams with shared goals — is far from free and automatic, and managers spend large amounts of time attempting to achieve and maintain it. The economic theory of organizations ought to reflect this” (Roberts 1994, p. 161). In support of this view, Roberts cites his own recent textbook in the field (Milgrom and Roberts 1992). Yet, as Brian Loasby points out in his excellent review of that textbook, Roberts’ own treatment of coordination is startlingly slight. “Even if ‘the treatment of the problem of co-ordination in Chapter 4 [of Milgrom and Roberts] goes well beyond anything that has yet appeared in the scientific literature of the economics profession’ — a claim which seems to depend on the definition of ‘scientific literature’ — a single theoretical chapter on coordination within organizations compared with five on motivation, incentives, and contracts surely reflects the balance of that scientific literature rather than the real problems of managing an organization” (Loasby 1995, p. 472).

Production costs redux: capabilities.

Why is coordination relatively so neglected in the mainstream economics of organization? The answer is to be found in large part in the partition between transaction costs and the costs of production, a partition rigidly upheld (in principle) by both price theory and organizational economics. Williamson, for example, maintains that, although he sees organizational structures as somehow resulting from the minimizing of the sum of production costs and transaction costs, his own analytical interest has lain in transaction costs alone (Williamson 1988, p. 361). That is, he (and most others) have sought to hold production costs constant and investigate the effects on organization form of differences in transaction costs *seuls*.²¹ This is by no means a nonsensical methodological position. In the end, however, production costs and transaction costs do affect one another, and they cannot be so neatly separated.

Indeed, the very notion of asset specificity brings production costs back in centrally, albeit in a somewhat *ad hoc* way. In the basic asset-specificity story, the nature of the rent dissipation that integration avoids is the inefficient choice of technology. Absent joint ownership of assets, the contracting party or parties at risk would choose a less-productive but more-liquid technology as a defense against holdup, thus dissipating quasirents in the same sense that residents of crime-ridden areas “waste” resources on locks and security guards in order to reduce the likelihood of becoming the victims of directly unproductive rent-seeking activities.

²¹ As Loasby points out, Milgrom and Roberts also ignore the production side. “[D]espite their ready acknowledgement of Chandler’s work. Milgrom and Roberts prefer the transaction as the unit of analysis, and do not enquire into the productive activities which a firm undertakes. The final chapter, of only ten pages, skims over technical change, team production, the creation of capabilities and organizational entrepreneurship” (Loasby 1995, p. 475).

But what makes choosing more-liquid assets inefficient in this case is the old Smithian production-cost tradeoff. As G. B. Richardson (1960, p. 151) puts it, the “sacrifice of adaptability which any act of real investment inevitably imposes should be regarded as simply the obverse side of the gains from specialization.” Not merely is the division of labor limited by the extent of the market, it is limited by the *predictability* of the extent of the market. Organization matters, then, because various organizational forms have quite different abilities to eliminate sources of uncertainty — and therefore to support a more elaborate division of labor.

But production costs and transaction costs are also arguably intertwined in a much more subtle and fundamental way. If one relaxes the rather stern assumption that productive knowledge is always in the nature of “blueprints,” the line between production costs and transaction costs begins to blur.

As we saw, standard Pigovian price theory partakes of the epistemology of old spy movies, in which complete knowledge of how to build and launch an ICBM could somehow be transcribed onto a microdot and hidden under a postage stamp. Michael Polanyi (1958) has taught us, however, that knowledge is not all of a form that can be articulated in words or pictures for easy transmission. Much knowledge — including, importantly, much knowledge about production — is *tacit* and can be acquired only through a time-consuming process of learning by doing. In a world of tacit knowledge, having the same blueprints as one’s competitors is unlikely to translate into having the same costs of production.²² Moreover, in a world of diffuse and variegated knowledge, the costs that can make transacting difficult — the costs

²² Indeed, having the same *equipment* may not guarantee the same production costs, as suggested by Polanyi’s own example of the Hungarians unable to make function a light-bulb machine identical to one operating flawlessly in Austria.

that may lead to internalization or various other business institutions — may go beyond those that arise in the course of defending against opportunism. In such a world, economic activity may be afflicted with what I call dynamic transaction costs,²³ the costs that arise in real time in the process of acquiring and coordinating productive knowledge (Langlois 1992b; Langlois and Robertson 1995).

In order to understand this point, we need to recognize that production faces two rather different kinds of coordination problems: problems of the *coordination of production* and problems of the *coordination of commitments*.²⁴ The former arise, in effect, when flexibility inhibits specialization. The latter — the obverse side — arise when specialization inhibits flexibility, especially the flexibility to seize profitable opportunities.

As we have seen, the main current of the transaction-cost literature (and, in a larger sense, so-called industrial organization in general) concentrates almost exclusively on problems of the coordination of commitments. Solutions to such problems typically follow the lines set out by Schelling (1960) and defined, among other places, in the domain of constitutional economics (Buchanan 1990). In certain situations, interacting parties can increase their welfare (severally as well as jointly) by committing in a credible way to one particular course of action. Paradoxically (from a standard economic point of view), the parties can actually make themselves better off by *reducing* the size of their choice set. In the case of specific assets, the

²³ Loosely, and perhaps somewhat cryptically, dynamic transaction costs are the costs of not having the capabilities you need when you need them (Langlois 1992b).

²⁴ I am indebted to Sergey Rumyantsev for this terminology.

²⁵ Problems of the coordination of commitments are tailor-made for game-theoretic modeling, an approach that dominates the high-brow regions of the field of industrial organization today. See, for example, the textbook by Tirole (1988).

reasons for this should be clear. By following inflexibly a predictable course of action, one can reduce uncertainty, thus allowing others to plan effectively and encouraging efficient specialization. One way to gain predictability is to follow codes of behavior, which, by restricting one's freedom of action, increase predictability (Heiner 1983; Langlois 1986).

But flexibility too is valuable. The cost of specialization is the ability to adapt to an uncertain future, which may mean, in particular, foregoing profitable market opportunities and emerging technological possibilities. Specialization is certainly a matter of highly specific tangible assets. Production requires the service not just of plant and equipment but of skills and experience that are highly specific in character.

Recently, a distinctive approach to the economics of organization has arisen that focuses precisely on the problems of specific and tacit knowledge on the production side. Influenced by such writers as Edith Penrose (1959), G. B. Richardson (1972), Richard Nelson and Sidney Winter (1982), and Alfred Chandler (1977, 1990, 1992), this dynamic-capabilities approach (Teece and Pisano 1994; Langlois and Robertson 1995) takes as a starting point the idea that productive knowledge is neither explicit nor freely transferable. Thus, individuals — and organizations — are necessarily limited in what they know how to do well. And the structure of complementarity and similarity among the various capabilities or competences in the economy affects the pattern of organization (including the firm-market boundary) in ways not fully explicable in terms of the costs of transacting. Indeed, the ability to transact (and therefore the cost of transacting) is itself a capability (Winter 1988), which suggests a blurring of the partition of the kingdoms.

It was G. B. Richardson who introduced the term “capabilities” to talk about the necessarily limited range of productive knowledge firms and individuals possess. Taking issue with the representation of knowledge in the production-function approach, he writes:

Of course I realise that production functions presume a certain level of managerial and material technology. The point is not that production is thus dependent on the state of the arts but that it has to be undertaken (as Mrs. Penrose has so very well explained) by organisations embodying specifically appropriate experience and skill. It is this circumstance that formal production theory tends to put out of focus, and justifiably, no doubt, given the character of the optimisation problem that it is designed to handle; nevertheless, it seems to me that we cannot hope to construct an adequate theory of industrial organization and in particular to answer our question about the division of labour between firm and market, unless the elements of organisation, knowledge, experience and skills are brought back to the foreground of our vision (Richardson 1972, p. 888).

Richardson’s discussion of capabilities is clearly indebted to Penrose (1959). In her theory, firms consist of acquired pools of resources — including, importantly, managerial resources — that come in lumpy bundles. In order to take advantage of excess capacity in some of the lumps, the firm may expand or diversify into areas in which that capacity is useful. This in turn may lead the firm to acquire other complementary capabilities, which will lead to further excess capacity, etc.

In Richardson’s terminology, production can be broken down into various stages or *activities*. Some activities are *similar*, in that they draw on the same general capabilities. Activities can also be *complementary*, in that they are connected in the chain of production and therefore need to be coordinated with one another. For Richardson, the central problem of economic coordination lies in the fact that what is complementary need not be similar: “Where activities are both similar and complementary they could be co-ordinated by direction within an individual

business. Generally, however, this would not be the case and the activities to be coordinated, being dissimilar, would be the responsibility of different firms. Coordination would then have to be brought about either through co-operation, firms agreeing to match their plans *ex ante*, or through the processes of adjustment set in train by the market mechanism” (Richardson 1972, p. 895).

Clearly, coordination — the matching, “in level or specification” (1972, p. 895), of complementary activities — could still be a matter of coordinating commitments. In many respects, this is the view taken by David Teece (1980, 1982, 1986), one of the few major scholars to have incorporated Richardson’s ideas. Unlike Richardson, who discusses the coordination of complementary *activities*, Teece talks about complementary *assets* that might be *cospecialized* to one another. As with Richardson’s closely complementary activities, cospecialized assets may be difficult to coordinate. But, unlike Richardson, Teece is inclined, with the broader asset-specificity literature that has influenced him, to believe that cospecialized assets may be a cause of integration more than of cooperation, especially to the extent that integration allows an innovator to appropriate the gains from innovation in regimes in which intellectual property rights are ineffective.

Thus, we might say that, for Teece, problems of coordination arise because markets (narrowly understood) exhibit *too little* “friction.” Governance structures alternative to the market arise to prevent slippery innovative knowledge from escaping the grasp of its creators, just as, in the main current of the transaction-cost literature,²⁶ alternative governance structures emerge to protect transactors from the

²⁶ Indeed, the formal economics of organization has lately begun to take cognizance of the idea of capabilities. But, rather than adopting the stance toward productive knowledge taken by Penrose and Richardson, it seeks to explain the tendency of firms to concentrate on specific activities in terms of problems of coordinating commitments. In Milgrom and Roberts (1992), for

“plasticity” of contract. An admixture of Penrose, however, suggests the opposite possibility. Coordination problems may arise because markets — or, indeed, any structure of business institutions, including large vertically integrated firms — exhibit *too much* “friction.” If Penrose and Richardson are right, the knowledge, skills, and traditions embodied in existing governance structures (be they firms, markets, or in between) may be too inflexible, especially in the face of major “Schumpeterian” change, to seize market and technological opportunities. In such circumstances, other governance structures that can muster the necessary capabilities may arise and prosper.

Morris Silver (1984) has suggested, for example, that much vertical integration arises not when firms venture into areas of similar capabilities but when firms are dragged, kicking and screaming, as it were, into complementary but dissimilar activities because only in that way can they bring about a profitable reconfiguration of production or distribution. For example, consider the once-famous calculator-maker Bowmar. After losing a defense contract, Bowmar was looking for some way of selling its light-emitting diodes. The company tried to interest makers of larger calculators in using the LEDs, to no avail. So Bowmar designed its own hand calculator, and the rest was history²⁷ (Schnaars 1994). On the other side of the ledger, we might tell a similar story about IBM’s motives for

example, a commitment to a narrow strategy allows managers engaged in a coordination game to avoid dominated equilibria. And Rotemberg and Saloner (1994) use the incomplete-contracts framework to argue that a firm may choose a narrow strategy (and thus ignore profitable opportunities) because strategic breadth leads to implementation problems^{post} that distort *ante* incentives. Rotemberg and Saloner (p. 1131) note that “increasing returns to specialization” — which comes closer to the Penrose-Richardson idea — may also be a reason for narrow strategies, but they do not investigate that possibility.

²⁷ As, soon, was Bowmar, which went belly-up a few years later, the victim of larger firms ~~wing~~ di Teecean complementary assets. I am indebted to Paul Robertson for this example and the Schnaars reference.

turning to the market rather than to its in-house capabilities in producing the original PC (Langlois 1992a). Paul Robertson and I (1995) have tried to think in some depth about the implications of these sorts of coordination problems.

Conclusion.

The last phrase of my title for this paper — “the passage of time” — was consciously intended as a *double entendre*. On the one hand, it refers to the importance of considering both production costs and transaction costs as occurring in time — and therefore in a world of bounded rationality and changing knowledge. But I also intended the phrase to refer to the passage of history, namely the history of economic thought. While we have progressed far in the the economics of transaction costs, our picture of production costs has — at least until recently — remained frozen in time. It is now time that our economics of organization became informed by an understanding of production costs that is as sophisticated and as institutional as our understanding of transaction costs.

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