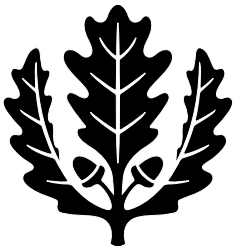

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Chandler in a Larger Frame: Markets, Transaction Costs, and Organizational Form in History

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In 1977, when Alfred Chandler's path-breaking book *The Visible Hand* appeared, the large vertically integrated "Chandlerian" corporation had dominated the organizational landscape for nearly a century. In some interpretations, possibly including Chandler's own, *The Visible Hand* and subsequent works constitute a triumphalist account of the rise of that organizational form: the large vertically integrated firm arose and prospered because of its inherent superiority, in all times and places, to more-decentralized market-oriented production arrangements. A quarter century later, however, the Chandlerian firm no longer dominates the landscape. It is under siege from a panoply of decentralized and market-like forms that often resemble some of the "inferior" nineteenth-century structures the managerial enterprise had replaced.[1]

What to do with a triumphalist history of something no longer triumphant? The menu of intellectual alternatives is short. One could reject Chandler's account as having been wrong from the start.[2] One could deny that the large corporation is less successful and superior today than it was in the past.[3] Or, most interestingly, one could attempt to reinterpret Chandler in a way that preserves the essence of his contribution while placing that contribution in a frame large enough to accommodate both the rise and the (relative) fall of the large managerial enterprise. This last alternative – if done right – has the great advantage of preserving the essence of Chandler's remarkable and profound insights while at the same time extending our understanding of the economic theory of organization.

In April, 2003, there appeared in print two long essays attempting this third approach. One is the work of the formidable trio of Naomi R. Lamoreaux, Daniel M. G. Raff, and Peter Temin (henceforth LRT); the other is my own paper called "The Vanishing Hand." Rather than rehash my own attempt to reframe Chandler, I propose to devote the first part of this essay to comparing my account with that of LRT. There is much common purpose and a good deal of overlapping explanation in the two papers; and I will choose to see the essential differences that remain as complementary rather than contradictory. Armed with this general comparison, I then examine how the two papers address what is perhaps the fundamental post-Chandlerian puzzle. Although transportation and communication costs appear to have been declining in secular fashion since antebellum times, organizational structure has not change monotonically. Instead, as LTR have noted, it has followed a pronounced hump-shape pattern over time, moving from highly decentralized to integrated back to decentralized again.[4] The question of why this has happened is crucial to how we assimilate Chandler into a new framework.

A "new synthesis."

Both LRT and "The Vanishing Hand" are fundamentally Chandlerian in orientation. They are homages to Chandler far more than critiques. But, as LRT observe, Chandler's achievement was largely descriptive, and it lacked an

underlying theory of organizational change.[5] The fundamental aim of both papers is to supply this missing theory.

The first place LRT look for theory is in the work of Oliver Williamson. The "lack of an underlying theory or organizational change made it difficult for [Chandler] to explain the erosion that occurred in the position of these giant firms by the late twentieth century," they write. "Fortunately, other scholars, most notably Oliver Williamson, had already recognized the need to fit Chandler's narrative into a broader theory of the firm"[6] A dominant figure in the present-day economics of organization, Williamson had self-consciously attempted to explain the rise of the Chandlerian firm as the "product of a series of organizational innovations that have had the purpose and effect of economizing on transaction costs"[7] In Williamson's account, vertical integration in the Chandlerian firm arose in response to incentive problems – especially in the face of asset specificity and asymmetric information – that disinclined potential market partners from investing in appropriate assets. LRT are anxious to adapt some of Williamson's basic apparatus to their own goal of explaining the Chandlerian firm as one element in a diverse array of possible organizational forms.[8]

The fundamental idea that LRT take from Williamson is that one can explain organizational form largely if not entirely as a response to incentive problems created by asymmetric information. In this respect, the theory LRT

supply to Chandler fits snugly within the mainstream of the modern neoclassical economics of organization.[9] There are many useful and important ideas here; and LRT use this theory to good advantage, especially in their discussion of America before the Chandlerian revolution, a discussion rich with both historical texture and economic explanation. It is also here that the overlap with my story is greatest. In discussing the antebellum period and the beginnings of the Chandlerian revolution, I also have occasion to cite issues of asymmetric information as part of what I call the evolutionary design problem organization had to solve.

My quarrel with this mainstream approach – and therefore with the analysis of Lamoreaux, Raff, and Temin – lies not so much with its substantive results as with its implicit explanatory claims. There are more things in heaven and earth than are dreamt of in the philosophy of asymmetric information. Harold Demsetz has pointed out the strange explanatory dichotomy under which the mainstream economics of organization operates. In this literature, the world of transacting is a jungle of contractual hazards, asymmetric information, agency problems, and opportunism; by contrast, the world of producing – the business of figuring out what to make and of learning how to make it – is a carefree land of perfect information and given blueprints. But surely knowledge must be as imperfect and costly in production as in transacting.[10] Following the lead of George Richardson, Richard Nelson and Sidney Winter, and others, a growing group of writers has begun to see as central the problem of how

economic agents and their organizations acquire economic *capabilities* – the limited and costly knowledge of how to produce.[11]

The philosopher Michael Polanyi has taught us that knowledge is not all of a form that can be articulated in words or numbers for easy transmission.[12] Much knowledge — including, importantly, much knowledge about production — is *tacit* and can be acquired only through a time-consuming process of learning by doing. Moreover, knowledge about production is often essentially *distributed* knowledge, that is to say, knowledge that is only mobilized in the context of carrying out a multi-person productive task; is not possessed by any single agent, and normally requires some sort of qualitative coordination — for example, through direction and command — for its efficient use.

In a world of tacit and distributed knowledge – that is, of differential capabilities – having the same blueprints as one's competitors is unlikely to translate into having the same costs of production. Generally, in such a world, firms will not confront the same production costs for the same type of productive activity. Moreover, the costs that can make transacting difficult, and may lead to internalization, can go beyond those that arise in the course of safeguarding against opportunism or damping moral hazard through monitoring or incentive contracts. In such a world, economic activity may be afflicted with "dynamic transaction costs," the costs that arise in real time in the process of acquiring and coordinating productive knowledge.[13] Problems of economic organization may

crucially reflect the possibility that a firm may control production knowledge that is, in important dimensions, strongly different from what others control. Thus members of one firm may quite literally not understand what another firm wants from them (for example, in supplier contracts) or is offering them (for example, in license contracts). In this setting, the costs of making contacts with potential partners, of educating potential licensees and franchisees, of teaching suppliers what it is one needs from them, etc., become very real factors determining where the boundaries between firms will emerge.

It is significant in this context that, when Chandler himself addressed directly the issue of the appropriate theoretical underpinnings of his work, he came down firmly in the evolutionary capabilities camp. He criticizes the post-Coase literature for its choice of the isolated transaction as the unit of analysis, and suggests instead that research focus on "the firm's facilities and skills." These are "the most significant factor in determining what will be done in the firm and what by the market."[14]

Drawing on many of these ideas, Paul Robertson and I have proposed an evolutionary theory of what we call business institutions, that is, of markets, hierarchies, and the many hybrid forms that live between and around markets and hierarchies.[15] What drives the theory is the costs faced by various business institutions of acquiring economic capabilities suitable to the profit opportunities they face. Three factors are important.

- *The pattern of existing capabilities in firm and market*. Are existing capabilities distributed widely to many distinct organizations or are they contained importantly within the boundaries of large firms?

- *The nature the economic change called for*. When technological change or changes in relative prices generate a profit opportunity, does seizing that opportunity require a systemic reorganization of capabilities (including the learning of new capabilities) or can change proceed in autonomous fashion along the lines of an existing division of labor?

- *The extent of the market and the level of development of market-supporting institutions*. To what extent can the needed capabilities be tapped through existing arrangements and to what extent must they be created from scratch? To what extent are there relevant standards and other market-supporting institutions?

One pattern typical in the history of business institutions emerges when existing capabilities are largely under separate ownership — or, to put it loosely and somewhat inaccurately, the existing production system is coordinated through market mechanisms – and a profit opportunity arises that requires systemic reconfiguration of those capabilities. Simultaneous change in several stages of production would likely render obsolete some existing assets and call for the use of capabilities not previously applied in the production of the product. Under this scenario, the vertically integrated 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 to be creatively destroyed but also the "dynamic" transaction costs of informing and persuading those who possess the necessary capabilities.

This scenario is of course the Chandlerian revolution. 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 required the creative destruction of existing decentralized systems of production and distribution in favor of systems involving significantly different capabilities.[16]

A concrete example might help. Consider vertical integration in the early years of the Ford Motor Company. LRT tell some interesting stories about how Ford used techniques like the $5 day and gender-coding of work to mitigate some of the agency problems of the moving assembly line. But, of course, this doesn't explain Ford's high level of vertical integration. LRT go on to describe Ford's strategy of classic mass production: making a more-or-less

undifferentiated product with a fine division of labor and specialized tools. In furtherance of this strategy, and unlike his early competitors, "Ford pursued a strategy of vertical integration in order to reduce costs and insure a ready supply of parts that precisely fit his specifications."[17] But why did vertical integration reduce costs? Why couldn't independent vendors produce a ready supply of parts to Ford's specifications? LRT never address these questions.

Robertson and I tell the story a different way. Begin by noticing that the moving assembly line was not about assembling cars; it was about *making parts*. To accommodate his mass-production strategy, Ford needed to invent new ways to make parts fast and cheap. Existing suppliers were typically generalists who used batch techniques: a radiator supplier might well be a firm whose principal business was making tin buckets. Mass producing parts called for a systemic change in the process of production. In effecting this change, it was far less costly for Ford to make the parts himself than to try to manipulate a grossly ill-adapted supplier network.[18] Why didn't Ford teach his suppliers the techniques of mass production and then buy from them? The very simple answer is that he couldn't teach them what he didn't yet know. Inventing the moving assembly line – or, rather, many different assembly lines for many different parts – was a process of capability-building that required lengthy trial-and-error learning. To say that the suppliers lacked the incentives to make the necessary investments may be true as a Scholastic point, but it scarcely captures the reality of the situation.

None of this is to say that issues of incentives and asymmetric information are never part of the story. Consider the case of Singer Sewing Machine, which in the late nineteenth century slowly replaced a network of commissioned sales agents with its own regional sales offices staffed by salaried employees who could demonstrate the machines, repair them, and offer credit to buyers. LRT explain this (and similar integration in other industries) in terms of Williamson's "externality principle": independent distributors failed to invest in necessary assets and exert adequate sales effort because they understood that other distributors could free ride on those investments. The evidence for this interpretation is persuasive. On the other hand, theory also suggests that such free-rider problems can be solved by adopting a different contracting structure like territorial exclusive dealing or resale price maintenance.[19] Why did Singer choose vertical integration? Chandler's account stresses Singer's *invention* of management techniques for selling sewing machines.[20]

> Transactions cost considerations played a significant part in the determination of the extent of both forward and backward integration. Even when suppliers and distributors were competent and reliable, they were often unable to deliver on schedule and in the quantity and quality required by the new capital-intensive industries. Distributors were often slow in returning sales revenues to the manufacturer or in providing necessary marketing services and information. But the initial move forward into distribution and marketing by entrepreneurs in the new industries of the Second Industrial Revolution was that often suppliers and distributors had neither sufficient knowledge of the novel and complex products nor the facilities required to handle them efficiently.[21]

In part, Singer needed to figure out how to manage the geographically dispersed distribution of a complex and expensive consumer product – and it was easier to learn and teach these management techniques through wholly owned branches than through contract.

We can never have a complete explanation of organizational form without attending to the transaction-cost (asymmetric-information) problems those forms help solve. But our explanation is in danger of being even more incomplete if such problems are all we pay attention to. For one thing, transaction-cost issues are seldom the *drivers* of organizational change, even though they may influence the shape of the final product of organizational change. As the railroad and the telegraph lowered transportation and communication costs in the late nineteenth century, it became economical to package goods centrally (as in cigarettes) or to coordinate the distribution of goods centrally (as in mail-order retailing). This created problems of asymmetric information that organization had to solve by branding and other means.[22] But these transaction-cost problems did not *drive* the organizational change. What drove the change were factors affecting production costs and production technology.

And sometimes transaction-cost explanations don't seem very helpful at all. Consider the problem of explaining the continued – perhaps even accelerated – dominance of the Chandlerian corporation in the middle years of the twentieth century. As I've argued, the transaction-cost approach does give

LRT some leverage in explaining the world before the rise of the large corporation and even some aspects of the managerial revolution – even if, as I have also argued, they miss many of the major reasons behind that revolution. As we will see, LRT also offer insights into the decline of the vertically integrated firm. But LRT devote little space to the middle twentieth century, and their treatment is essentially descriptive – a paraphrase of Chandler. For good reason, there is no mention of asymmetric information or transaction costs, as neither of these is particularly helpful in explaining this period.

The evolutionary capabilities perspective fares much better. One strand of that theory takes as its text Edith Penrose's 1959 *Theory of the Growth of the Firm*, which offers an account of how, under some circumstances, capabilities may evolve within the context of existing large firms.[23] As Penrose saw it, firms consist of a set of "resources," many of which are in the nature of skills, knowledge, and capabilities. Such resources typically come in "lumpy" bundles, and thus present themselves as fixed costs or overheads. Often a firm finds that a particular set of its resources is in excess capacity; and to spread those overheads more widely, it seeks out appropriate opportunities for diversification. To the extent that the overhead resources consist in knowledge and skills, the firm will seek to diversify into areas requiring closely related knowledge.

Penrose's theory arguably fits the large corporation in the middle years of the twentieth century. Because of the path of vertical integration on which the large enterprises had set out, capabilities tended to develop within that integrated structure rather than outside of it. This was especially true to the extent that the internally grown capabilities were relevant to the major technological developments of the era.[24] At the same time, many large American firms benefited from a certain amount of *de facto* protection after the Japanese and European economies were devastated in World War II. This attenuated selection environment reduced the threat of "capability destroying" innovations from external sources and allowed American firms to pursue profitable "capability enhancing" innovation.[25] For a while, that is. With increased globalization, beginning with the requickening of German and Japanese competition in the 1970s, this golden age began to pass away.

It is important to recognize that Chandlerian firms are not the only possible response to problems of asymmetric information; neither are they the only possible response to the need to rearrange economic capabilities. Consider a second scenario that flows from the Langlois-and-Robertson explanatory framework. Suppose that, when exogenous forces call for a realignment of capabilities, institutions exist – or can be cheaply created – to channel change into a decentralized pattern. In such a case, change can proceed in autonomous fashion along the lines of an existing or a developing division of labor.

This scenario can play itself out in a number of ways. Indeed, it was at work even in the era of the Chandlerian firm. Branding by large multi-unit firms was one solution to the problems of quality guaranteeing that arose with high-volume trade. But another was standards. By the middle of the nineteenth century, lowered transportation and communications costs made possible bulk shipment of wheat from the mid-west. This necessitated the mixing together of wheat form many different farmers, which destroyed traditional small-scale mechanisms of reputation based on the identity of the farmer. As a result, farmers no longer had strong incentives to maintain quality. The Chicago Board of Trade addressed the problem by creating standard categories of wheat and eventually by hiring inspectors to enforce the standards. The resulting system was one of high-throughput market exchange, with a bit of hierarchy added in by the Board of Trade.[26] As Alfred Marshall insisted, markets as well as firms require conscious organization.[27]

This is by no means an isolated case. In "The Vanishing Hand" I mention a more recent example: the creation of standards in home mortgage lending by the Federal National Mortgage Association and other banking institutions, which led to the creation of alienable securities in home mortgages and an ongoing de-verticalization of the home mortgage industry.[28] An even more dramatic example is that of personal computers, which I have written about extensively elsewhere. Here standards generated a modular system that allowed entry points for market players at virtually all vertical and lateral stages of

production.[29] Notice that in these (late twentieth century) cases, the development of market-supporting institutions creatively destroyed the existing system of capabilities contained within Chandlerian firms. This scenario is the *unmaking* of the Chandlerian revolution.

Explaining the hump.

In setting forth our framework, Robertson and I explicitly describe the process of explaining organizational form as "necessarily complex and historically contingent."[30] Both scenarios – as well as others – can occur and have occurred throughout the last 150 years, and both will continue to occur. But to tackle the question that LRT and I both address – why was the large Chandlerian firm relatively more dominant in the past and relatively less dominant now? – one has to pay attention to systematic changes in boundary conditions. Transportation and communications costs have fallen monotonically since antebellum times; population and per capita income have risen in secular fashion.[31] These are the boundary conditions to which both they and I apply our contingent theories in order to confront the post-Chandlerian puzzle.[32]

What LRT and I – and others – observe is that, although the boundary conditions seem to have changed monotonically, organizational form has not. In the antebellum era, the population of organizational arrangements consisted almost entirely of decentralized, market-oriented, and relational forms. In the era Chandler chronicles, the large managerial corporation clustered into an

important and perhaps dominant place in that population. In the last quarter century, the relative importance of the large managerial corporation has declined, as has its typical level of vertical integration – which makes the population of arrangements today begin to look a lot more like the antebellum one. Keeping in mind the population logic of this claim, we might loosely say that vertical integration started low, increased, and then decreased again even as the boundary conditions changed monotonically.

In what is an important substantive contribution to the discussion, LRT draw our attention to the income variable. Classic mass production had generated economies of scale by optimizing on a standardized product. That product may have represented no consumer's ideal bundle of attributes; but the price was so low that, on a value-per-dollar basis, the undifferentiated product dominated higher-priced specialty goods. As incomes continued to grow in the twentieth century, however, consumers began to be willing to pay for higher-quality and more-individualized goods. Born of the era of classic mass production, Chandlerian hierarchies proved too inflexible to compete against networks of agile specialist firms for the custom of these wealthy buyers.[33]

Of course, transportation and transaction costs must matter, too. For one thing, antebellum consumers had even lower incomes, but they were served by markets and relational contracts. LRT appeal here to Paul Krugman's core-periphery model of industrial location, in which a kind of "reswitching" occurs.

Roughly speaking, the model predicts that, when transportation costs are high, production takes place nearby to consumption; as transportation costs decline, it begins to pay to locate production in a core and ship to the periphery; but as transportation costs decline further, the core-periphery structure starts to become less pronounced.[34] LRT take from this the message that, when transportation and communications costs are high, "economic activity tends to be local and consequently small in scale. When communication is virtually instantaneous, as on the Internet, and transportation is very cheap, then, all else equal, economic activity can be located virtually anywhere and even tailored to individual needs. When communication and transportation costs are neither prohibitive nor trivial, however, there are advantages to be obtained from concentrating productive activity in specific locations *and in large firms*."[35]

Notice that, taken literally, this is not by itself the explanation we seek. To the extent it addresses the point at all, Krugman's model predicts "large firms" only in the sense of price theory (producing a lot of output) rather than in the sense of Coase (incorporating many activities or stages of production). Krugman's model is about where firms locate, not about how they are organized. Indeed, most of the book cited (and much of Krugman's other work) suggests that the core ought to look like a Marshallian industrial district. But if we take the "reswitching" idea as an analogy, and incorporate the income variable, we can in fact arrive at an approach to the puzzle.

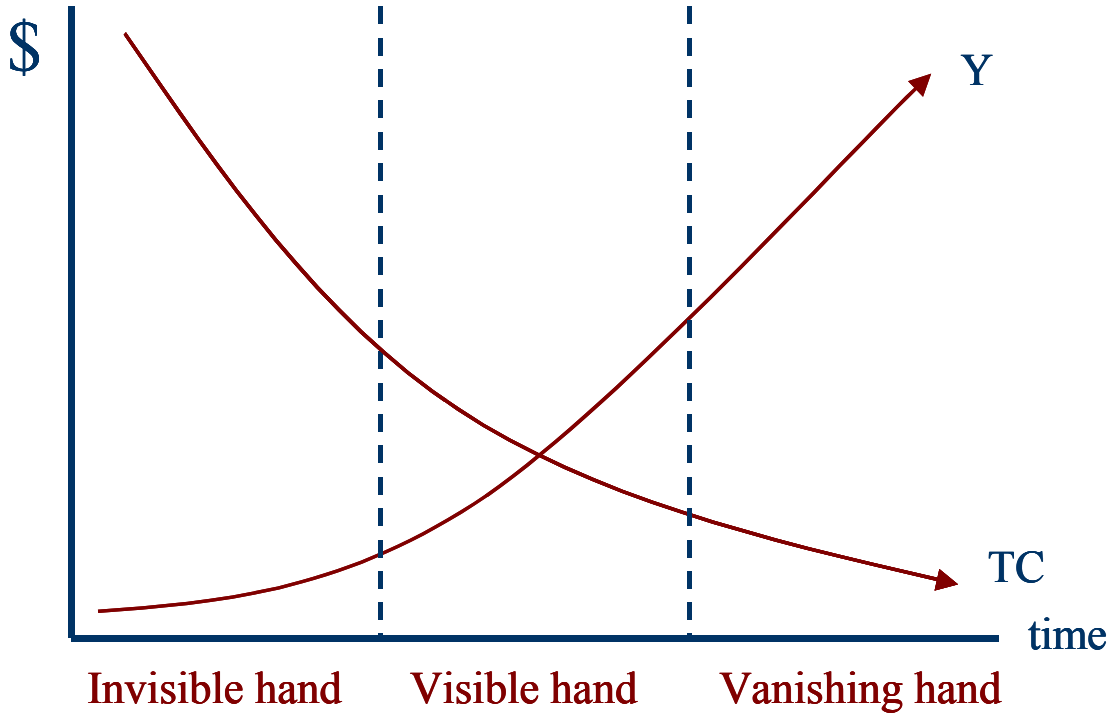

Figure 1
The Lamoreaux, Raff, and Temin explanation?

See Figure 1. Early on, high transportation and transaction costs (TC) dominate the story. Production has to be small-scale and relational, and a low level of income (Y) only reinforces that fact. In today's economy, income dominates the story, as consumers demand distinctive and individualized products, which are best supplied by agile market-oriented and relational forms. A low level of transaction and transportation costs either reinforces this tendency or, if it fails to reinforce it, the TC effect is swamped by the demand effect.[36] In the middle, when incomes are still relatively low but transportation and transaction costs are falling, Chandlerian firms work best.

Of course, we still need a theory of *why* Chandlerian firms work best in this intermediate range. LRT are not specific on this point. They seem to take it for granted, as indeed many do, that classical mass production implies large vertically integrated firms and that customization calls for smaller, more flexible, relational firms. But why is this so? Two related facets of classical mass production stand out: (1) the need for dedicated machinery and other specialized assets and (2) the presence of high fixed costs in a high-throughput setting. If we focus on the first alone, we get a story consistent with the Williamsonian tenor of LRT's overall argument. But if we take in both facets, I argue, we are led to an explanation far more in accord with Chandler.

In the mainstream economics of organization, it is the highly specific character of the productive assets that matter. Assets are "specific" here in the sense that they hold value largely or exclusively within the context of a transaction; they need not be specialized to tasks in the sense of Adam Smith, although presumably there is a correlation between contract-specific and task-specific assets. Put simply, specific assets are significant in this literature because they make possible a potential threat of expropriation, which can be avoided through internal organization involving common ownership of the specific assets. Assuming in addition that there is a connection between this kind of asset specificity and classical mass production, then we have a Williamsonian prop for the LRT argument.[37]

In Chandler, by contrast, what is at issue is the management of a high-throughput system whose assets are specialized in the sense of Smith. Producing an undifferentiated product with dedicated assets (including routines and knowledge) reduces unit costs by spreading overheads over more and more output.[38] For this to work, however, it is crucial that the high-fixed-cost assets be used to capacity. In "The Vanishing Hand," I appeal to a notion of *buffering* that I borrow from the "cybernetic" theory of organization developed in the 1960s and 1970s.[39] Buffering mechanism are various features and designs intended to insulate the organization, especially a high-throughput system, from environmental variation. Such environmental variation includes, but goes well beyond, the threat of hold-up because of opportunistic behavior. In this account, the managerial structure Chandler describes arises not as a way of solving a problem of hold-up but as a mechanism of ongoing coordination to "buffer" threats to the system.

Whereas LRT discuss rising incomes and lowered transportation and communications costs, I talk about *the extent of the market*, which varies positively with population and per capita income and negatively with transportation and communication costs (political as well as technological). When the extent of the market is small, clearly production will be local, small in scale, and oriented to markets. As extent of the market expands, it pays to take advantage of economies of scale in high-throughput systems. The demand-side certainly matters: because relatively low-income consumers are willing to accept

undifferentiated products, this high-throughput production can take the form of classical mass production, which requires a high level of buffering by internal management in order to actualize potential scale economies.[40] But the supply side also matters. It is a major part of my argument that, as the extent of the market grows, markets (and market-supporting institutions) can take over many of the buffering functions of management.

"In the beginning there were markets" is Williamson's famous heuristic dictum.[41] For him, a fair comparison between markets and hierarchies implicitly requires us to assume that the same capabilities are available through contract as would be available to hierarchy. I have been at pains to suggest that, from a historical and evolutionary perspective, this heuristic leads us astray. Especially in times of significant economic transformation, internal organization may arise precisely because the relevant capabilities are not cheaply available through contract. As time passes and the extent of the market grows, however, we should expect markets (that is, "contracting" broadly understood) to become more "capable."[42]

As time passes, all other things (including extent of the market) equal, the outlines of new capabilities will become sharper; activities will become more routine and better understood; and capabilities will thus begin diffuse to others.[43] Moreover, economic agents can be expected to discover techniques other than integration for mitigating problems of asymmetric information. As the extent of

the market grows, all other things (including knowledge) equal, it will pay to incur the set-up costs that markets and market-supporting institutions (like formal standards) require. Moreover, as markets become thicker, assets are likely to become less transaction specific (because there are many more potentially similar transactions) and relative minimum efficient scale is likely to decline in general.

In principle, a Chandlerian revolution could happen again if a radical change in technology or exogenous factors creatively destroyed existing market capabilities and rendered existing market-supporting institutions irrelevant. In the small, this is happening all the time. But if we are considering the question of dominance within the entire population of organizational forms, then *absolute* levels of the extent of the market have to matter. For one thing, larger markets can support more "general specialties" or "general-purpose technologies."[44] A Chandlerian firm starting up today can plug into modern financial markets, modern banking, containerized shipping, Federal Express, personal computers, and the Internet without having to reinvent those stages of production itself. This suggests that, not only should we expect Chandlerian forms to occupy a smaller niche in the population of firms as the extent of the market grows, but we should also expect those firms to be less vertically integrated on average.

In the end there are markets. This is not a historicist claim, merely a claim that history matters. Williamson's catch-phrase is self-consciously ahistorical.

To apply any contingent theory, including LRT's, we need to look at history. We need to look at boundary conditions and at how those boundary conditions change systematically. I believe both papers do that. But I have tried in my account to remain faithful not to Williamson's Chandler but to a Chandler who sees the evolution of the capabilities of firms (and of markets) as crucial to explaining economic organization in history.

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Notes

[1] I take this assertion as a starting point rather than as something to be demonstrated. But evidence is far from lacking. For econometric studies showing increased outsourcing and vertical specialization, see for example Robert C. Feenstra, "Integration of Trade and Disintegration of Production in the Global Economy," *Journal of Economic Perspectives* 12 (Fall 1998): 31–50 and John R. Baldwin, Desmond Beckstead, and Richard E. Caves, "Changes in the Diversification of Canadian Manufacturing Firms (1973-1997): A Move to Specialization," Statistics Canada, Analytical Studies Branch, Research Paper 179, 2002. For various other kinds of evidence, see also Naomi R. Lamoreaux, Daniel M. G. Raff, and Peter Temin, "Beyond Markets and Hierarchies: Toward a New Synthesis of American Business History," *American Historical Review* 108 (April 2003): 404-433; Richard N. Langlois, "The Vanishing Hand: The Changing Dynamics of Industrial Capitalism," *Industrial and Corporate Change* 12 (April 2003): 351-385; Timothy J. Sturgeon, "Modular Production Networks. A New American Model of Industrial Organization," *Industrial and Corporate Change* 11 (June 2002): 451-496; and Todd R. Zenger and William S. Hesterly, "The Disaggregation of Corporations: Selective Intervention, High-Powered Incentives, and Molecular Units," *Organization Science* 8 (May-June 1997): 209-222.

[2] An alternative that some writers have long been suggesting. See for example Charles F. Sabel and Jonathan Zeitlin, "Historical Alternatives to Mass Production: Politics, Markets, and Technology in Nineteenth-Century Industrialization," *Past and Present* 108 (August 1985): 133-176.

[3] It may not be entirely unfair to suggest that Chandler himself has taken this approach. For example, his account of the rise of the electronics industry after World War II is at pains to stress the contribution of large firms like IBM, and it invites us to see the rise of this industry as akin to, if not identical to, the original Chandlerian revolution of the late nineteenth century. What this fails to stress is that the "large" firms today – like Intel and Microsoft – are far less vertically integrated than traditional Chandlerian firms and are imbedded in thick market-like networks more akin to traditional industrial districts. IBM is one of the few genuinely Chandlerian firms to make the transition to the New Economy, but it did so by radically de-verticalizing and by emulating its more specialized competitors. For Chandler's account, see Alfred D. Chandler, Jr., *Inventing the Electronic Century* (New York, 2001). For my own account of the rise of the electronics industry, see Richard N. Langlois, "External Economies and Economic Progress: The Case of the Microcomputer Industry," *Business History Review* 66 (Spring 1992): 1-50; Richard N. Langlois, "Digital Technology and Economic Growth: the History of Semiconductors and Computers," in *Technological Innovation and Economic Performance*, ed. Benn Steil, David Victor, and Richard R. Nelson (Princeton, N. J., 2002), 265-284; and Richard N. Langlois and W. Edward Steinmueller, "The Evolution of Competitive Advantage in the Worldwide Semiconductor Industry, 1947-1996," in *The Sources of Industrial Leadership,* ed. David C. Mowery and Richard R. Nelson (New York, 1999), 19-78.

[4] Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies"(2003) 429-430; Langlois, "Vanishing Hand," 377-379.)

[5] Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies" (2003), 406.

[6] Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies" (2003), 406.

[7] Oliver E. Williamson, "The Modern Corporation: Origins, Evolution, Attributes," *Journal of Economic Literature* 19 (December 1981): 1537-68, quotation at 1537. See also generally Oliver E. Williamson, *The Economic Institutions of Capitalism* (New York, 1985).

[8] LRT "retain Williamson's core assumption that imperfect information creates the potential for exploitation whenever goods or services are exchanged, but argue that economic actors have attempted to resolve these problems in a wide variety of ways" (Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies" (2003), 407.) That is to say, LRT depart from Williamson only in rejecting the simple markets-hierarchies distinction in favor of a world in which there are also many kinds of hybrid forms that mix aspects of market and hierarchy. This latter point LRT view as a major theme of their paper.

[9] A paradigmatic representative of the mainstream economics of organization is Paul J. Milgrom and John D. Roberts, *Economics, Organization, and Management* (New York, 1992). In the footnotes, LRT do invoke the idea of path dependency, citing Paul David, and claim affiliation with the evolutionary theories of Douglass North and of Richard Nelson and Sidney Winter. (See Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies" (2003), 409n14 and 410n16. See also Douglass C. North, *Structure and Change in Economic History* (New York, 1981); and Richard R. Nelson and Sidney G. Winter, *An Evolutionary Theory of Economic Change* (Cambridge, Mass., 1982); and Paul A. David, "Why Are Institutions the 'Carriers of History'?: Path Dependence and the Evolution of Conventions, Organizations and Institutions," *Structural Change and Economic Dynamics* 5 (December 1994): 205-220.) But this invocation comes specifically and narrowly in the context of a discussion of the complex ways actors confront and solve problems of asymmetric information. Moreover, in an earlier footnote, LRT distinguish their effort from that of "The Vanishing Hand" precisely on the grounds that the latter "takes recent experience as the culmination of a process of economic evolution" (Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies" (2003), 405n3). I return to this claim below in a slightly different context.

[10] Harold Demsetz, "The Theory of the Firm Revisited," *Journal of Law, Economics, and Organization* 4 (1988): 141-161. For an elaboration of this point, see Richard N. Langlois and Nicolai J. Foss, "Capabilities and Governance: The Rebirth of Production in the Theory of Economic Organization," *Kyklos* 52 (1999): 201-18.

[11] G. B. Richardson, "The Organization of Industry," *Economic Journal* 82 (September 1972): 883-96; Nelson and Winter, "An Evolutionary Theory."

[12] Michael Polanyi, *Personal Knowledge* (Chicago, 1958).

[13] 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 See Richard N. Langlois, "Transaction-cost Economics in Real Time," *Industrial and Corporate Change* 1 (1992): 99-127.

[14] Alfred D. Chandler, Jr., "Organizational Capabilities and the Economic History of the Industrial Enterprise," *Journal of Economic Perspectives* 6 (Summer 1992): 79-100. Quotation is from page 86.

[15] Richard N. Langlois and Paul L. Robertson, *Firms, Markets, and Economic Change: A Dynamic Theory of Business Institutions* (London, 1995).

[16] 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. I return to this point below.

[17] Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies" (2003), 420.

[18] Richard N. Langlois and Paul L. Robertson, "Explaining Vertical Integration: Lessons from the American Automobile Industry," *Journal of Economic History* 49 (June 1989): 361-375.

[19] See Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization* (Reading, Mass., 1999), 405-408. Evidently, Singer's territorial contracts with independent dealers were not exclusive, inducing the dealers to free ride on Singer's reputation while pushing other brands of sewing machine. (Andrew B. Jack, "The Channels of Distribution for an Innovation: the Sewing Machine Industry in America, 1860-1865," *Explorations in Entrepreneurial History* 9 (1957): 133-41.) Exclusive dealing would have eliminated that particular problem.

[20] Alfred D. Chandler, Jr., *The Visible Hand: the Managerial Revolution in American Business* (Cambridge, Mass., 1977), 302-306. Chandler also notes that Singer was rolling in free cash flow, and much of its vertical integration into things like timberland and an iron mill may have been the result of a weak selection environment.

[21] Chandler, "Organizational Capabilities," p. 87.

[22] Sukkoo Kim, "Markets and Multiunit Firms from an American Historical Perspective," *Advances in Strategic Management* 18 (June 2001). But compare Langlois, "Vanishing Hand," 368n25.

[23] Edith T. Penrose, *The Theory of the Growth of the Firm* (Oxford, 1959).

[24] I take this to be part of Chandler's point in *Inventing the Electronic Century.*

[25] This terminology is from Michael L. Tushman and Philip Anderson, "Technological Discontinuities and Organizational Environments," *Administrative Science Quarterly* 31 (1986): 439-465.

[26] Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies" (2003), 414-415. The story LRT tell here draws on William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York, 1991).

[27] Brian J. Loasby, "Firms, Markets, and the Principle of Continuity," in *Centenary Essays on Alfred Marshall*, ed. J. K. Whitaker (Cambridge, England, 1990), 120.

[28] Michael G. Jacobides, "Why Do Markets Emerge? Organizational Unbundling and Vertical Dis-Integration in Mortgage Banking," Working Paper, Centre for the Network Economy, London Business School, 2003.

[29] Langlois, "External Economies"; Richard N. Langlois and Paul L. Robertson, "Networks and Innovation in a Modular System: Lessons from the Microcomputer and Stereo Component Industries," *Research Policy* **21** (August 1992): 297-313.

[30] Langlois and Robertson, "Firms, Markets, and Economic Change," 3.

[31] Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies"(2003), 429-430.

[32] In the penultimate version of their paper, published as a prestigious National Bureau of Economic Research working paper, LRT single me out (twice!) as poster child for the view that "the organizations that appear to be characteristic of the present era [are] a new endpoint toward which history has been evolving." (Naomi R. Lamoreaux, Daniel M. G. Raff, and Peter Temin, "Beyond Markets and Hierarchies: Toward a New Synthesis of American Business History," Working Paper 9029, National Bureau of Economic Research, July, 2002, p. 58). What distinguishes their work from mine, they say, is that I "see the economy of the 1990s to be the last stage in a historical evolution" (ibid., p. 2n3). After I protested to the authors and supplied them with the final version of my paper, they eliminated the former reference and changed the latter to the slightly more ambiguous claim, cited earlier, that my paper "takes recent experience as the culmination of a process of economic evolution" (Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies" (2003), 405n3). Culmination? If this claim is intended to mean that (unlike them?) I am a follower of Nelson and Winter, then I embrace it warmly; if it is intended to suggest that I see evolution in teleological or historicist terms, then it is extraordinarily wide of the mark. For my views on the non-teleological character of evolutionary explanation, see Richard N. Langlois, "Rationality, Institutions, and Explanation," in *Economics as a Process: Essays in the New Institutional Economics,* ed. Richard N. Langlois (New York, 1986), 225-55; Richard N. Langlois and Michael J. Everett, "What Is Evolutionary Economics?" in *Evolutionary and Neo-Schumpeterian Approaches to Economics,* ed. Lars Magnusson (Dordrecht, 1994), 11-47; and Müfit Sabooglu and Richard N. Langlois, "Knowledge and Meliorism in the Evolutionary Theory of F. A. Hayek," in *Evolutionary Economics: Program and Scope,* ed. Kurt Dopfer (Dordrecht, 2001), 231-251.

[33] Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies" (2003), 430.

[34] Paul Krugman, *Geography and Trade* (Cambridge, Mass., 1991), 111. At least in the version of the model cited, reswitching never actually occurs, as the value of the key parameter never gets bigger than one even for zero transportation costs.

[35] Lamoreaux, Raff, and Temin, "Beyond Markets and Hierarchies" (2003), 429-430, emphasis added.

[36] It is the focus on the demand side that distinguishes the LRT explanation from otherwise similar explanations that rely solely on arguments about changes in transaction costs arising from present-day computer and communications technology. Of course, a naïve account that appeals only to modern computer and communications technology is inadequate, since, as Ronald Coase pointed out, whether new technology favors markets depends on whether that technology lowers the cost of market exchange more than it does the costs of hierarchical control. See Ronald H. Coase, "The Nature of the Firm," *Economica* (N.S.) 4 (November 1937): 397n3. Sophisticated arguments must contain an account of why modern technology favors markets over firms. In a paper published a bit ahead of the Internet curve, Malone, Yates, and Benjamin present just such a sophisticated argument. They isolate two factors that determine the boundaries between market and hierarchy: asset specificity and the complexity of product descriptions. The latter refers to "the amount of information needed to specify the attributes of a product in enough detail to allow potential buyers … to make a selection." See Thomas W. Malone, JoAnne Yates, and Robert I. Benjamin, "Electronic Markets and Electronic Hierarchies," *Communications of the ACM* 30 (June 1987): 484-497, quotation at 486. Modern technology shifts the margin in favor of markets along both dimensions. Flexible manufacturing technology reduces the specificity of assets, and higher-bandwidth communications technology can transmit complex product information more cheaply. For empirical evidence that information technology tends to favor vertical disintegration, see Lorin M. Hitt, "Information Technology and Firm Boundaries: Evidence from Panel Data," *Information Systems Research* 10 (June 1999): 134-149.

[37] This implies both good news and bad news for Williamson. On the one hand, it endorses his view that asset specificity is the fundamental determinant of vertical integration. On the other hand, it suggests that his key variable is rapidly losing its significance in the modern economy.

[38] On the idea of knowledge reuse as a source of economies of scale (and scope), see Richard N. Langlois, "Scale, Scope, and the Reuse of Knowledge," in *Economic Organization and Economic Knowledge: Essays in Honour of Brian J. Loasby,* ed. Sheila C. Dow and Peter E. Earl (Cheltenham, England, 1999), 239-254. On the idea that the Chandlerian firm lowered unit costs by transforming to a high-fixed-cost high-throughput system, see William Lazonick, *Business Organization and the Myth of the Market Economy* (Cambridge, England, 1991).

[39] See Herbert A. Simon, "The Corporation: Will It Be Managed by Machines?" in *Management and the Corporations, 1985*, ed. M. L. Anshen and G. L. Bach (New York, 1960), 17–55; Richard M. Cyert and James G. March, *A Behavioral Theory of the Firm* (Englewood Cliffs, New Jersey, 1963); James D. Thompson, *Organizations in Action* (New York, 1967); and Jay Galbraith, *Designing Complex Organizations* (Reading, Mass., 1973).

[40] Chandler ("Organizational Capabilities," p. 81) argues that high-throughput facilities "demanded the constant attention of a managerial team or hierarchy. The potential economies of scale and scope, as measured by rated capacity, are the physical characteristics of the production facilities. The actual economies of scale and scope, as measured by throughput, are organizational. Such economies depend on knowledge, skill, experience, and teamwork - on the organized human capabilities essential to exploit the potential of technological processes."

[41] Oliver E. Williamson, *Markets and Hierarchies: Analysis and Antitrust Implications* (New York, 1975), 20.

[42] Langlois, "Transaction-cost Economics."

[43] In the terminology of Malone, Yates, and Benjamin, "Electronic Markets," product descriptions will become more standardized and interpersonally shared, thus reducing the complexity of the information that has to be exchanged in transaction.

[44] "General specialties" is the terminology of George Stigler, "The Division of Labor Is Limited by the Extent of the Market," *Journal of Political Economy* 59 (June 1951): 185-193, more recently revived under the term "general-purpose technologies." See, for example, Elhanan Helpman, ed. *General Purpose Technologies and Economic Growth* (Cambridge, Mass., 1998).