

Offprint

Journal of Institutional and Theoretical Economics

JITE

Zeitschrift für die gesamte Staatswissenschaft

Rudolf Richter

Methodology From the Viewpoint of the Economic Theorist –
Thirty Years on

Douglass C. North and John J. Wallis

Integrating Institutional Change and Technical Change in Economic History
A Transaction Cost Approach

Gerhard Clemenz

Competition Via Shopping Hours: A Case for Regulation?

Bernard Steunenberg

Decision Making Under Different Institutional Arrangements:
Legislation by the European Community

Alfred Maussner

Wage Flexibility, Menu Costs, and Price Level Stickiness

Peter Michaelis

Regulate Us, Please! On Strategic Lobbying in Cournot-Nash Oligopoly

Barthold Albrecht and Marcel Thum

Privatization, Labor Participation, and the Threat of Bankruptcy:
The Case of Poland

**Views and Comments on
Economics and Religion**

With Contributions by Laurence R. Iannaccone, Jean Ensminger,
Geoffrey P. Miller, Aryei Fishman, Timur Kuran



Vol. 150, No. 4

December 1994

This offprint cannot be purchased in a bookstore.

Editor / *Herausgeber*

Rudolf Richter

Co-editor / *Mitherausgeber*

Ekkehart Schlicht

Advisory Board / *Beirat*

Armen A. Alchian, Eirik G. Furubotn, Bengt R. Holmstrom,
 Terence W. Hutchison, Heinz König, Siegwart M. Lindenberg,
 Ernst-Joachim Mestmäcker, Wolfgang F. Stolper, Barry R. Weingast

Integrating Institutional Change and Technical Change in Economic History A Transaction Cost Approach

by

DOUGLASS C. NORTH* and JOHN J. WALLIS*

As one of the oldest Reviews in the field of Political Economy (founded in 1844), this Journal deals traditionally with problems of Economics, Social Policy and their Legal Framework.

Papers for publication in English should be sent in triplicate to: Professor Dr. Ekkehart Schlicht, University of Munich, Department of Economics, Schack-Str. 4, 80539 München, Germany. Manuscripts should be typewritten on one side of the paper only, double-spaced with wide margins.

Submission of a paper will be held to imply that it contains original unpublished work and is not being submitted for publication elsewhere. The Editor does not accept responsibility for damage or loss of papers submitted. All articles are refereed by specialists.

Manuskripte in englischer Sprache sind in dreifacher Ausfertigung zu richten an: Professor Dr. Ekkehart Schlicht, Ludwig-Maximilians-Universität, Seminar für Theorie und Politik der Einkommensverteilung, Schack-Str. 4, 80539 München. Manuskripte bitte nur in Maschinenschrift, einseitig beschrieben, mit doppeltem Zeilenabstand und breitem Rand einsenden. Es wird davon ausgegangen, daß es sich bei eingereichten Manuskripten um unveröffentlichte Originalbeiträge handelt, die nicht anderwärts zur Veröffentlichung vorgelegt worden sind. Für Verlust oder Beschädigung eingesandter Manuskripte übernimmt der Herausgeber keine Haftung. Literaturhinweise bitte wie im vorliegenden Heft.

Books for review to be addressed to the publisher. *Rezensionsexemplare werden an den Verlag erbeten.*

JITE is listed in the Journal of Economic Literature, the Social Science Citation Index and the International Bibliography of the Social Sciences.

Subscriptions: JITE is published in quarterly issues of approx. 190 pages each; annual subscription rate is DM 298,- plus postage.

Please send your subscription order to the Publisher: J.C.B. Mohr (Paul Siebeck), P.O.Box 2040, 72010 Tübingen, Germany – or to your usual subscription agency. Back volumes available on request.

© 1994 by J.C.B. Mohr (Paul Siebeck) Tübingen. – This journal with all articles and figures may not be reproduced in any form (beyond that permitted by copyright law) without the publisher's written permission. This applies particularly to reproductions, translations, microfilms and storage and processing in electronic systems. – Printed in Germany.

ISSN 0932-4569

1. Introduction

One of the central themes in modern economic history is that the enormous productive potential unleashed by the technical changes of the last two centuries could only be captured by fundamental changes in the institutional structure of the economy. Changes in technology reduced the cost of physically taking land, labor, and capital and making physical things – what we call transformation costs – provided the fundamental driving force for increasing incomes. In turn, these changes in the production process induced changes in the institutions that control the cost of purchasing inputs, monitoring the production process, and selling outputs – what we call transaction costs.

There is a strong suggestion that at the level of the firm over time transformation costs have been falling, while transaction costs have been rising. For example, economies of scale have induced the development of hierarchical managerial structures, but the cost of operating those structures has ultimately placed a limit on firm size and the economies of scale that can be realized. In an earlier paper we estimated that the transaction sector has grown from 25 to 45 percent of GNP over the last century. Between 1870 and 1970 the percentage of the industrial labor force employed in purchasing and marketing departments or as managers, supervisors, or clerical workers grew from 3 to 25 percent in mining, 4 to 30 percent in manufacturing, 13 to 18 percent in transportation, and from 6 to 28 percent in services (WALLIS and NORTH [1987, 107–108]). The numbers suggest that the growth of the transaction sector may

* The authors would like to thank Elizabeth Case for editorial assistance; seminar participants at the Washington Area Economic History Seminar, California Institute of Technology, and University of Hawaii; and Kenneth Sokoloff, Sumner LaCroix, Lance Davis, Barry Weingast, Alfred Chandler, and Claudia Goldin, and several referees for their comments and assistance.

be a drag on economic growth, that firms incur increasing transaction costs to manage their ever growing size and complexity, and that these costs may gradually erode the productivity gains associated with technological change and economies of scale.

This essay explores the interplay between institutional and technical change and suggests a less pessimistic interpretation of the growing transaction sector. We focus on the level of the firm, rather than the level of the market or the individual, because the relationship between technique and institutional structure are most obvious there. COASE [1937] and [1960] gave birth to the transaction costs approach to the study of institutions by studying the firm. We begin with "The Nature of the Firm" followed by a reexamination of WILLIAMSON [1985] and CHANDLER [1977], the two most productive uses of Coase's insight. One summary hypothesis of Coase is: *given* the existence of a specific technology, institutions are chosen by firms to minimize transaction costs. This formulation of Coase, and its shorthand, rule of thumb expression – institutions are chosen to minimize transaction costs – have been extremely productive starting points for understanding the evolution of institutions in the modern economy.

But what happens when technologies are *not given*? What happens when technologies and institutions are simultaneously chosen? Then the rule of thumb proposition that institutions are chosen to minimize transaction costs is demonstrably false. Institutions will be chosen that minimize total costs, the sum of transformation and transaction costs, given the level of output. This essay is an exploration of the possible interpretations of technical and institutional change that emerge from taking heed of that simple fact.

The framework developed in this paper suggests a new historical perspective on the relationship between technical and institutional change. It questions whether the growth enhancing effects of technical change – driving down transformation costs – are ultimately limited by the rising transaction costs associated with the institutional changes necessary to implement new technologies. While the process may work this way in some sectors of the economy, in other sectors technical change may lower transaction costs, not raise them. In other cases institutional change may raise transaction costs if, at the same time, it lowers transformation costs. This is a fundamental revision of the basic way in which economists and economic historians think about the process of economic growth.¹ Rather than viewing institutional change as a way of imple-

¹ This essay is concerned with the interplay between institutional forms of organization and technical change in the context of rational decision makers. The institutions examined are typically at the level of the firm and, therefore, the institutions and techniques chosen by firms will enhance the rate of economic growth. Of course, this is only true in the context of a basic institutional framework conducive to economic growth, such as existed in the United States. NORTH [1985] and [1988] explores the consequences of the basic institutional framework for the growth or non-growth of economies.

menting technical change, our framework allows for institutional change to be an important and independent source of growth. Technical change also has a broader impact, sometimes changing transformation costs, but sometimes changing transaction costs directly.

2. Coase, Transaction Costs, and the Transaction Sector

In "The Nature of the Firm" Coase laid the intellectual foundation for a transaction cost analysis of economic institutions (COASE [1937]). He examined the conditions under which exchange will take place within the firm and when it will take place between firms. His model establishes a straightforward boundary condition for firms: internalize an exchange if the marginal benefit of doing so exceeds marginal cost. Transaction costs played a prominent role in this decision.

You might say that Coase started us in the right direction, but with the wrong emphasis. By focusing on the boundary between the firm and the market, he diverted attention from other determinants of institutional structure that do not directly impact the boundary decision. His insight was true, but his language focused on firm size as the key element of institutional structure: integrate an exchange within the firm if the transaction costs of doing so are less than the costs of using the market. The firm became a way of "minimizing transaction costs."² Since the market is treated as exogenous to the firm, attention was directed to internal changes in the firm as the explicandum for changing firm size, ignoring the fundamental impact that changing market conditions have on the institutional possibilities that are available to use within the firm. Technical change became an exogenous driving force to which the institutional structure responds.

Just what are transaction costs and how can they be measured?³ Economically valuable goods and services can be thought of as bundles of characteris-

² We are not blameless in confusing the minimization of transactions costs with the rationale for the existence of economic institutions. "A theory of property rights is necessary to account for the forms of economic organization that human beings devise to reduce transaction costs and organize exchange" (NORTH [1981, 170–180]). Neither, however, are we alone. In their review article of Williamson's book ALCHIAN and WOODWARD [1988, 65, emphasis added] delineate Williamson's interests: "The restrictions that interest Williamson are not 'anticompetitive' (though some used to be presumed so by some economists) but rather those crafted in competitive markets and that *minimize transaction costs* both across markets and within firms." In their influential article GROSSMAN and HART [1986, 693, emphasis added] summarize the transaction costs approach to vertical integration: "Furthermore, if vertical integration *always reduces transaction costs*, then..."

³ For a full treatment of the conceptual issues involved in the measurement of transaction costs and transaction services see WALLIS and NORTH [1987].

tics. Some characteristics are physical attributes: size, shape, color, location, chemical composition, and weight for example. Other characteristics are the property rights to the good: the rights to use, derive income from, and exclude others from using the good. Just as the physical attributes affect the value of the good to the user so too the property right attributes affect the value of the good.

Changing the physical attributes of a good or service is the transformation function. Changing the property right attributes of a good or service is the transaction function. Transformation costs are the costs of the land, labor, capital, and entrepreneurial skill required to physically transform inputs into outputs. Transaction costs are the costs of the land, labor, capital, and entrepreneurial skill required to transfer property rights from one person to another.⁴

Many transaction costs are unobservable. A prospective house buyer typically spends time looking at available houses, a cost the buyer incurs that is not transferred to the seller. This transaction cost is not quantifiable. On the other hand the buyer may engage the services of a realtor. The realtor's fee is a quantifiable transaction cost. The realtor's service is a transaction *service*, that is, a transaction cost that results in a visible exchange and is therefore observable. The transaction *sector* is made up of the various transaction services that are exchanged within the economy. The size of the transaction sector is, therefore, a lower bound estimate of the level of transaction costs in the economy in much the same way that GNP is a lower bound estimate of welfare in the economy.

The concept of transaction services provides an empirical measure of transaction costs that can be integrated into the Coasian framework using a simple production function model of a firm. Firms are concerned with transaction costs because transaction costs use real resources. Firms must not only devote resources to physically transforming inputs into outputs, they must also devote resources to transacting for the purchase of inputs, the coordination and monitoring of inputs in the transformation process, and the sale of outputs.⁵

The production function of a typical firm can be written as:

⁴ Remember that not all transaction costs occur at the point of exchange, many occur before and after the point of exchange. Information costs typically occur before exchange and monitoring costs typically occur after exchange. The transaction and transformation cost distinction can be quite subtle. It is not, for example, the same as the production and distribution cost distinction. Transporting a good from one place to another is a transformation activity, since it changes a physical attribute of the good – location – while it is typically treated as a cost of distribution. On the other hand, hiring a foreman to supervise workers is a transaction cost, since it changes the property rights attached to the labor services by transferring the right to direct labor from the worker to the foreman, while the foreman is typically treated as a cost of production.

$$(1) \quad Q = f(L_f, K_f, D_f, IG_f, L_a, K_a, D_a, IG_a, E; T, I),$$

where the subscripts *f* and *a* denote inputs devoted to the transformation and transaction functions respectively; where *Q* is output, *L* is labor, *K* is capital, *D* is land, *IG* is intermediate inputs, *E* is entrepreneurial input, *T* is technique, and *I* is institutions. Institutions include political, legal, and contractual structures, norms of behavior regarding contract fulfillment, honesty, and effort, and the like. Technique includes the physical limitations imposed on the possible combinations of inputs within the state of existing knowledge.

Transaction costs are the sum of the costs of the land, labor, capital, intermediate goods, and entrepreneurial skill required to perform the transaction function (*L_a*, *K_a*, *D_a*, and *IG_a*). A profit maximizing firm or individual will incur transaction costs only when the expected benefits of doing so exceed the expected costs. Since the rational firm or individual will treat transaction costs just like any other cost, the economics of transaction costs is just the same as the economics of any costs.⁶

The Coasian firm determines its boundaries on the input side by comparing the difference in cost between purchasing an intermediate good and producing it internally using raw land, labor, and capital inputs. On the output side the firm determines whether to sell an output, *Q*, which is more or less finished, based on the difference between the selling price of finished and unfinished products and the cost of the land, labor, and capital used in finishing the product and any differences in the transaction costs of selling finished and unfinished products.

Two aspects of the Coase model are important for our purposes. First, the firm is not concerned with minimizing either transaction costs or transformation costs in isolation: the firm wants to minimize the total costs of producing and selling a given level of output with a given set of characteristics. The firm will regard transaction and transformation inputs as interchangeable in the production process and will utilize each input up to the point where the usual marginal conditions are satisfied for all inputs. Therefore, transformation costs and transaction costs are not independent since changes in transaction costs will lead to changes in transformation costs and vice versa. For example, a rise in the price of a transformation input will lead, *ceteris paribus*, to an increase in the use of transaction inputs, except in the case of gross complements.

Second, transaction costs are transaction costs whether they are incurred inside or outside of the firm. For example, a firm may purchase an input through a market specialist (a middleman) or directly from producers through its own procurement division. The first method involves the purchase of an

⁶ "More generally, the object is not to economize on transaction costs but to economize in both transaction and neoclassical production cost respects" (WILLIAMSON

intermediate good (the services of the middleman) whereas the second involves the production of a transaction service within the firm using raw inputs. Both methods use real resources, incur real costs, and are real transaction costs. Which alternative is chosen will depend on which method has the lowest total costs, not necessarily the lowest transaction costs.

3. Williamson and Chandler

The most detailed theoretical development of Coase's insight is Williamson's *Economic Institutions of Capitalism* and the most ambitious historical application is Chandler's *Visible Hand*. Both Williamson and Chandler view the historical development of the large firm as a distinct institutional response to the problems posed by transacting in an increasingly complicated economic environment. Managerial innovation has been and remains a necessary element in the growth and realization of new productive technologies. This is the major qualitative conclusion of "The Nature of the Firm," the root of Williamson's critique of the anti-trust laws, and the central theme of *The Visible Hand*.

In their respective fields Williamson and Chandler have provided the most comprehensive integration of transaction cost economics into the analysis used by economists and economic historians. Their contributions have been fundamental, but their goal has been to analyze the relationship between institutions and transaction costs within and at the boundaries of the firm. Unfortunately their framework is seriously deficient when it comes to analyzing the importance of and method by which institutional and technical change contribute to the growth of the economy. The problem is not that Williamson and Chandler believe that the firm exists to minimize transaction costs. The deficiencies stem from a theoretical, historical, and empirical approach that focuses exclusively on firms and begins with the premise that transaction costs are unobservable. The result is a theory of economic institutions in which institutions respond to, rather than create, technical opportunities in the transformation sector. It is also a theory that excludes much of the potential richness of the transaction cost concept.

Williamson's theory of transaction cost economics is presented in chapter 1 of *The Economic Institutions of Capitalism*. The empirical structure of Williamson's work is built around the idea that transaction costs are, generally, not subject to quantification. "Also, costs of both types [ex ante and ex post transaction costs] are often difficult to quantify. This difficulty, however, is mitigated by the fact that transaction costs are always assessed in a comparative institutional way, in which one mode of contracting is compared with another. Accordingly, it is the difference between rather than the absolute magnitude of transaction costs that matter" (WILLIAMSON [1985, 21-22]).

The differences in the absolute magnitude of transaction costs between different institutions, i.e. contractual forms, can be assessed in a theoretical way

using the concept of asset specificity. Contracts involving assets which are relatively more specific to the exchange in consideration are subject to greater risk of contract violation and therefore involve greater transaction costs, both before and after the contract is agreed to. Therefore a ranking of different contractual forms by asset specificity will also produce a ranking by the level of transaction costs they involve. This ranking can then be used to predict how institutional forms will vary in different circumstances.⁷

This approach to the problem of transaction costs and economic institutions completely ignores the presence of transaction services. Transaction costs in a Williamson world are like the time that a prospective buyer spends looking for a house: a cost which is real, but unmeasurable because it does not result in a market exchange. Unmeasurable costs may not be trivial, but measurable realtor's fees are typically about 5 or 6 percent of the purchase price and other measurable closing costs are equally large.

The critical weakness in Williamson's approach is that all changes in observable costs must, by construction, come from what he calls "neoclassical production costs" and we call transformation costs. In a Williamson world we can only explain institutional change as the result of that technical change that alters neoclassical production costs since they are the only observable costs, or as the result of traditional relative price changes. Any explanation that suggests that transaction costs change independently of changing production functions is empirically unsupportable, since we do not, cannot, and need not observe transaction costs.

Chandler builds on Coase and Williamson, yet the distinction he makes between transaction and transformation costs is not as dramatic or as empirically loaded as in Williamson's work. Chandler, instead, makes much of the distinction between transaction costs that are internal to the firm as opposed to transaction costs that are external to the firm, to the extent that he gives them different names: the former being "organizational costs" and the latter "transaction costs." In this respect Chandler comes close to arguing that the form of an institution is determined by the desire to minimize transaction costs. Firms internalize functions only when the transaction costs of doing so are less than

⁷ This whole approach obviously skirts a critical problem: if we can't measure the absolute level of transaction costs associated with two types of contracts how can we tell that the transaction costs are higher in one contract than in another? There is no obvious empirical ability to tell whether transaction costs are higher or lower under one contract than under another.

Economic historians have used the technique extensively. It has been used in the debate over sharecropping and the organization of post-bellum southern agriculture as well as a number of other institutional applications. There is no doubt that where significant asset specificity is involved or where monitoring labor is important, as in the case of sharecropping vs. fixed wage vs. fixed rent contracts, variations in transaction costs over various forms of contracts may be large. See LIBECAP [1987] for examples.

when the firm contracts for the same function in the market. This type of argument is at the foundation of his description of the railroads. The railroads ultimately developed an industrial organization composed of a few large firms, not because of cost advantages on the transformation side but because of the high transaction costs attendant on the operation of rail lines that are extremely asset specific and thereby liable to all kinds of contractual problems.⁸

On the other hand Chandler is aware that institutional arrangements have a marked effect on transformation costs as well as on transaction costs (including his organizational costs). The central importance of throughput in his explanation of the growth of large firms is built around the idea that transformation cost savings of economies of scale could only be realized by incurring increasingly high levels of transaction costs necessary to run large firms. Like Williamson, Chandler's conclusion is that technical change in the process of transformation drives firms to adopt institutional forms that, while expensive, are the only way to capture the lower transformation costs offered by the new, large scale industrial technologies. Incurring higher transaction costs were necessary to realize the gains from technical change in the transformation process.⁹

4. An Alternative Framework

We can improve upon Williamson simply by noting that some transaction costs are measurable and do involve real resource costs, but this does not move us closer to understanding the relationship between technical and institutional change. We have already emphasized the theoretical proposition that rational individuals will select techniques and institutions to minimize all costs, subject to the appropriate benefit constraints. This section examines these interrelationships more closely and extends the analysis to the paths by which the impact of technical change is transmitted to institutions and transaction costs.

In Williamson and Chandler, the effect of technical change is to alter the menu of transformation possibilities available to the firm. Different production techniques work best under different institutional arrangements and the firm

chooses the best combination of techniques and institutions. Whether one thinks of the firm as picking the lowest cost transformation technique and then selecting the institutions with the lowest transaction cost institution or, more appropriately, picking the institution and technique that gives the lowest total of all costs, changing techniques affect the choice of institutional structure by changing the available transformation opportunities.

The unexamined dimension in all this is the relationship between technical change and transaction costs, which are implicitly assumed to be independent of technique. In reality, transaction costs are directly affected by technique. Indeed, several of the major innovations of the industrial revolution, particularly in transportation and communications, may have had their most important impact in reducing transaction costs directly. We can illustrate this by expanding the basic Coasian model of the firm.

If we were to combine the production function of equation (1) with an appropriate set of input and output prices we could perform the standard optimization analysis, derive a set of first order conditions for profit maximization, and evaluate the effect of either a technical or an institutional change on transaction costs or transformation costs. In reality, of course, neither institutions nor technologies can be represented by simple numbers, and the model is intended only for illustration. If X_a are the transaction inputs and X_f are the transformation inputs, then the implicit assumption is that $d(dQ/dX_a)/dT = 0$. The notion that institutions affect transformation costs can be written as $d(dQ/dX_f)/dI \neq 0$.

We use the term "augmenting" ("attenuating") to refer to the positive (negative) effect of a change in techniques or institutions on the partial derivative of output with respect to an input. Thus transaction augmenting institutional change is an institutional change that raises the productivity of transaction inputs; transaction augmenting technical change is a technical change that raises the productivity of transaction inputs; and, likewise, a transformation augmenting technical or institutional change is a technical or institutional change that raises the productivity of transformation inputs. The case of transaction augmenting institutional change and transformation augmenting technical change are straightforward, but it may help to give examples of the cross cases.

As an example of transaction augmenting technical change consider the telephone. Alexander Graham Bell perfects his knowledge of a set of technical relationships between certain inanimate materials that allow him to produce a telephone system. Within the communications industry the invention is a transformation augmenting technical change since it directly alters the relationship between labor, capital, land, intermediate goods, and entrepreneurial skill engaged in the process of transforming raw materials into finished telephones. If we shift our focus to other industries, however, the invention of the telephone is typically a transaction augmenting technical change. Purchasing departments could purchase more with fewer resources, managers and foremen could mon-

⁸ While there were obvious cost(s) advantages to running more freight over a system of a given size, it is not clear that there were cost advantages to having bigger systems (after some minimum size was reached) other than those associated with the transaction related problem of keeping freight volume up.

⁹ Of course, Chandler is not alone. This is the accepted explanation of institutional change in the 19th and 20th century offered by economic historians and economists – the explicit economic history of institutional change; NORTH [1981], DAVIS and NORTH [1977], and ROSENBERG and BIRDZELL [1985], all use this framework. Changes in the institutional structure are assumed to be made in response to changes in production techniques, and were not in themselves the source of economic growth.

itor and coordinate more workers with fewer resources, and marketing departments could sell more output with fewer resources. Thus per unit transaction costs are reduced by increasing the marginal product of transaction inputs.

As a case of transformation augmenting institutional change consider the introduction of the through bill of lading by the railroads. The through bill had a direct impact on transaction costs as it immediately became easier to sell tickets and freight, thereby increasing the productivity of shipping clerks, freight managers, etc. But it had a similar impact on the transformation side of the operation, effectively allowing a given number of engines, cars, and engineers to haul a larger amount of freight over a given amount of track.¹⁰

It is at this point that the focus on individual firms becomes limiting. The role of intermediate goods, both in the transaction and transformation process, is central to understanding how technical and institutional change are transmitted throughout the economy. As in the case of the telephone, technical change in one industry may lead to lower transaction costs and institutional change in another. In the terms of our simple model, $d(dQ/dIG_{int})/dT_j > 0$, where T_j is technique in industry j and IG_{int} are intermediate transaction inputs in industry i . The large reduction in transaction costs caused by the introduction of the telephone were realized only when firms, primarily outside of the communications industry, purchased telephones as intermediate goods. Other significant reductions in transaction costs accompanied the development of the railroad, the telegraph, various types of office machinery, and better methods for information processing in general.

In a similar way institutional change in one industry can be transmitted to another industry via intermediate goods. As an example, consider the financial sector, where the development of investment banking, an organized bond market, and a securities market dramatically altered the internal structure of firms in other industries when it became possible to raise capital through an external agency. The impact is transmitted to firms outside the financial sector through the availability of an intermediate good – a transaction service, such as the use of an investment banker.

Figure 1 presents a heuristic way to think about these relationships. The figure represents the Coasian decision making process in a typical firm. The horizontal axis measures the volume of transactions the firm makes, the

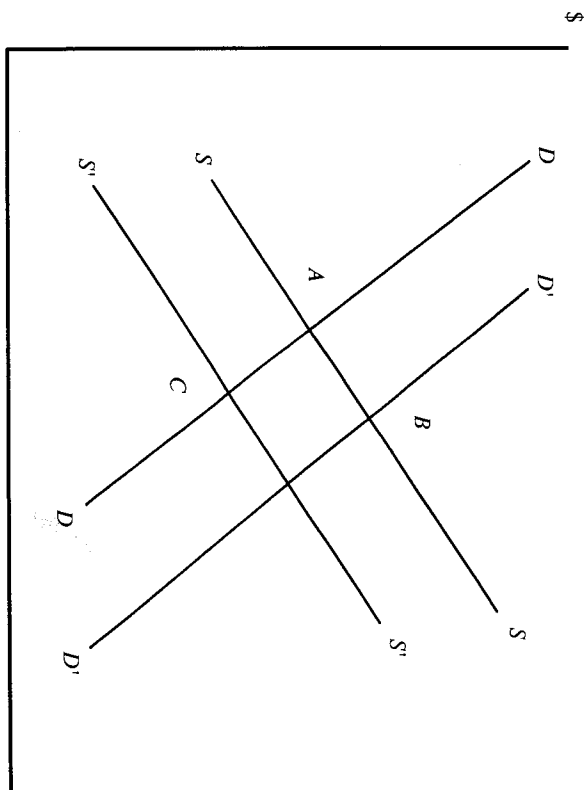


Figure 1

demand curve, D , is derived from the demand for the firms final product (assume that the price of the product is exogenously determined in a competitive market), and the supply curve, S , is determined by the price and productivity of the transaction inputs available to the firm.¹¹

A transformation augmenting technical change, say one that creates lower costs at a higher level of output, will increase the derived demand for transactions (and therefore for transaction inputs) to $D'D'$. Both transaction costs per transaction and aggregate transaction costs rise. Although it is not clear whether the share of transaction costs in total costs will rise or fall when the change occurs, it is clear that marginal transaction costs as a share of all marginal costs will increase. Rising transaction costs per exchange are eventually becoming a limiting factor in realizing the gains the firm receives from the new transformation technique.

A transaction augmenting technical change will have a much different effect. Rather than shifting the derived demand for transactions it will shift the supply of transactions to $S'S'$. The shift from point A to point C on the graph, while

¹⁰ Transformation augmenting institutional change is central to the major conclusion of Chandler's research: the management of throughput is essential to the operation and cost advantage of the large, modern manufacturing enterprise. Without the management, i.e. institutional structure to control a large organization, a firm cannot realize the benefits of technical change. Chandler's entire body of scholarship is, therefore, the best example of transformation augmenting institutional change that we could possibly cite. We will consider Chandler's history in detail later in the paper.

¹¹ The concept of "transactions" here is unfortunately vague, but is essentially the same one that Coase uses.

resulting in lower transaction costs per transaction, could result in either higher or lower total transaction costs. Depending on the relevant elasticities of substitution between transaction and transformation inputs, a fall in the cost of transacting can lead to a larger or smaller share of factor payments going to the transaction sector. In contrast to the previous case, however, now technical change is leading to economic growth by reducing transaction costs.

5. *The Visible Hand*

The extent to which technical change raises or lowers transaction costs is a subject for future research. We do not provide any quantitative empirical evidence in this paper one way or the other. But Chandler's historical account suggests that transaction augmenting technical change may have been very important in shaping the growth of large firms in the nineteenth century. In this section we recast Chandler's arguments in the terms of our model and find a strong indication that a complex relationship between institutional and technical change was at work.

Chandler's views on the origin of large firms can be compressed into three elements. First, the modern business enterprise takes its initial impetus from developments in transportation and communications. The modern business enterprise "has taken several forms since the coming of the railroad, steamship, telegraph and cable transportation and communications and made possible modern forms of production and distribution" (CHANDLER [1987, 13]). Second, the effects of the new transportation and communications technologies were both transaction and transformation augmenting, and Chandler places the heaviest weight on the coordination of large scale production and distribution of goods. In order to fully realize the technical possibilities of innovations in basic industrial techniques it was necessary to operate on a very large scale. "What is of basic importance to an understanding of the coming of modern industrial enterprise is that the cost advantage of the larger plants cannot be fully realized unless a constant flow of materials through the plant or factory is maintained. The decisive figure in determining costs and profits is then the throughput..." (CHANDLER [1987, 6]).

The final step in the argument goes beyond economies of scale in transforming, however. Economies of scale help explain why production units became larger, but not why multi-unit, multi-product firms emerged. "The economies of scale as measured by throughput help to explain why the large firms appeared in the industries that they did and why they appeared when they did, but they do not explain why they initially grew by integrating forward into distribution and backward into purchasing. The new mass producers might well have continued to buy from and sell to commercial intermediaries – wholesalers, retailers, and manufacturers' agents. By doing so they would have been spared

the expense of investing in expensive distribution and purchasing facilities and personnel" (CHANDLER [1987, 10]). But they did not spare themselves that expense. None of the large and successful firms failed to integrate forward into marketing their output, although the nature of that forward integration varied widely from industry to industry.

Two aspects of Chandler's history bear directly on the role of transaction costs in explaining the growth of large firms. First, the incident that triggers the birth of large business enterprises is transaction augmenting technical change – the development of railroads, steamships, telegraphs, and cables. Transformation augmenting technical change in the transportation and communications industries led directly to transaction augmenting technical change in other industries. The transmission mechanism for this change was intermediate goods – the availability of regular transport and cheap, rapid communications significantly altered the transaction costs of purchasing inputs and selling outputs.¹² For any level of output, Q , this substantially reduced the transaction resources, the L_a , K_a , D_a , and IG_a , necessary to produce that Q . This meant that a regular flow of raw materials and orderly disposition of finished products could be accomplished at a considerably lower resource cost.

In addition Chandler is aware of significant institutional development in the structure of finance and trade that occurs before the implementation of technical change that leads to large firms. This development predates large firms and must, to some extent, have reduced transaction costs for the economy as a whole and made larger firms more feasible.

Transaction cost reduction from many sources made it profitable to adopt the developing large scale batch and continuous process methods of production (transformation) that characterize the industries in which large firms develop. The first lesson to draw from Chandler is that it was the fall in transaction costs, occasioned by technical change in other industries, that made the new large business firms possible in the first place.

The second aspect is equally important. The firms which ultimately grew to become large firms (Chandler uses employment over 20,000 as a measure of "large") integrated forward into the distribution of outputs, and many integrated backwards into the purchase of inputs. In our earlier paper we showed that the largest source of growth in the transaction sector between 1870 and 1970 came *within* firms. In 1870 only 10 percent of the transaction sector, 2 percent of GNP, was within firms in the non-transaction industries (industries other than wholesale and retail trade; finance, insurance, and real estate; and government). In 1970 over one-third of the transaction sector, or 10 percent of GNP, was within those firms.

¹² Remember that transportation costs themselves are transformation, not transaction costs. It is, as we all know, the regularity of rail transport that makes it competitive with canals, not cost per ton mile shipped.

What developed after 1870 was qualitatively and quantitatively different from the impetus to the growth of large firms created by technical change in transportation and communications. As Chandler amply and eloquently documents, the large firms that succeeded were the ones who were able to "manage" this expansion. To do so required a revolution in the methods of managing large groups of people. That is, what happened after the 1870's was a transformation and transaction augmenting institutional change. A change in the methods of managing large business organizations.

6. Conclusions

We believe that there is a plausible, indeed strong, case to be made for the argument that institutional change and falling transaction costs were a significant source of economic growth over the last two centuries. The exact magnitude of their contribution remains to be measured, of course. We have advanced a framework for integrating transaction costs and institutional change into economic history. A critical element in this framework is that institutions do not exist to minimize transaction costs. Rational economic actors wish to reduce costs at all margins. Technical innovation can lead as easily to reductions in transaction costs as it can to reductions in transformation costs. Likewise institutional change may lead to reductions in either transaction or transformation costs. There is not, and should not be, a one to one identification between institutions and transaction costs or between techniques and transformation costs.

By assuming an implausibly strong link between institutions and transaction costs, economists have been able to further assume that transaction costs need not be measured. Under that assumption, theories that propose an important role for institutional change in explaining the development of economies must necessarily be content with making assertions that can rarely be confirmed or falsified, since the economic variable they rely on, transaction costs, is unobservable. Further, theories built on this assumption are forced to conclude that the development of institutional structures embodied in a growing transaction sector has been a constraint on the rate of economic growth rather than an independent source of growth. Perhaps the assumption is correct, perhaps institutional change has not played an independent role in creating growth, perhaps transaction costs have been rising in the aggregate and per exchange. But we cannot determine whether the assumption is accurate if we use a theoretical framework that precludes, by design, the possibility that the assumption is wrong.

Now we are in a position to at least challenge the assumption that transaction costs rose because of the need to accommodate technical change. In heuristic terms, if the demand for transaction inputs was sufficiently elastic, in the way that the demand for cheap cotton textiles or Model T's was elastic, then a

significant expansion in the size of the transaction sector could have been induced by a reduction in transaction costs. The growth of the transaction sector may not have been caused by an increase in the derived demand for transaction services, but by a shift in the supply curve of those services. Both alternatives are consistent with the evidence presented in our earlier paper and there is, as yet, little ground to choose between the two. But the predisposition to favor the derived demand explanation is nothing more than that, a predisposition.

We have only to go back to the "Nature of the Firm" to find a theory that allows for the possibility that changes in institutions and transaction costs either constrain or promote growth. We have built upon Coase to suggest a framework that allows us to make the important distinctions between transaction and transformation costs and to, potentially, disentangle the effects of institutional and technical change. Separating transaction from transformation costs gives us a deeper understanding of the complex interdependent structure of an economy as it evolves, enabling us to see clearly the interplay between technical and institutional change. The essay demonstrates that technical change may have far reaching consequences for transaction costs and institutional change, and equally that transaction costs may have far reaching implications for our understanding of how technical change affects economic growth.

The integration of transaction costs into economic history also provides a solid theoretical footing for business history. Chandler has pioneered the way in providing us with an in-depth analysis of the evolving organizational structure of the business firm. What has been missing is the overall quantitative magnitudes necessary to substantiate his findings and the theoretical framework to integrate business history with both economic history and economics proper.

References

- ALCHIAN, A. A. and W. WOODWARD [1988], "A Review of Oliver E. Williamson's *The Economic Institutions of Capitalism*," *Journal of Economic Literature*, 26(1), 65-79.
- CHANDLER, A. D. [1977], *The Visible Hand*, Boston: Belknap.
- [1987], "Technological and Organization Underpinnings of Modern Industrial Multinational Corporations," pp. 30-54 in: *Multinational Enterprises in Historical Perspective*, Teichova, M. Levy-LeBoyer and H. Nusbaum (eds.), New York: Cambridge University Press.
- COASE R. H. [1937], "The Nature of the Firm," *Economica*, 4, 386-405.
- [1960], "The Problem of Social Cost," *Journal of Law and Economics*, 3, 1-44.
- DAVIS, L. and D. C. NORTH [1971], *Institutional Change and American Economic Growth*, New York: Cambridge University Press.
- GROSSMAN, S. J. and O. D. HART [1986], "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economy*, 94(4), 691-719.
- LIBECAP, G. D. [1986], "Property Rights in Economic History: Implications for Research," *Explorations in Economic History*, 23(3), 227-252.

- NORTH, D. C. [1981], *Structure and Change in Economic History*, New York: Norton.
- [1984], "Government and the Cost of Exchange in History," *Journal of Economic History*, 44 (2), 255-264.
- [1985], "Transaction Costs in Economic History," *Journal of European Economic History*, 14 (3), 557-576.
- [1987], "Institutions, Transaction Costs and Economic Growth," *Economic Inquiry*, 25 (3), July, 415-428.
- and J. J. WALLIS [1983], "The Growth of Government: A Historical Perspective," *American Economic Review*, 72 (2), 336-340.
- ROSENBERG, N. and BIRDZELL, L. E. [1986], *How the West Grew Rich*, New York: Basic Books.
- WALLIS, J. J. and D. C. NORTH [1987], "Measuring the Transaction Sector in the American Economy: 1870:-1970," pp. 95-161 in: Engerman and Gallman (eds.), *Long Term Factors in American Economic Growth*, Chicago: University of Chicago Press for NBER.
- WILLIAMSON, O. E. [1985], *The Economic Institutions of Capitalism*, New York: Basic Books.

Professor Douglass C. North
Department of Economics
Washington University
Elliot Hall 205
St. Louis, Missouri 63130-4899
U.S.A.

Professor John J. Wallis
Department of Economics
University of Maryland
at College Park
Tydings Hall
College Park,
Maryland 20742
U.S.A.

Journal of Institutional and Theoretical Economics
Zeitschrift für die gesamte Staatswissenschaft

Vol. 150, No. 4 **JITE** December 1994

Articles/Abhandlungen

- RICHTER, RUDOLF: Methodology From the Viewpoint of the Economic Theorist – Thirty Years on 589
- NORTH, DOUGLASS C. and WALLIS, JOHN J.: Integrating Institutional Change and Technical Change in Economic History: A Transaction Cost Approach 609
- CLEMENZ, GERHARD: Competition Via Shopping Hours: A Case for Regulation? 625
- STEUNENBERG, BERNARD: Decision Making Under Different Institutional Arrangements: Legislation by the European Community 642
- MAUSSNER, ALFRED: Wage Flexibility, Menu Cost, and Price Level Stickiness 670
- MICHAELIS, PETER: Regulate Us, Please! On Strategic Lobbying in Cournot-Nash Oligopoly 693
- ALBRECHT, BARTHOLD and THUM, MARCEL: Privatization, Labor Participation, and the Threat of Bankruptcy: The Case of Poland. 710
- DIEHL, MARKUS: How the Computation of Perfect Foresight Equilibria Can Fail 726
- BERNHOLZ, PETER and GERSBACH, HANS: The Present Monetary Theory of Advanced Inflation: A Failure? 733

*Views and Comments on
Economics and Religion*

- SCHLICHT, EKKEHART: Editorial Preface. 736
- INNACCONI, LAURENCE R.: Progress in the Economics of Religion. 737
- ENSMINGER, JEAN: The Political Economy of Religion: An Economic Anthropologist's Perspective 745
- MILLER, GEOFFREY P.: The Legal-Economic Approach to Biblical Interpretation 755
- FISHMAN, ARYEL: Religious Socialism and Economic Success on the Orthodox Kibbutz 763
- KURAN, TIMUR: Religious Economics and the Economics of Religion 769