

On the Relations Between Evolutionary and Contractual Theories of the Firm

by

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Abstract

It has recently been argued by a number of writers that the evolutionary theory of the firm is a genuine theoretical rival to the contractual theory of the firm. This paper presents a reconstruction of the evolutionary theory of the firm. A taxonomy developed by the Polish philosopher Krajewski is then utilized for the purpose of the discussing the relations between the evolutionary and the contractual theory of the firm. It is possible to argue that the evolutionary and the contractual theories of the firm are rivals. However, it is also possible to argue that they have complementary areas of research, some of which are briefly described in the paper. (JEL: B4, L22).

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1. Introduction

This paper is a comparative study of what are arguably the two dominant economic approaches to the theory of the firm, namely the *contractual* and the *evolutionary* approaches.¹ In their modern manifestations, the evolutionary and contractual approaches to the firm begin their take-off period at almost the same time, namely at the beginning of the 1970s ([NELSON and WINTER [1973], ALCHIAN and DEMSETZ [1972], WILLIAMSON [1971]), but both may point to for a long time and strange reasons neglected contributions as important precursors (COASE [1937], ALCHIAN [1950]).

Although the two streams of research have hitherto made relatively little contact, a number of writers have recently claimed that the evolutionary approach to the firm is beginning to look like a serious *alternative* to the contractual theory.² This should be understood in the sense that the evolutionary approach is argued to be able to address the central explananda of the contractual approach (which are here taken to the *existence*, *boundaries* and *internal organization* of the firm (cf. HOLMSTRÖM and TIROLE [1989]))³, using an explanatory approach that is fundamentally different from that employed in contractual theories of the firm. For example, the existence of firms is not rationalized in terms of their ability to efficiently align the incentives of the various

¹ Both of these two concepts are *portmanteau* concepts that disguise substantial intra-category differences, for example, in the case of the contractual approach, what is underneath this category is really a plethora of approaches, such as Oliver Williamson's brand of transaction cost economics (WILLIAMSON [1985]), "nexus of contracts" theories (ALCHIAN and DEMSETZ [1972], JENSEN and MECKLING [1976]), property rights/incomplete contract theories (GROSSMAN and HART [1986]), and modern agency work on the firm (HOLMSTRÖM and MILGROM [1994]). In this paper, I suppress intra-category differences and only focus on generic features.

² See particularly KOGUT and ZANDER [1992], FOSS [1993], DOSI and MARENGO [1994], GHOSHAL, MORAN and ALMEIDA-COSTA [1995], WITT [1995], CONNER and PRAHALAD [1996], and HODGSON [1996]. It should be noted that not all of these refer to their theories as "evolutionary", but use such concepts as "capabilities-based" or "resource-based".

The evolutionary critique may be seen as part of a larger and ongoing heterodox critique of contractual economics. For a recent exchange between proponents of contractual economics and its heterodox critics, see GROENEWEGEN [1996].

³ Admittedly, this is too narrow; for we are certainly also interested in other types of economic organization. The emphasis on the firm is solely due to expository convenience.

input-owners that take part in productive activities under certain circumstances. Rather, it is claimed that firms exist because they are superior institutional arrangements for accumulating specialized productive knowledge, quite independently of considerations of opportunism, incentive-alignment and the like. It is different mechanisms that are invoked.⁴

This position would indeed seem to imply that there is a relation of *theoretical rivalry* between the two theories. However, as I shall argue, the relation may be much less clear-cut than simple rivalry. For example, it is certainly possible to argue that key insights from the two theories may be fruitfully combined (e.g., LANGLOIS and FOSS [1996]), or one may speculate whether we cannot have a third, overarching theory that can accommodate both the contractual and the evolutionary theory of the firm as special cases. In fact, I shall present an approach, based on the work of the philosopher Wladyslaw KRAJEWSKI [1977], that helps us to understand and make systematic in a relatively precise way the possible relations between the two theories. Thus, the aim is to try and construct a sort of roadmap that future research in the area may use for orientation rather than to take a firm stand on which relation obtains between the two theories.

A further reason for raising the issue under consideration here is that it provides an opportunity to present the rudiments of the evolutionary theory of the firm to the readers of this journal. Clarification and some reconstruction is necessary here, because evolutionary work on the firm is heterogenous and scattered. In contrast, contractual theories are more clear-cut, established, homogenous, and, at any rate, well-known to the the readers of this journal. I begin the paper by providing an overview and reconstruction of the evolutionary theory of the firm (section 2) and then turn to a more detailed discussion of the relations between the two theories (section 3).

⁴ In this paper, I focus more on explanatory *mechanisms* than on underlying theoretical assumptions. Thus, I sidestep issues such as the difference between the two theories in terms of their behavioral assumptions, the use of equilibrium methodology, etc. Clearly, a full discussion would have to take this into account, but space prohibits this in the present case.

2. The Evolutionary Theory of the Firm:

A Primer

A. Preliminary

The theory of the firm and evolutionary economics are themes that have historically had a close connection. In fact, they have to a large extent co-evolved, and their mutual impact has introduced a good deal of what we may call “intellectual path-dependence”.⁵

For example, as a large revisionist literature (LOASBY [1976], MOSS [1984], O'BRIEN [1984], METCALFE [1989]) has made clear, what we think of as “Marshallian” theory today is in many ways less the creation of Alfred Marshall than of some of his successors. Marshall sought to incorporate variety as a critical dimension in his explanatory apparatus. His concept of industry equilibrium, which combined a population of disequilibrium firms with industry level supply-demand equilibrium, was a reflection of Marshall's attempt to analytically approach variety, and his concept of the representative firm was designed in order to bridge the firm level and the industry level. In the hands of Marshall's successors (primarily Pigou and Robinson), however, the representative firm was transformed into something presumably far from Marshall's intentions, namely into the uniform equilibrium firm of standard price theory. This may be seen as a minor and subtle change; but according to the revisionists cited above, it had the effect of suppressing all of that in Marshall's thought that had an evolutionary or developmental character. The triumph of the new value theory over the older Marshallian approach was the decisive event that cemented maximization, equilibrium, complete uniformity, and single-exit-modelling as the essentials of neoclassical economics, and thus hindered the development of evolutionary economics for a number of decades

⁵ Of course, more broadly, economics and theoretical biology has to some extent co-evolved, particularly in the founding periods of both disciplines.

The evolutionary rear-guard action occurred, of course, in the context of the so-called profit maximization controversy.⁶ This involved such illustrious figures as Fritz MACHLUP, Milton FRIEDMAN [1953], Armen ALCHIAN [1950] and Edith PENROSE [1952]. The debate is important for two overall reasons: First, it demonstrated the viability of a population-perspective in economics.⁷ For example, Alchian demonstrated that it was possible to derive the usual qualitative results of standard price theory using an approach in which firms are assumed to act in a very myopic and non-deliberative way. Second, the debate points directly towards the formal evolutionary work by Sidney WINTER [1964, 1971, 1975], which was directly provoked by FRIEDMAN's [1953] arguments in profit maximization controversy, and Winter's somewhat later joint work with Richard NELSON [NELSON and WINTER, 1982].

On the background of these episodes, one could perhaps entertain the expectation that the theory of the firm must be one of the most highly developed subject areas within evolutionary economics. However, it is fair to say that within the evolutionary economics of the last two decades the theory of the firm has not at all been given attention on a par with the attention given to, for example, technological change.⁸ This has to do with the explanatory role of firms in evolutionary economics, where (to put it briefly) firms have been part of the *explanans* of evolutionary economics, but not (until recently) of the *explanandum*. Thus, the role of firms in most of evolutionary economics is not fundamentally different from the role of firms in standard price theory: They are intermediate steps in the explanatory logic, not entities to explained

⁶ It is seldom recognized that these two incidents are closely related. Thus, Nelson and Winter, their many references to Schumpeter notwithstanding, are in reality much more Marshallian than Schumpeterian. Their emphasis on incremental innovation and routinized firm behavior, as well as the use of an industry equilibrium concept that features a population of heterogenous disequilibrium firms is straight out of *Principles of Economics* rather than out of *The Theory of Economic Development*.

⁷ By a "population-perspective" is meant that the object of analysis is a heterogenous population of agents (e.g., firms) which are subject to a process of selection.

⁸ Some confirmation of this assertion may be obtained by consulting the house journal of The International Joseph Schumpeter Society, *The Journal of Evolutionary Economics*.

themselves. It is in fact only quite recently that a distinct evolutionary theory of the firm has been cultivated, and many of the important developments have taken place where management studies and evolutionary economics overlap.

In order to better appreciate what is meant by an “evolutionary” theory of the firm, it is necessary to take a brief look at the explanatory structure, and the methodological and metaphysical of evolutionary economics. This is not the place to provide a detailed discussion of the evolutionary research programme, but it is necessary to provide an outline, simply because this helps pinning down restrictions on and desiderata to an evolutionary theory of the firm.

B. Some Elementary Evolutionary Ideas

Defining the meaning of “evolutionary economics” is a venture fraught with dangers and uncertainties. To some extent, this is a matter of the plethora of meanings that have been ascribed to the term (see HODGSON [1993]). But it is also a matter of almost automatically becoming involved in a long and inconclusive debate about the validity of using analogies to the central mechanisms of evolutionary change (variation, heredity/retention, selection) on the social domain. My own position with respect to this issue is that too much energy has been invested in the search for precise analogies and isomorphism in the mapping from biological mechanisms to social mechanisms, and that our conventional analogies do have relatively precise and, at any rate, very *useful* connotations within economics (cf. MOKYR [1991]). However, because they are likely to mislead, I shall not use these analogies and metaphors systematically.

A (possibly idiosyncratic) synthesis of central contributions to evolutionary economics⁹ produces something like the following short list of central propositions (their order does not necessarily reflect their importance):

1. Microfoundations are necessary.¹⁰

⁹ I here rely on NELSON and WINTER [1982], HODGSON [1993], WITT [1992], DOSI and MARENGO [1994], NIGHTINGALE [1994].

2. Microfoundations should be built on the related ideas that
 - 2A) there is an imperfect *understanding* of the environment ,
 - 2B) there is imperfect *adaptation* to the environment, and
 - 2C) there is always a possibility of discovering something new, that is, to say of *novelty* being injected into the system.
3. Aggregate phenomena (e.g., industry structure) should be explained as *emergent* phenomena, using the idea that
4. There exists a mechanism, working on the level of the environment, that
 - 4A) sorts among members of a population (or some populations over other populations),
 - 4B) sorts on the basis of some criterion/criteria that connects to realized behaviors, and
 - 4C) manifests itself in, for example, differential growth rates of firms.

Several things may be said about this list. First, it evidently connects to the three central mechanisms of evolutionary change in biology, namely variation (point 1 and 2), heredity/retention (point 2) and selection (point 3 and 4). Second, although firms and firm behavior is not a strictly necessary component of evolutionary economics (one can have evolutionary processes in a strict exchange economy), the points dovetail rather directly with firms. Consider, for example, point 2) in the context of the firm.

The overall idea here is that there is a gap between the *competence* of agents and the *difficulty* of the decision problems they confront (HEINER [1983]), in contrast to most mainstream economics where such a gap does not exist. The implication is that agents will normally come equipped with different frameworks and heuristics for solving problems (a source of variation), where these frameworks are heavily shaped by past

¹⁰ This does not emphatically not imply extreme methodological individualism, but rather the sort of “organicism” described by HODGSON [1993].

experience and by the limits imposed by the particular sets of heuristics in play (a source of heredity/retention). Clearly, the relevant frameworks, experience and sets of heuristics may be firm-specific and shared rather than specific to individuals. Much of the contemporary discussion of “core competence”, “corporate culture”, “capabilities” and the like reflects indeed precisely the firm-specific nature of shared mental frameworks. An implication of this view is that agents are more than Popperian “zeros” (POPPER [1967]). That is to say, behavior is not best analyzed as simply the application of a rationality principle to the logic of the situation. Rather, agents come equipped with an internal make-up consisting of decision-rules (“theories”) that may be changed, for example, in the face of refuting instances (see LOASBY [1991]), but which typically are relatively stable over time.

In the context of the evolutionary theory of the firm, this is accounted by postulating that firms come equipped with, for example, “*routines*” (NELSON and WINTER [1982]) or “*competences*” (DOSI and MARENGO [1994])¹¹, which are thought of as recurring and context dependent action patterns, which are selectable (e.g., by the environment) and have some automatic quality, but may change through learning.¹² Because of these features, routines will seldom be “optimal”, routines will differ among agents, and behaviors cannot be deduced from simply observing the environmental signals (such as prices) that agents are exposed to (NELSON and WINTER [1982]). This variety drives the evolutionary process, since firms articulate rent-seeking strategies on

¹¹ ALCHIAN [1950] was taken to task by Edith PENROSE [1952] for not incorporating a mechanism of inheritance. The missing mechanism was explicitly supplied by WINTER [1964] in his identification of *firm routines* as the relevant carriers of knowledge. However, implicitly Penrose herself has identified the mechanism, namely in her 1959 conceptualization of the firm as a bundle of accumulating and idiosyncratic knowledge resources. Thus, in spite of her harsh critique of evolutionary explanations in economics (PENROSE [1952]), her own discussion of [differential] firm growth and the causes of firm growth is perfectly consistent with an evolutionary explanation.

¹² NELSON and WINTER [1982] construct this less stylized view by suggesting an “organizational genetics”, where firms’ hierarchically arranged routines are the relevant genotypes. Organizational structure, degree of diversification, revealed firm performance, etc. thus correspond to the phenotype, that is, the outward manifestation of the firm-specific knowledge coded in routines.

the basis of their routines and competencies, and competition in the product market constitutes an important part of the selection environment confronting firms.

C. Firms and Evolutionary Economics

The upshot of the preceding section is that firms and firm behavior rather naturally connects to the basic explanatory structure of evolutionary economics, and one would therefore seem to be justified in expecting the theory of the firm to occupy a central place in evolutionary economics. As has already been noted, this has not typically been the case. The perhaps most important reason for this lies in the population-ecological orientation of modern evolutionary economics. For example, Nelson and Winter's 1982 book is primarily a story about what happens to an industry's population of firms, not about individual firms *per se*. Nelson and Winter's two chapters [1982, chapter 4 and 5] about firms, routines, capabilities, etc. merely function to create a foundation for asserting a certain rigidity of firm reactions,¹³ and to rationalize variety in terms of unit costs, and therefore differences in revealed competitive advantages.

In such a story, it is not *necessary* to say much about the firm, for exactly the same reason that it is not necessary to say much about the firm in neoclassical price theory. In both cases, the firm is a step in the mental apparatus constructed for analyzing industry level phenomena (MACHLUP [1967]). At the face of it, the role of firms in phylogenetic economic evolution seems to be as restricted as the role of firms in traditional neoclassical microeconomic. As NELSON [1992, 166-167] admits:

“...the treatment of firms in our models (i.e., NELSON and WINTER [1982], NJF) and in neoclassical ones is similar in many respects. Our interest is in what happens to variables defined at the level of an industry

¹³ It should be noted that the evolutionary argument that firms are inert does not amount to the proposition that firms are completely unable to change. Rather, it is a much more subtle argument that some parts -- perhaps the crucial ones -- are much less likely to change rapidly in response to outside changes than other parts. It is widely recognized that the resources that matter the most for firm success -- such as technological competencies, culture, reputation, etc. -- are best viewed as *stock variables* that can only be gradually changed by appropriately chosen input flows (DIERICKX and COOL [1989]).

or economy. The only attributes that are modelled are those that bear on these matters”.

However, there are in fact some differences between neoclassical and evolutionary industry-level analysis with respect to how the firm is conceptualized.

First, in contrast to neoclassical models, there cannot be any representative firms in evolutionary models; there is just a distribution of different firms and it is meaningless to single any of them out as “representative”.¹⁴ Second, what individual firms do matter in models such as those in NELSON and WINTER [1982]. This is because firms are modelled as making “draws” from a probability distribution of technical advances. Thus, best-practice technology at any time can be seen as having been found by particular firms, which means that fully understanding the dynamics of the Nelson and Winter models requires a description of what *particular* firms did (NELSON [1992: 167]). Third, firms in evolutionary models, such as the Nelson and Winter models, are less anonymous than neoclassical firms, because they come equipped with *different* decision-rules, whereas neoclassical firms are only hard-wired with maximization as decision-rule. Interestingly, it is essentially the population logic, with its emphasis on variation, that produces a need for a less stylized view of the firm.

In fact, things are changing, since there has during the last 5-10 years emerged a steadily growing body of work that explicitly deals with the *individual* firm, rather than with the aggregate results of interaction among firms. What is noteworthy about this work is that it, in addition to containing many new perspectives and insights, addresses many of the same issues as the contractual approach does, such as the issue of what are the efficient boundaries of firms.¹⁵

¹⁴ As a historical aside, it may be suggested that it was precisely the difficulties of giving meaning to representativity within a population perspective that caused the problems that Marshall’s concept of the representative firm met with, even among sympathetic interpreters.

¹⁵ Some examples are ELIASSON [1990], LOASBY [1991], MARENGO [1992], KOGUT and ZANDER [1992], LANGLOIS [1992], FOSS [1993], DOSI, TEECE, WINTER and RUMELT [1994], WITT [1995], HODGSON [1996], LANGLOIS AND FOSS [1996]. One is also comforted by the observation that the theorists more responsible than anyone else for turning the attention of modern economists towards

D. The Individual Firm in Recent Evolutionary Economics

NELSON and WINTER [1982] devote two chapters (4 and 5) to developing the notion of routines as parts of a wider theory of organizational knowledge; an analysis that is firmly grounded in behaviorist organization theory, but adds to this an elaborate analysis of the notion of tacitness as it connects to organizational knowledge. According to Nelson and Winter, routines code organizational knowledge, and are history-bound, socially produced and reproduced, and rigid. Their presence introduces path-dependence and inflexibility on the cost side, while introducing specialization advantages and coherence on the benefit side. The conceptualization of the firm that emerges from Nelson and Winter's two chapters is one of *a body of idiosyncratic and productive knowledge which is implemented in productive tasks through existing routines*. It is this conceptualization that is the starting point for recent developments in the evolutionary theory of the firm. Evolutionary economists argue that this conceptualization helps us address issues that are only inadequately addressed by contractual theories of the firm. Grand Questions in this regard are, Why do firms differ? How does it matter? And how should it be theoretically approached (cf. NELSON [1991]). More specifically, we may ask empirically motivated questions (cf. DOSI and MARENGO [1994]), such as

- Why do we observe such a *wide dispersion of returns* among firms, even within the same industry (cf. RUMELT [1984])?
- Why is this dispersion seemingly *persistent*? [ibid.].
- Why do firms exhibit *different* rates of growth?

evolutionary economics and for reforming evolutionary economics, Richard Nelson and Sidney Winter, are both increasingly directing their interests toward the firm (rather than the industry level) (e.g., NELSON [1991], WINTER [1993]).

- Why do firms, even within the same industry, have *different* boundaries, strategies, organizational structures, etc.?

It is not clear that the contractual approach help us explaining all of these questions, or even any of them.¹⁶ The reason? They would seem to hinge on variety, dynamics, differing endowments of productive (knowledge) resources, etc. – that is to say, issues that have hitherto received relatively little treatment in the context of non-evolutionary theories of the firm (standard neoclassical, industrial organization, contractual). To the extent that differences among firms are admitted in these theories, they are rationalized by pointing to some *initial* -- and therefore essentially unexplained -- differences in endowments (including information), and barriers to imitation (i.e., prohibitive costs of information, patent rights, etc.) sustain these differences. Thus one can have an equilibrium with firms of different efficiency, yielding different returns (which are then interpreted as rents) (LIPPMAN and RUMELT [1982]). This is an nteresting line of research, but it does not capture all, or even the most important aspects, of sustained inter-firm differences. Rather, theoretical answers may turn on the essentially evolutionary notions of firms as knowledge-bearing, learning, and novelty creating entities, that is to say, on a notion of the firm as *endogenously* creating its productive opportunity set (PENROSE [1959, 1]).

The point here is that in order to satisfactorily address the above issues (and, no doubt, also many other issues), we really need a fine-grained analysis of the individual firm, one that explicitly makes room for issues relating to the production and exploitation of productive knowledge. Evolutionary theories that are explicitly concerned with analyzing the individual firm (rather than firm populations, industries or the economy) in these terms are sometimes called “*ontogenetic*” theories. By this is

¹⁶ It is possible, of course, to invoke different ways of handling transaction cost problems as an explanation of, for example, differences in returns (see WILLIAMSON [1994]). However, it strains redulity to argue that this explains all observable variations in returns.

meant that they are concerned with the evolution of the individual “organism”; for example, they inquire into the “unfolding process” (PENROSE [1959, 1]) of firm growth.

¹⁷ Such theories better allows us to understand *why* firms differ and gives an improved basis for discussing *how* such differences matter (cf. NELSON [1991]). That is, we are more detailed and explicit about a necessary element in the overall evolutionary explanation.¹⁸

E. Streams of Research

With respect to recent evolutionary work on the individual firm, a number of partly overlapping streams of research can be identified, of which I here provide a small conspectus.

The overall conceptualisation of the firm that underlies much evolutionary work on the was perhaps best stated by the late Edith Penrose in her *The Theory of the Growth of the Firm* (1959) and explicitly differentiated by her from the prevailing production function view. “The firm”, Penrose says, “is...a collection of productive resources the disposal of which between different uses and over time is determined by administrative decision” (PENROSE [1959, 24]). Resources in Penrose’s view yield services, and it is these services that interest her the most. Because resources/services become specialised to firms – and mesh with each other in a

¹⁷ There has traditionally been a rather sharp diversion between ontogenetically oriented approaches to the firm in which the firm is factored in its own right, and *phylogenetic* theories in which firms are factored because they embody mechanisms of heredity, variety and variety-creation but where the analytical attention is towards the industry-level. Of course, the difference in terms of the anonymity with which firms are described is to a large extent a matter of the difference in terms of level of analysis. Sometimes, however, one also see the distinction phrased a matter of a deep and clear-cut difference between the study of the adoption on the part of economic system or the study of individual adaptation (see PENROSE’S [1952] of ALCHIAN [1950]). However, the distinction between economics as either the study of systemic adoption or the study of individual adaptation is a false one. Selection is perfectly consistent with intentionality and rationality, with carefully chosen strategies and with adaptation – if not with perfect adaptation (see HODGSON [1993: chapter 14]). What matters in terms of the working of the basic evolutionary mechanisms is *differential* firm growth.

¹⁸ This is not necessarily to say that the fundamental evolutionary mechanisms are inapplicable to the organizational level. On the contrary, Herbert SIMON [1962] long ago explicitly tied organization-level learning dynamics to evolutionary theory by arguing that processes of search and discovery can be conceptualized in terms of variety and selection. Thus, it is not necessarily sloppy terminology to say of a firm that it is “evolving” rather than “developing”.

team-like manner – they are worth more to the firm than to the market (meaning other firms). They therefore yield quasi-rents, part of which may be appropriated by the firm’s owners. Moreover, although resources/services are firm-specific, they are nevertheless “fungible” inside the firm, and, when in excess, they are stepping-stones for diversifying to new markets. Penrose’s work helped define at least three distinct areas of research that all relate to or are part of contemporary evolutionary work on the firm.

The first one partially stems from her emphasis that specialised, scarce and valuable resources/services yield rents; this has helped founding what is today referred to as “the resource-based perspective” in contemporary firm strategy research (WERNERFELT [1984], FOSS [1997]). The main research focus here concentrates on clarifying what must obtain for resources to yield long-lived rents (that is, give rise to sustained competitive advantage). The other area of research is diversification studies (e.g., DOSI, TEECE, and WINTER [1992]) where the Penrosian theory based on hard-to-trade resources in excess is perhaps the dominant economic theory of diversification.

The third area of research that Penrose’s work helped to establish is organisational behaviour and learning studies which also owe a heavy debt to seminal contributions to organisation theory such CYERT and MARCH [1963]. Penrose argued that the management team holds *images* of the external environment and of the firm’s internal resources, that these images are produced through internal learning processes, and that they determine “the productive opportunity set” of the firm, that is, what the firm can see and take advantage of.

Such ideas have been revived in recent evolutionary work on firm learning which has taken its cues not only from Penrose, but also, and perhaps even more from the Nelson and Winter treatment of organizations, making more explicit the behavioralist components of that analysis. Important contributions within this stream of research have been made by James MARCH [1991], Luigi MARENGO [1992], and

Massimo WARGLIEN [1995], among others. This approach is explicitly process oriented (because of the emphasis on learning), and in its most recent manifestations it is much given to the method of computer simulation.

A key idea in this approach is that knowledge is not only dispersed (or distributed) in markets (cf. HAYEK [1945]); a considerable dispersion of knowledge also characterizes at least large firms. In fact, management in very large firms confront a knowledge dispersion problem on a par with the problem that confronts a would-be social planner (see GHOSHAL, MORAN and ALMEIDA-COSTA [1995]). Therefore, a main organizational problem confronting firms is to create a shared knowledge-base that will ease efficient coordination, for example, between functions or divisions, to take place. It is a matter of making sure that agents interpret various events in the same way. Concepts such as “routines” and “corporate culture” are, of course, representatives of such shared knowledge bases that have received considerable theoretical attention, but what is new in the emerging evolutionary organizational learning literature is that the process of emergence of such shared knowledge-bases is actually modelled.

A study by Luigi MARENGO [1992] exemplifies this approach. Taking his cues from CYERT and MARCH [1963], Marengo is particularly interested in the coordination of individual learning processes inside the firm, and how a stock of organizational knowledge emerges from the interaction of these learning processes. In his simulation model, agents do not have any prior knowledge of the environment they are facing and they do not possess a shared partition of the states of the world (that is, there is no common knowledge).

However, such a shared partition is necessary for coordination – for example, understanding the demand of the exogenous market and coordinating this with the different shops inside the firm – to take place. And, in fact, as demonstrated by Marengo’s simulations, coordination emerges gradually and spontaneously, as agents interact under given organizational structures and under the impact of given environments. Thus, spontaneous order may arise within the planned order of the firm (to borrow HAYEK’S [1973] terminology), as it were.

This is an important contribution towards better understanding the more “emergent” aspects of the internal organizations of firms, something about which contemporary contractual theory is almost entirely silent. Moreover, it goes a long way in accounting for the ultimate sources of firm heterogeneity: Because of the role of random influences and the path-dependent nature of collective learning processes, these are particularly likely to be the key causal forces behind the emergence of essential variation among firms.

The other dominant evolutionary approach to the firm is *the capabilities approach*. Whereas the organizational learning approach is directly associated with organization studies, the capabilities approach has had a leaning towards the firm strategy field (e.g., RUMELT [1984], WERNERFELT [1984], FOSS [1997]). This is not surprising, since there is a close connection between the various properties of capabilities and their ability to generate and sustain a rent-yielding capacity when deployed to a product market. For example, partial tacitness makes it costly to imitate capabilities. Moreover, capabilities contain 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.¹⁹ Indeed, capabilities are precisely characterized by these features: they may be seen as team-embodied and partly tacit production and organization knowledge that can be operated by team-members for a strategic purpose.

One may conclude from this brief presentation that the organizational learning and the capabilities approach are *complementary*: the one investigating learning process, the other one investigating the properties of the products of these processes. However, it is arguably somewhat misleading to make a sharp distinction between the process and the content of learning, a point repeatedly emphasized in NELSON and WINTER’S

¹⁹ Of course, not all distributed knowledge requires conscious direction for its efficient utilization; in fact, it is a standard argument in favor of the market order that it better utilizes distributed knowledge than any known directed order (HAYEK [1945]).

[1982] critique of traditional choice theory. And in the end both perspectives conceptualize firms essentially as *problem-solvers* (LOASBY [1976, 1991], DOSI and MARENGO [1993]), where the problems to be solved may include, but certainly are not restricted to, finding organizational forms that economize with transaction costs.

To sum up on this section, the overall evolutionary understanding of the firm is that it is a body of largely tacit, local and distributed production knowledge where this knowledge is coordinated by shared knowledge and understandings and by administrative *fiat*, and grows through application to productive task. Thus, to a large extent the firm is seen as a *cognitive entity*.

F. The Evolutionary Theory as a Theory of Economic Organization

An important implication of the epistemic assumptions of evolutionary theory is that coordination problems will, *prima facie*, loom larger in evolutionary economics than in standard neoclassical economics and arguably also loom larger than in the contractual approach to the firm. This may have important implications for the theory of the firm. For example, it implies that firms may find a rationale in their ability to supply some shared knowledge base to some subset of the economy's input-owners (KOGUT and ZANDER [1992], GHOSHAL, MORAN and ALMEIDA-COSTA [1995], WITT [1995]). And it also implies that the pure coordination aspects of firm organization should not be sacrificed at the expense of incentive-alignment issues.

As LANGLOIS and FOSS [1996] point out, there are in fact two principal theoretical avenues easily closed off by a conception of the firm as merely the solution to a problem of incentive alignment. One is the possibility that knowledge about how to produce and organization is imperfect, dispersed, bounded, sticky and idiosyncratic. The second is the possibility that knowledge about how to link together one person's (or firm's) productive knowledge with that of another is also imperfect. The first possibility leads us to the issue of capabilities; the second leads to the issue of qualitative coordination. Both issues are central in recent attempts to construct an independent evolutionary approach to economic organization.²⁰

For example, KOGUT and ZANDER [1992], LANGLOIS [1992], FOSS [1993] and LANGLOIS and ROBERTSON [1995] argue that problems of economic organization may reflect the possibility that a firm controls production knowledge that is, in important dimensions, strongly different from what others control.²¹ 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

²⁰ These attempts thus confirm the conjecture of contractual theorists, Paul MILGROM and John ROBERTS [1988] that "The incentive based transaction cost theory has been made to carry too much of the weight of explanation in the theory of organizations. We expect competing and complementary theories to emerge - theories that are founded on economizing on bounded rationality and that pay more attention to changing technology and to evolutionary considerations" [p.450].

²¹ In the terminology of George RICHARDSON [1972], their capabilities are highly "dissimilar".

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 of firms will be placed.

Note that these “dynamic transaction costs” (LANGLOIS [1992]) are in a different category from the transaction costs usually considered in the contractual theory of the firm. Transacting difficulties are not a matter of incentive problems within an otherwise well-defined and well-understood exchange context. The basic story has nothing to do *per se* with misaligned incentives in already established relations, but rather centers around the more basic coordination problem of getting everybody on the same wavelength, as it were. Similarly, the work of MARENGO [1992] does not directly appeal to misaligned incentives, but instead highlights other types of coordination problems – namely the coordination of knowledge, learning and expectations – as more basic for an understanding of internal organization.

3. Evolutionary and Contractual Theories of the Firm:

Towards an Understanding of their Relations

Debate on the respective roles and merits of different theories of the firm is certainly not new to economics. Almost three decades ago, Fritz MACHLUP [1967] and Brian LOASBY [1971] in two classic contributions assessed contemporary debate within the theory of the firm, specifically the behavioralist critique of the neoclassical theory of the firm. Both concluded that the behavioralist theory of the firm was not a rival to the neoclassical theory of the firm, since they had different domains of application. The behavioralist theory of the firm that Machlup and Loasby discussed was then unconnected to evolutionary economics (except for WINTER [1964]), but today the connection has been made explicit by a number of evolutionary theorists in an expanding literature (e.g., NELSON and WINTER [1982], LOASBY [1991], MARENGO

[1992]). It would therefore seem natural to discuss whether we today have an evolutionary theory of the firm that is competitive relative to neoclassical theories of the firm or whether we reach a conclusion similar to Machlup and Loasby's.

A. Relations Between Theories: General Considerations

In the preceding pages, the importance to evolutionary theories of the firm of concepts such as learning, routines and capabilities has been noted. These concepts would seem to play an organizing role similar to the role that “contracts, incentives, transaction costs, etc.” play in contractual theories of the firm. However, they evidently refer to quite different phenomena. A further consideration may be that evolutionary theories of the firm do not at all live up to the standards of rigour that characterize contemporary contractual theories of the firm (see TIROLE [1994]).

However, this is arguably an unfair observation, since it involves treating one body of thought in terms of the criteria with which another body of thought is evaluated. A more fruitful approach and one that will be followed here is to “...compare the abstractions and the methods of analysis which are legitimised by each, the kinds of answers which each can give, and the questions which each permits to be asked” (LOASBY [1971, 882]). On these four criteria the two bodies of theories would at first glance seem to be miles apart, perhaps even incommensurable, in the (weak) sense of having different domains of application.²² But the relation may be more complex. In order to make more systematic the inquiry into the relation between these two theories, I make use of twenty years old work by the Polish philosopher Wlasyslaw KRAJEWSKI [1977]. He suggested a useful terminology for classifying relations between alternative theories. The taxonomy in table 1 reflects this terminology. Specifically, it maps possible relations between two theories, T_1 and T_2 , in terms of their domain of application (D) (explanandum) and their “theoretical language” (V) (explanans).

²² KUHN [1970] packs much more radical implications into his concept of incommensurability. For an application of Kuhn's ideas to the theory of the firm, see LOASBY [1971].

XXXXXXXXXX Insert Table 1 about here XXXXXXXXXXXX

Krajewski's taxonomic apparatus was primarily constructed with reference to physics. However, I hope to demonstrate that it may also prove useful in the context of economics, specifically in the context of comparing evolutionary and contractual theories of the firm. The right place to start is to inquire into whether our two theories are *commensurable* in the sense that they have overlapping domains of application.

B. Domains of Application

At first glance, one is led to think of evolutionary and contractual theories as having non-overlapping domains of application, simply because the *main* thrust of the theories is so different: Whereas contractual theories are concerned with the efficient organization of transactions in terms of the incentive-alignment properties of alternative governance structures, evolutionary theories are concerned with a complete different set of explananda, namely the production and utilization of knowledge. However, as the preceding sections have clarified we now have a growing, if heterogeneous, collection of evolutionary models and theories of firms' market behavior, of their internal organization, of their boundaries and of their role as repositories of knowledge. In fact, as is conveyed by *table 2*, it turns out that evolutionary and contractual theories of the firm in fact share overlapping domains.

XXXXXXXXXX Insert Table 2 about here XXXXXXXXXXXX

Thus, if one brings into play the whole corpus of evolutionary theories of the firm, it would seem to turn out these theories have the same objects of explanation as modern contractual theories. They are therefore *commensurable* in the narrow sense in which the term is used here. Moreover, evolutionary theories adds something, namely the role of firms as repositories of knowledge (this role is not treated in contractual theories). Therefore, the domain of application of contractual theories is therefore, strictly speaking, a subset of that of evolutionary theories. Finally, the theories would indeed

appear to make use of different *theoretical languages*, and it does not seem possible to translate the theoretical language of contractual theories (incentives, property rights, transaction costs, contracts) to the language of evolutionary theories of the firm (discovery, utilization and accumulation of knowledge).²³ As a result, the relation between the two theories cannot be one of *equivalence*.

This leaves us with a number of other possibilities. For example, are they competitive and perhaps in *contradiction* to each other; or, is it possible to establish some sort of *correspondence* between them; or, is it perhaps even possible to show to *reduce* one of the theories to the other one? These possibilities are discussed in the following sections.

C. The Competitive Relation

So far we have concluded that there is a substantial sharing of domain between the two theories, and that they use different explanatory apparatuses and different concepts. These may even be in conflict. For example, the central evolutionary concept of novelty may conflict with the contractual idea of minimizing transaction costs: It may be misleading to portray transaction costs as something to be minimized on an *ex ante* basis, simply because the extent and seriousness of the knowledge problems which transaction costs are expressions of may not be known until they have occurred. For these and other reasons, it would seem to be a rather natural conclusion that the theories in question are *competitive*. Now, commensurable and non-identical theories may be competitive in at least two different ways:

- 1) They may be competitive in the sense that they claim different degrees of relevance for their objects of explanation.²⁴

²³ That is, there is no one-to-one relation between the “languages”, $V_1 \leftrightarrow V_2$. This means that it is not possible to translate T_1 to T_2 , and *vice versa*, $T_1 = L_1 [T_2]$ and $T_2 = L_2 [T_1]$. For example, the concepts of opportunism and morally hazardous behavior more generally are not normally employed in evolutionary theories of the firm and cannot be translated into the explanatory language used in these theories.

²⁴ I owe this point to Ulrich Witt.

- 2) They may be competitive in the sense that they address the same object of explanation ($D_1=D_2$) and the hypotheses that underlie the relevant alternative theories have some implications where they are in opposition ($T_1 \Rightarrow \neg T_2$, $T_2 \Rightarrow \neg T_1$), and where it is, therefore, possible to discriminate between them.

With respect to 1), it has in fact been asserted that, while transaction cost considerations are not unimportant *per se*, they are nevertheless practically subordinate to more long-run considerations of knowledge-accumulation and creation (e.g., LOASBY [1991]). Innovation, the creation of markets, learning within and between firms and other evolutionary pet-themes are either side-stepped or implicitly taken to be unimportant to economic organization in the contractual theory of the firm. As a result, and if one believes this characterization to be true, the evolutionary theory of the firm is inherently more relevant than the contractual theory of the firm, at least in the sense in which longer term strategic issues are more important or relevant than short-term operational issues.

With respect to point 2), *table 2* indicates the presence of a substantial amount of domain-sharing. But the underlying theoretical languages are widely different; for example, evolutionary work on the firm typically play down the incentive alignment considerations that are central in the contractual theory. Moreover, the theories have different and rival implications for a number of phenomena. For example, Williamson rather explicitly argues that transaction cost minimization is *the* relevant criterion of survival (see WILLIAMSON [1994]). There is little reason to doubt that transaction cost properties is a trait of important selective significance, and that this to a large extent can be traced back to underlying incentives and property rights. However, the evolutionary perspective is that even though particular constellations of incentives and property rights (HOLMSTRÖM and MILGROM [1994]) is an *aspect* of the firm, the firm is *also* a structure of hierarchical and nested information flows, and a structure of productive knowledge, residing in competencies. Moreover, the kind of organizational theory that

has traditionally influenced evolutionary economics emphasizes the political nature of the firm (e.g., CYERT and MARCH [1963]).

In an evolutionary perspective, these “traits” of the firm – that is, incentives, capabilities, the distribution of power – may all have some selective significance. Moreover, they may interact in various way – producing “epistatic effects” (KAUFFMAN [1993]) – and this interaction may in itself have fitness implications.²⁵ This indicates the possibility that not all of the organization’s traits are necessarily equally conducive to long term survival. For example, a firm with very strong transaction cost properties may have inferior properties in terms of learning competencies (and *vice versa*²⁶). Thus, there is no guarantee of a perfect alignment between the various traits, that is, aspects of the firm.

The upshot of all this is that it would indeed seem reasonable to claim a competitive relation to exist between contractual and evolutionary theories of the firm. Because they are so different, the two theories may continue to develop more or less along their own tracks. However, it is a rather general recognition that one way in which science may make progress is by it being demonstrated that seemingly opposed theories are in reality closer to each other than was immediately apparent (LAUDAN [1977]). Such a demonstration may be accomplished in many ways. For example, it may be demonstrated that one of the theories under consideration can be reduced to the other theory. Or, one may build a more general theory that incorporates the seemingly rival theories as special cases. Etc. Some of these possibilities are further treated in the following section.

D. Relations of Reduction and Correspondence

²⁵ Perhaps rather counter-intuitive ones. For example, there is no apriori guarantee that, say, two fit traits create a fitter combination, or that the combination of relatively unfit traits necessarily produces an unfit combination.

²⁶ In fact, much can be said in favor of the (old) view that there is a trade-off between the provision of incentives and learning. For example, while diversity of behaviors and preferences leads to agency problems, diversity also fosters learning (cf. LOASBY [1991]). For a splendid treatment of the related trade-off between "exploitation" and "exploration", see MARCH [1991].

An alternative to claiming a competitive relation to exist between two theories is to claim that one of the theories may be *reduced* to the other theory. Two general types of reduction may be distinguished (see *table 1*). The first, the homogenous reduction, obtains when theory T_1 may be shown to be a special case of a more general theory T_2 (so that $D_1 \subset D_2$), and where there is strong isomorphism between the explanatory apparatuses employed between the two theories (in fact, $V_1 \subset V_2$).²⁷

In the other type of reduction, the *heterogeneous reduction*, there is no direct isomorphism between the explanatory apparatuses. Additional translation is necessary. An example may be the relation between a macro theory and a micro theory, where we not only need supplementary hypotheses (the A in table 1) relating to, for example, parameter values, but also need principles of composition (the S in table 1), for example, that macro relations are obtained *via* simple aggregation.

It will probably be agreed that the relation between evolutionary and contractual theories is not one of reduction, not even of heterogeneous reduction. Thus, the evolutionary theory of the firm (at least as this exists now) is not simply a more general theory that encompasses the contractual theory as a special case. The problem, of course, is that contractual and evolutionary theories may have conflicting implications for certain domains of application. For example, the argument that opportunism play a key role in explaining economic organization conflicts with the argument of many evolutionary writers on the firm that capabilities are the prime determinants (and *vice versa*).

It would therefore seem to make more sense to examine those relations between theories in which a theory is more general than another comparable theory, but also implies a *correction* of the other theory. In a *homogenous relation of correspondence*, the two theories apply basically isomorphous explanatory apparatuses, and T_1 is an adequate

²⁷ However, in order to demonstrate that T_1 is actually a special case of T_2 , one needs supplementary hypotheses, $T_2 \wedge A \rightarrow T_1$. An example is the representation of Keynesian economics in the neoclassical synthesis, where Keynesian results are produced by introducing a rigid money wage into an otherwise classical model.

approximation to T_2 within D_1 , while the more general theory T_2 corrects T_1 in $D_2 - D_1$ by taking into account new parameters, mechanisms, etc.²⁸ Again, this relation cannot be claimed to obtain because the lack of isomorphism between the explanatory apparatuses of the two theories.

In the *heterogenous relation of correspondence*, different explanatory apparatuses are employed, so that translation is necessary. WINTER [1971] argued that this is the sort of relation that obtains between a neoclassical approach to market phenomena and an evolutionary is essentially one of heterogeneous correspondence. This is because 1) standard neoclassical price theory may be obtained as a special case of evolutionary analysis, 2) evolutionary analysis adds something (e.g., analysis of technological change as a normal part of the market process), 3) implies some corrections in relation to the basic neoclassical story (e.g., with respect to factor substitution), and 4) applies a different explanatory apparatus. Per implication, may the same relation exist between the contractual (and largely neoclassical) theory of the firm and the evolutionary theory? It seems reasonable to venture a qualified “yes” and we have in fact some recent theorizing in which contractual insights are presented as special cases in a broader evolutionary story. An example is LANGLOIS and ROBERTSON [1995]. They argue that in the emerging phases of technologies and markets, economic organization is primarily turns on differential capabilities, whereas a more stable industrial landscape allows economic organization to hinge more on standard contractual factors, such as opportunism. The overall perspective, however, remains evolutionary.

In spite of such integrative attempts, it is still the case that there are many and deep-seated differences between the explanatory apparatuses that are employed by our two theories. However, some of these differences may do more to differentiate the approaches from each other than other differences. For example, it may be argued that the fact that many evolutionary theories of the firm do not make substantial use of incentive-alignment arguments is a relatively unimportant difference, since these

²⁸ An example is the relation between the Hicks/Allen theory of consumption behavior and Lancaster’s theory of consumption behavior.

arguments can be integrated with the knowledge accumulation and utilization arguments that are central in the evolutionary theory. This indicates that there may exist a more “pragmatic” relation between the theories than those that have been considered in the preceding pages. Specifically, there may be areas where the theories under consideration here complement each other in the sense that one of the theories is made richer by including some insights and propositions of the other theory. For lack of a better word, this is here referred to as a “*relation of complementarity*”.

E. Identifying and Utilizing Complementarities

The aim of this section is to provide a small conspectus of areas where evolutionary and contractual insights make contact. Some of these are obvious and/or has already been discussed in the literature, and will not be dealt with here.²⁹ The discussion is very intuitive and pragmatic and, somewhat in contrast to the preceding sections, aims at carving out a few areas of possible future research.

Explanatory considerations: As has been made clear from a well-known debate on explanation in the social sciences, it is possible to associate at least two, quite different, meanings with “a theory of phenomenon X”. One of these, the *genetic* approach, accounts for the existence of X – such as a firm – in terms of its history of emergence. The other approach, the *teleological* (functionalist or intentionalist) approach, accounts for the existence of a firm in terms of its good consequences for the involved actors. However, usually a social phenomenon can only be fully comprehended if its history of emergence is included in the explanation. Otherwise, the “explanation” will easily degenerate to mere description of the thing to be explained, the explanandum. For example, we are only fully able to understand a given firm’s pattern of diversification by incorporating its prior development of capabilities in the explanatory apparatus (PENROSE [1959]). As WINTER [1993] argues, transaction costs at a given point of time only explains a part of why a firm looks like it does at that point of time; historical considerations, including

²⁹ For example, that capabilities are specific assets in the sense of WILLIAMSON [1985]. For an analysis along these lines, see WINTER [1993].

considerations of path-dependency and localized learning, need to also enter the explanation. The upshot is that the contractual theory as a basically teleological theory “needs” genetic explanation for this reason. In economics, that sort of explanation is supplied by evolutionary economists.

Change - particularly unexpected change. Contractual theories of the firm, such as, for example, WILLIAMSON [1985], use concepts – complexity, uncertainty, incomplete contracts, asymmetric information – the meaning of which is only fully comprehensible on the background of an economic reality characterized by change. In other words, change is *implicitly* seen as necessary to make sense out of these theories. In fact, we have it from Hayek that “It is...worth stressing that economic problems arise always and only in consequence of change” [1945, 82]. And we have it from COASE [1937] (paraphrasing Knight) that the firm would not arise in the absence of “uncertainty”, and that one aspect of the efficiency of the firm has to do with its *flexibility* in adjusting to certain kinds of unanticipated change. However, clearly not all kinds of change may be relevant to economic organization. For example, an important distinction relates to whether we allow for unanticipated contingencies or not.

As Coase observed, interesting contracts were not only long in duration but also open-ended, because it is usually too costly or epistemically impossible to specify all future contingencies. This is a theme that has been increasingly addressed by a number of contributors to the theory of the contracts and the firm (e.g., WILLIAMSON [1985], GROSSMAN and HART [1986], KREPS [1992], TIROLE [1994]). As these writers make clear, some notion of unforeseen contingencies, as embodied in the notion of an incomplete contract, is necessary to tell a convincing story about why there should be firms. In the formal manifestations of this idea, however, agents are typically portrayed as so clever that they are able to design *ex ante* contracts that can efficiently handle unanticipated future change, so that later revisions of contracts are not necessary. This is obviously somewhat problematic, and there is in fact a debate on precisely this issue (see TIROLE [1994] for a survey).

However, it is hard to reject the broader argument that unpredictability “...is a kind of relevant knowledge which rational agents should use...For if we expect the unexpected, we can do something to prepare for it” (LOASBY [1991, 3]). For example, we can hold reserves of various kinds, or we can decide to transact within a framework of incomplete contracts.

One aspect of the evolutionary view of the firm is that the firm is an institution for solving particular sorts of productive problems (e.g., LOASBY [1991]). Problem-solving is an activity with distinctly hierarchical and complementary features. Thus, one solves problems by dividing problems into sub-problems, solving these sub-problems, checking whether the solved sub-problems imply a solution to the overall problem, performing further solution of the sub-problems if they do not fit into an overall solution, etc. This process of decomposing problems and solving sub-problems is clearly a trial and error process. Hierarchical coordination – at least in an evolving environment and in large firms – is very much characterized by such features. It is therefore essentially a learning process, rather than a matter of simply issuing the right commands and underscoring these by the right incentives and the right doses of monitoring. In this perspective, a structure of incomplete contracts is necessary for intra-firm coordination.

Explananda requiring both theories: A pragmatic argument in favor of the complementarity interpretation is that there are certain explananda that would seem to require the incorporation of both insights of the evolutionary and the contractual approaches. An example concerns the organization of the innovative process. In order to fully understand this

A specific example of research that recognizes the need for integrating evolutionary and contractual consideration is the work of David TEECE [1982, 1986], who has combined insights from contractual and evolutionary economics in his attempt to address efficient diversification [1982] and the innovation boundaries of the firm [1986]. Much more ambitiously, Douglass NORTH [1990] has combined insights from contractual

economics with insights from evolutionary economics in his attempt to seek an institutional answer to the causes of the wealth of nations.

A more general theory?

4. Conclusions

The aim of this paper has been to undertake a sort of “reconstruction” of the contemporary evolutionary theory of the firm and to compare it with the contractual theory. It emerged from this discussion, that it is possible to claim that the evolutionary and contractual theories of the firm are (now) theoretical rivals: they address the same explananda with different explanantia and have different implications for these explananda. Thus, what speaks in favor of the interpretation that stresses the rivalrous nature between the two approaches simply is that the evolutionary theory of the firm is on the verge to become a fully-fledged, independent approach to economic organization. What is lacking, however, is the formal rigor and relative agreement on “first principles” that characterize contemporary contractual research (cf. TIROLE [1994]).

However, other interpretations can also be defended. For example, I have loosely indicated that there may be relations of complementarity, in which key ideas of the contractual approach are brought to bear on key considerations in the evolutionary perspective and *vice versa*. A pragmatic argument here is that there are explananda that would seem to require insights from both approaches for their satisfactory explanation.

I have tried to refrain from too explicitly taken a side on which interpretation is “the right one”. My aim has rather been to identify some of the possible (and plausible) relations between the two dominant theories of the firm, and to clarify positions and interpretations, so that a somewhat clearer roadmap for future research in economic organization may emerge.

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Table 1
A taxonomy of relations between theories³⁰

Type	Domain	Theoretical language	Relation
<i>Commensurability</i>	$D_1 \cap D_2 \neq \emptyset$		
<i>Equivalence</i>	$D_1 = D_2$	$V_1 \leftrightarrow V_2$	$T_1 = L_1(T_2)$ $T_2 = L_2(T_1)$
<i>Reduction:</i>			
- <i>Homogenous</i>	$D_1 \subset D_2$	$V_1 \subset V_2$	$T_2 \wedge A \Rightarrow T_1$
- <i>Heterogenous</i>	$D_1 \subset D_2$	$V_1 \rightarrow V_2$	$T_2 \wedge A \wedge S \Rightarrow T_1$
<i>Contradiction</i>	$D_1 = D_2$	$V_1 \neq V_2$	$T_1 \Rightarrow \neg T_2$ $T_2 \Rightarrow \neg T_1$
<i>Correspondence:</i>			
- <i>Homogenous</i>	$D_1 \subset D_2$	$V_1 = V_2$	$T_2 \Rightarrow a T_1 \text{ in } D_1$ $T_2 \Rightarrow \neg a T_1 \text{ in } D_2 - D_1$
- <i>Heterogenous</i>	$D_1 \subset D_2$	$V_1 \rightarrow V_2$	Same as above

³⁰ Reproduced from KRAJEWSKI [1977: 67] with slight modifications. The notation is standard set notation; however, some of the expressions used deserve explanation. " \leftrightarrow " means that there is a one one to one correspondence (so that double translation between two theories is possible; "L" is a translation operator; " \rightarrow " is used to indicate a one-sided correspondence (so that double translation is not possible); " \Rightarrow " refer to implications of a theory (e.g., " $T_1 \Rightarrow \neg T_2$ ") means that the negation of T_2 follows from T_1); "A" refers to supplementary hypotheses; "S" are bridging principles (as explained in the text); and "a" means "approximates".

Table 2:
**Domains of application of evolutionary
and contractual theories of the firm**

<i>Domain of application</i>	<i>Evolutionary theories of the firm</i>	<i>Contractual theories of the firm</i>
<i>Internal organization</i>	E.g., MARENGO [1992]: Spontaneous emergence of coordinating, shared knowledge	E.g., principal-agent theory: Optimal incentive schemes
<i>Existence and boundaries</i>	LANGLOIS [1992], KOGUT and ZANDER [1992], FOSS [1993], TEECE et al. [1994]: The firm is a response to non-incentive related coordination and communication problems.	Transaction cost theory, e.g., WILLIAMSON [1985] and incomplete contract theory, e.g., GROSSMAN and HART [1985]: The firm is a particular distribution of property rights over physical assets.
<i>Knowledge-accumulation and strategy</i>	PENROSE [1959], NELSON and WINTER [1982], MONTGOMERY [1995]: The firm is a cluster of knowledge assets, and articulates its strategy on this basis	Knowledge-accumulation not treated. Strategy only deals with product markets (New IO). Strategy is a matter of tactical ploys.
<i>Industry-level analysis</i>	E.g., NELSON and WINTER [1982]. The firm is a relatively anonymous bundle of routines (“phylogenetic theories of the firm”).	Standard price theory: The firm is an anonymous production function.