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Expectational bottlenecks and the emerging of new organizational forms

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ABSTRACT

In this article we discuss the dynamics of organizational change when agents have heterogeneous initial conjectures and do learn. In this framework, conjectural equilibrium is defined as a steady state of the learning process, and all the adjustment occurs in disequilibrium. We discuss the properties of the system under different "rationality" assumptions, and using well-known learning algorithms. We prove analytically that multiplicity of equilibria, and failure of good organizational routines, cannot be ruled out: better, they are fairly probable. Stability is a crucial matter: it is shown to depend on initial conjectures. Finally, learning does not necessarily select the best.

1. Introduction

In this article we investigate the emerging of new organizational forms as a learning process on the part of the manager and of workers. We start from a conceptualization of technology that is familiar to evolutionary economics, namely a set of problem-solving routines that assign resources to specific nodes of the input–output graph; then we add a parallel view of the firm as a set of organizational routines that try to harmonize the conflicting interests at the shop floor level, given technological constraints. The study of the learning scheme is included as an essential feature of the setup, including initial conjectures as *primitives* of the problem.

The novelty of this approach is twofold. On the one hand, we put forth a setup in which the capability view and the incentive view of the firm can be reconciled, making a step forward in the agenda proposed by Dosi et al. (2003). On the other hand, we introduce a discussion of the equilibrium process as genuinely based on disequilibrium (or *non-tâtonnement*) adjustments: equilibrium is a terminal state of the dynamical system, or to put it differently, a steady state of the learning algorithm.

From the methodological point of view, this approach is *open*, in that it requires a formalization of the learning algorithm: it can be completed by adding empirically grounded formalizations of the learning dynamics, which will further increase the robustness of existing evolutionary theorizing.[1] Moreover, the possibility of performing (at least) local stability analysis can help making concrete predictions.

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[1] In the second part of this article we will use Bayesian algorithm, without suggesting that this should be the only road to be followed.

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Coming to the main results of the article, we show that even under rather general assumptions lock-in results are unavoidable: organizational innovation may fail because of what we term 'expectational bottlenecks'. While traditional lock-in results are grounded on the existence of some kind of externality or increasing returns (Arthur, 1989), our result depends explicitly on the agents' learning activity. In the second part, using a Bayesian formalization, we prove that there exists a continuum of conjectural equilibria, implying *path-dependency*: i.e., the system can converge to different equilibrium states, depending on agents' reciprocal expectations; in addition, we discuss some conditions for stability of equilibria. While the continuum of equilibria per se might pose coordination problems, it is the learning activity itself, taking place during any specific history, that solves this problem making the economy converge, possibly, to one steady position. On the other side, since the system might get trapped in a low-expectation state, our approach suggests that institutional and/or policy interventions might help to avoid unsatisfactory lock-in phenomena.

The article proceeds as follows: Section 2 presents the background on technology and firm theory in an evolutionary framework; Section 3 discusses the building blocks and a general characterization of equilibria; Section 4 presents an example of the general model under Bayesian conjectures and learning; finally, Section 5 concludes.

2. Production theory: alternative views, and a conjectural equilibrium approach

In the mainstream framework a technology is a set of activities. An activity is a *complete* list of inputs and outputs. The emphasis on 'complete' is necessary: technically, such things as entropy, mental concentration, time should be included as well, and different qualities of the same input should be treated as different inputs. Moreover, for descriptive purpose the level of disaggregation of each production should be maximum. Once put this way, constant returns to scale are simply a tautological implication: duplication of the inputs should produce the same output. In the description of the system, only the activities that are feasible given the time window considered in the analysis should be included. This is the approach to General Equilibrium Theory put forth by Neumann (1945).

In this framework: (1) no such a thing as a firm exists, and everyone can enter a market and produce, given the available technology (this is the way in which Walras, 2003; Hicks, 1939, were addressing the problem, formalizing the free-entry concept of the Classics); and (2) a market must exists for every input and output, which implies zero transaction costs everywhere. The "firm" was introduced in the theory by Arrow and Debreu (1954), but this was done in a framework where entry and exit are not allowed: one lacks an explanation for the make-or-buy decision, and it is unclear what is controlled by command and what is left to market exchange. Put plainly, no answer to Coase (1937)'s question is provided.

The blank is filled, in partial equilibrium, by the theory of corporate governance (e.g. Aghion and Bolton, 1992; Holmstrom and Tirole, 1997; La Porta et al., 2002), which is game-theoretical in spirit and focuses on incentive compatibility, and which can be included in general equilibrium along the lines provided by Demichelis and Ritzberger (2011).

In an alternative *capability based* perspective, a technology is a concrete knowledge base. Here, a set of problem solving procedures are available or can be developed, which match the system's agents with a set of input–output vectors (Winter, 2006; Dosi and Grazzi, 2006, 2010): a problem solving procedure assigns agents and resources to the nodes of the input output graph.[2]

In this framework, there is radical uncertainty on the dimension and the characteristics of the production possibility set, which is the cartesian product of a *fuzzy* space of problem-solving procedures and a set of input–output vectors. Knowledge is dispersed, with various degrees of tacitness and significant costs of acquisition, exploration and replication. As stressed by Dosi and Grazzi (2006), firms know, possibly in a tacit way, their current technique, and tend to explore, in a local and cumulative way, some neighborhood of their location in the production set, departing from their present position.

If we incorporate organizational theory into the latter framework, we can conceive routines in a larger sense as including mechanisms of governance for conflicting interests. By exploring the role of institutional arrangements, this enlarged perspective tries to bridge the gap between the capability view and the incentive view of the firm (Dosi et al., 2003).

In our view, organizational arrangements are tentative answers given by economic agents to the existence of conflicting interests *and* to the management of knowledge: this is, in our opinion, the way to approach Coase (1937)'s question. Indeed, the Coasian balance between market exchange and command aims also at efficiently running the way knowledge is coordinated, used, and modified in economic affairs: the very notion of "corporate culture" (e.g. Kreps, 1990; Crémer, 1993) is grounded on the intuition that organizations can sometimes perform this task better than markets. This is obviously due to commonality of experiences-routines-languages that tends to reinforce reciprocal understanding and expectations.

However, this reciprocal reinforcement is the source of a different difficulty: when an *organizational innovation* is conceived and proposed, by definition some parts of the existing routines are called into question, and there is no guarantee that this innovation is well understood by all participants. In fact, what a corporate culture ensures is a sort of 'local' agreement/coordination on the *preexisting* set of routines, and nothing ensures that this agreement still holds when some elements of the corporate culture are displaced by the proposed innovation. What needs to be carefully studied is how *learning* takes place, in order to understand whether, and to which degree, the innovation will be successful: from this point of view, the configuration

[2] In the words of Dosi (1988) a technological paradigm is a set of pieces of knowledge, involving heuristics about "how to do things" and some basic templates of artifacts (i.e. already known activities or production processes).