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## The dynamics of organizational structures and performances under diverging distributions of knowledge and different power structures

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# LEM

## WORKING PAPER SERIES

**The dynamics of organizational structures  
and performances under diverging  
distributions of knowledge and different  
power structures**

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# The dynamics of organizational structures and performances under diverging distributions of knowledge and different power structures.

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## Abstract

In this work we analyze the characteristics and dynamics of organizations wherein members diverge in terms of capabilities and visions they hold, and interests which they pursue. How does society put together such distributed and possibly conflicting knowledge? The question is “Hayekian” in its emphasis on the distributed features of the latter. However, our analytical point of departure is quite “anti-Hayekian” in that it focuses on how organizations aggregate and put to use such knowledge by means of different combinations among power of allocation of decisions and exercise of authority. Together, organizational power shapes the very preferences of organizational members. More specifically, we study the efficiency of different balances between the three foregoing mechanisms. In all that, organization for sure “aggregate” and make compatible different pieces of distributed knowledge, but the causation arrow goes also the other way round: organizations shape the characteristics and distribution of knowledge itself, and of the micro “visions” and judgements.

JEL classification: D21, D23, D71

Keywords: authority, power, distributed knowledge

# 1 Introduction

In this work we analyze the characteristics and dynamics of organizations wherein members diverge in terms of capabilities and visions they hold, and interests which they pursue. How do organizations and society as a whole put together such distributed and possibly conflicting pieces of knowledge?

The question is “Hayekian” in its emphasis on the distributed features of the latter. However, our analytical point of departure is quite “anti-Hayekian” in that it focuses on how organizations aggregate and put to use such knowledge by means of different combinations among power of allocation of decisions and exercise of authority (instead of or in addition to incentives schemes). Together, organizational power shapes the very preferences of organizational members. More specifically, we study the efficiency of different balances between the three foregoing mechanisms. In all that, organization for sure “aggregate” and make compatible different pieces of distributed knowledge, but the causation arrow goes also the other way round: organizations shape the characteristics and distribution of knowledge itself, and of the micro “visions” and judgements.

Indeed, the fact that knowledge in society is widely fragmented and highly heterogenous should be taken as quite obvious, were it not for the rather outrageous “simplifications” of many economists’ models. And equally heterogenous are beliefs, ‘visions of the world’, cognitive structures, in addition of course to interests and motives. But if all this holds, how does coordination occur?

Certainly, it occurs only to a very limited extent via market transactions. As emphasized by Simon (1991), most human activities take place in social structures other than markets. In his famous metaphor of the visitor from Mars approaching Earth and able to spot activities within firms (and other institutions) marked in green and market transactions marked in blue, the visitor would see green as the dominant colour with a few blue lines connecting green masses of different sizes (Simon 1991, p. 27).

The crucial issue then regards the nature of social structures themselves (including of course business firms). One class of answers, with diverse qualifications, minimizes the distance between the nature of what goes on within non-market institutions and what happens in market transactions. As known, a large literature suggests that organizations are themselves bundles of (explicit or implicit) optimal contracts. The whole stream of agency-based theories of organization builds on that idea, which finds its central explanatory variable of the inner working of organizations into the *incentive structures* entailed by different distributions of information among agents, largely neglecting differences in knowledge, capabilities and cognitive frames.

Here, on the contrary, we build on a significantly different perspective, which focuses on the structure and dynamics of the distribution of knowledge, cognitive frames and behavioural heuristics.

Having as one of the basic “primitives” of the interpretation of what organizations are the distribution of knowledge they embody, rather than the mapping information/incentives, already brings precious insight on the comparative statics of organizational types, even when keeping otherwise quite orthodox equilibrium assumptions: see, from different angles, Radner (1993), Radner (2000), Sah and Stiglitz (1986), Garicano (2000), Van Zandt (1999), Becker and Murphy (1992).

Other works, contributing to an emergent evolutionary capability-based theory of the firm, go much further and explore the dynamics of learning and adaptation when knowledge is distributed in different ways among organizational units or members (see, among the others, Winter (1987), Winter (2006), Marengo and Dosi (2005), Coriat and Dosi (1998), Dosi, Levinthal, and Marengo (2003), Felin and Knudsen (2012) and the surveys Dosi, Faillo, and Marengo (2008) and Dosi, Faillo, Marengo, and Moschella (2011)).

As already emphasized, the starting point of this family of analyses is knowledge, its distribution, its coordination, and its evolution. However, heterogeneity in knowledge, visions and power across organizational members entails also ubiquitous conflict, exercise of authority and diverse incentives. In Marengo and Pasquali (2012) one explicitly addresses the effect of the latter factors upon learning and coordination. That is, one begins to analyze the interaction between the political and the cognitive dimensions of collective adaptive learning. Here we build and refine on that model and focus on the effect of power in its different forms upon the learning and coordinating performances of organizations. In section 2 we discuss the various facets of power, a crucial but largely neglected feature of organizations. Section 3 presents the simulation model and section 4 discusses the main results. Finally, in section 5 we draw some conclusions and implications.

## 2 Power, authority and hierarchies

A major ‘foundational’ dimension of organizations concerns their hierarchical authority-ridden nature and the associated notion of power. In social sciences, also in this respect, one finds two alternative archetypes.

The first one (presented for instance by Williamson (1995)) proposes that (a) the notion of ‘power’ does not have any clear analytical status; (b) the basic unit of analysis ought to remain as much as possible that of transactions; and (c) organizations are primarily governance structures. When the word

“power” is used at all it just stands for market power or for differential access to resources (Rajan and Zingales 1998). Call this model the *exchange view* of interactions and organizations. The second, which we shall (improperly) call the *political view*, holds on the contrary that (a) an essential, although not unique, feature of organizations is their authoritative structure; (b) authority relations are inherently different from exchange relations; and (c) power must be considered an autonomous interpretative dimension. In the following we shall explore the implications of the latter perspective for coordination and learning.

The political view, of course, does not claim to be exhaustive: command and exchange coexist in different forms within and outside organizations. But it claims - at least as we interpret it - that the sole consideration of exchange relations prevents any first-order understanding of what goes on within the ‘organizational black box’, of the boundaries between organizations and of organizational dynamics.

Here we shall adopt a quite broad definition of power. First, power entails the ability of some agent (the “ruler”, the authority) to determine the set of actions available to the other agents (the “ruled”). Second, it involves the possibility of the authority to veto the decisions or intentions of the ruled ones. Third, power relates to the ability of the authority to influence or command the choice within the “allowed” choice set (i.e. the span of control of the “ruled”), according to the deliberations of the ruler himself (this definition echoes in some ways the analysis contained in Luhmann (1979)). Here, in these respects, the units of analysis are the dimensionality and boundaries of the choice sets and the mechanisms by which authority is enforced.

As Herbert Simon puts it: “Authority in organizations is not used exclusively, or even mainly, to command specific actions. Most often, the command takes the form of a result to be produced (“repair this hinge”), or a principle to be applied (“all purchases must be made through the purchasing department”) or goal constraints (“manufacture as cheaply as possible consistent with quality”)” (Simon 1991, p. 31). These aspects of command are part of what in the following we shall call “policies”.

Fourth, the most subtle exercise of power concerns the influence of the authority upon the preferences of the ruled themselves, so that, in Max Weber’s words, the conduct of the ruled is such that it is “as if the rules had made the content of the command the maxim of their conduct for its own sake” (Weber 1978, p. 946). That easily accounts for the fact that “organizations can be highly productive even though the relation between their goals and the material rewards received by employees, if it exists at all, is extremely indirect and tenuous” (Simon 1991, p. 38).

Obedience, docility, identification in the role and in the organization are

central elements of such processes of adaptive learning and coordination (classic discussion of these processes are in Milgram (1974), Simon (1976), Simon (1981), Simon (1993), Lindblom (1977), Lukes (2005), Moore (1958)). Docility offers the inclination to “depend on suggestions, recommendation, persuasion and information obtained through social channels as a major basis for choice” (Simon 1993, p. 156). And, emphatically, such inputs are not inputs to an inferential (let alone Bayesian) decision process. Both cognitive frames and preferences are endogenous to the very process of social adaptation and social learning.

It is crucial to note that the social endogeneity of identity building is exactly the opposite to any type of decision-theoretic model: one learns socially not only what one can do, but, more fundamentally, what one wants, the very interpretation of the natural and social environment one lives in, and, ultimately, the very self-perception and identity of the agents.

The conjecture we shall explore in the following is that in many circumstances such processes of cognitive and behavioural adaptation yield also much more efficient and quicker coordination patterns. In social affairs, there are matters which are too serious to be left to the market rather than to command: the historical record robustly show that wars, for instance, are a good case to the point (as an example on the US WWII see Devons (1950)).

## 3 The model

### 3.1 Policies, preferences and delegation

We model an organization that combines together dispersed pieces of knowledge in order to accomplish an organizational task. The model is an extension and generalization of the one contained in Marengo and Pasquali (2012).

The organizational task requires combining  $n$  “policies” or ensembles of tasks (binary, for simplicity)  $P = \{p_1, p_2, \dots, p_n\}$ . Policies are of course interrelated and therefore the policy landscape is, in general, complex and rugged. Instead of assigning arbitrary fitness values to each policy vector, we will simply consider their rankings i.e. the one-to-one mappings from the  $2^n$  binary vectors of policies to the integers in the interval  $[1, 2^n]$ , where rank 1 is attributed to the fittest configuration and rank  $2^n$  to the least fit one.

The organization is formed by one principal and a set of agents  $A = \{a_1, a_2, \dots, a_h\}$ , with  $1 \leq h \leq N$ . Each agent holds its own ranking of the policy environment which is, in general, different from other agents’ and different from the “true” one. These differences reflect both heterogeneity of knowledge (they have different representations of the world in which they

operate) and heterogeneity of objectives and perceived interests.

Agents can therefore be characterized by their competence, i.e. the extent to which their individual landscape is correlated to the true one. The degree of competence of an agent can be measured by Spearman's rank correlation between his own ordering and the true one.

Agents can also be characterized by the extent to which their objectives are aligned with the principal's, i.e. the rank correlation between an agent's ordering and the principal's.

Both competence and objectives' alignment may be subject to adaptive change. The former through a learning process by which an agent tries to adjust his own landscape to the true one, the latter through a kind of influence/adaptation process by which an agent conforms his own landscape to the principal's. Of course the agent's propensity to adapt his own landscape to the principal's can be considered an indicator of the agent's docility as mentioned above (Simon 1993).

We assume that the principal does not perform directly any task but simply allocates them to the different agents. Let  $d_i \subseteq T$  be a generic non-empty subset of the set of tasks. We call the allocation of decision rights a partition<sup>1</sup> of the set of tasks, i.e. a set of non-empty subsets  $D = \{d_1, d_2, \dots, d_k\}$  such that:

$$\bigcup_{i=1}^h d_i = T \text{ with } d_i \cap d_j = \emptyset, \forall i \neq j$$

We call *organizational structure*  $\mathbf{O}$  a mapping of the set  $D$  onto the set  $A$  of agents, i.e. a mapping that assigns each subset of tasks to one and only one agent, i.e.  $\mathbf{O} : D \mapsto A$ .

Finally, the organizational structure may also be characterized by an *agenda*  $\alpha = a_{i_1}, a_{i_2}, \dots, a_{i_h}$ , that is a permutation of the set of agents defining the sequence with which agents are called to perform their tasks.

As already mentioned, we suppose that the principal does not perform any task directly, but can:

- freely choose and modify the organizational structure (that is the allocation of tasks to the agents);
- exert power of overruling the agents' decisions;

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<sup>1</sup>Actually we could also allow for some decision rights to be ambiguously allocated, so that two or more agents are entitled to modify the same policy. This phenomenon, which is often found in real organizations, can be easily modeled in our framework, but we leave it to future investigation.



- directly intervene upon the behavioural patterns of the agent, irrespectively of his preferences;
- exert indirect power through influence by making the agents' landscapes progressively more and more aligned with her own.

### 3.2 Organizational decision making

When asked to perform the tasks under his control, an agent will make the choice that ranks higher in his own ordering, given the current state of the other policy items that are not under his control. Every agent has a ranking over the entire set of  $2^n$  policy vectors, but, in general, can decide only on the subset of policies which have been delegated to him by the principal. This is of course an extreme and unrealistic set-up, but having agents access only a subset of the policy vector would only reinforce our conclusion.

We assume that the agent chooses the policies under his control that, given the current value of the policies which are not under his control, produce the policy vector which ranks higher in his own ordering. For instance, assume that the set of policies is made of four binary policies. Agent  $i$  is allocated the first policy, and the current policy vector is 0101: agent  $i$  will choose to implement policy 0 if  $0101 \succ 1101$  in his own ordering, and policy 1 if  $1101 \succ 0101$ . Of course, because of interdependencies among policies, his preference in this case of, say, 0 over 1 might well be reversed when the three policies not under his control have current values which differ from 101.

We assume that at the outset an initial “*status quo*” policy vector is (randomly) given<sup>2</sup>. Then the first (according to the agenda) agent may modify the policies under his control. He generates all the sub-vectors for the policies under his control and chooses the one that, together with the status quo policies that are not under his control, will produce the vector he prefers.

With some probability  $\pi_{auth}$  the principal may exert authority and overrule the agent's decision. We consider two possible kinds of authority: a simple *veto power* and a *strong authority*. In the former case the principal can simply veto a policy change proposed by an agent, in which case the current status quo is preserved, even if the agent preferred a change. In the case of strong authority the principal does not only have the choice between the status quo and the changes proposed by the agent but can impose to the agent, within

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<sup>2</sup>In the simulations we present in this paper we start from all the  $2^n$  possible initial policy vectors and find all possible equilibria and cycles the decision process can end up in.

his subset of policies, the one she prefers, i.e. the agent is *de facto* replaced by the principal for the current decision.

When the first agent in the agenda has taken a decision (and possibly the principal has overruled it), the value he (or the principal in his behalf) has chosen for the policies under his control becomes part of the new status quo. Then the same procedure is repeated for the second, third,  $\dots$ ,  $h$ -th agents in the agenda. Once all the agents have acted on the policies under their control, the agenda is repeated over and over again until an equilibrium or a cycle is reached. An organizational (local) equilibrium is a policy vector whereby no agent (nor the principal, in the case of strong authority) wants to modify items under his control according to the procedure outlined above. A cycle is a sequence of policy vectors that the agents keep repeating in the same order.

### 3.3 Learning and adaptation of preferences

We implement three types of learning and adaptation: the first two concern, respectively, the principal and the agents that adapt their own rankings to the “true” one, while the third one implies that agents adapt their own rankings to the principal’s. In all the three cases we use a very simple procedure for adaptive learning based exclusively on actually experienced feedbacks.

Let us first describe adaptations to the “true” ranking of policy vectors. They take place only when a new organizational equilibrium is reached, the corresponding policy vector is implemented, and a feedback from the environment is received. In particular, we suppose that principal and agents can observe only whether the new organizational equilibrium is better or worse than the previous status quo in terms of the “true” ranking (i.e. which one of the two is “preferred” by the environment). If the previous status quo  $\bar{p}^i$  ranked worse (better) than the new one  $\bar{p}^j$ , with some probability  $\pi_{plearn}$  for the principal and  $\pi_{alearn}$  for the agents those who ranked  $\bar{p}^i$  better (worse) than  $\bar{p}^j$  will swap the positions of the two vectors in their rankings. If, instead, either the individual preference is in accordance with the environment’s, or the organizational decision process has produced a cycle and no equilibrium has been implemented, no learning occurs.

Moreover, agents can also adapt their rankings to the principal’s with probability  $\pi_{docil}$ , which is a measure of the agents’ propensity to conform to the principal, i.e. of their docility. Also in this case we suppose that adaptation can only occur through a very simple mechanism based on actual observation. We suppose that whenever the principal overrules an agent decision (either by veto or by fiat) and imposes policy vector  $\bar{p}^j$  over  $\bar{p}^i$  chosen by the agent, the overruled agent learns that for the principal  $\bar{p}^j \succ \bar{p}^i$

and with probability  $\pi_{docil}$  will swap the positions of the two vectors in his own ranking. If, instead, the principal does not overrule the agent's decision, either because she does not exert authority or because she shares with the agent the same preference, no such adaptation occurs.

### 3.4 Simulations

We will simulate the organizational decision making process described so far, comparing different organizational structures and analyzing the role of authority (in the three versions of veto power, strong overruling and influence), with learning by the principal and/or by the agents, each of them controlled by the corresponding probabilities.

We simulate randomly generated policy landscapes with  $n = 8$  policy items and up to eight agents with randomly generated preferences. We test the following organizational structures with 1, 2, 4 and 8 agents:

- **O1:**  $a_1 \leftarrow \{1, 2, 3, 4, 5, 6, 7, 8\}$
- **O2:**  $a_1 \leftarrow \{1, 2, 3, 4\}, a_2 \leftarrow \{5, 6, 7, 8\}$  with agenda  $\alpha = a_1, a_2$
- **O4:**  $a_1 \leftarrow \{1, 2\}, a_2 \leftarrow \{3, 4\}, a_3 \leftarrow \{5, 6\}, a_4 \leftarrow \{7, 8\}$  with agenda  $\alpha = a_1, a_2, a_3, a_4$
- **O8:**  $a_1 \leftarrow \{1\}, a_2 \leftarrow \{2\}, a_3 \leftarrow \{3\}, a_4 \leftarrow \{4\}, a_5 \leftarrow \{5\}, a_6 \leftarrow \{6\}, a_7 \leftarrow \{7\}, a_8 \leftarrow \{8\}$  with agenda  $\alpha = a_1, a_2, \dots, a_8$

In what follows, we study the properties of decision-making in randomly generated policy landscapes (that is the true ordering of policy vectors). In each simulation we study the outcome for every initial status quo and we repeat the exercise for 1000 different randomly generated problems.

## 4 Results

We will concentrate on the role of organizational structure, authority, learning and docility. We will consider the performance of organizations in randomly generated policy landscapes. As indicators of performance we shall use the following:

- average performance, i.e. the average *true* ranking of all the attainable organizational equilibria
- best performance, i.e. the *true* ranking of the best attainable organizational equilibrium

- average control, i.e. the average ranking according to the *principal's preferences* of all the attainable organizational equilibria
- best control, i.e. the ranking according to the *principal's preferences* of the best attainable organizational equilibrium
- principal's competence, i.e. the final correlation between the principal's ranking and the true one

## 4.1 Organizational structure

The role of organizational structure when neither authority nor learning are in place can be summarized in table 1. It shows that the decision process in O8 ends up in a cycle in 78 percent of cases. If it does not lead to a cycle, it stops in about 3 different organizational equilibria. On the contrary, in O1 all decisions are delegated to one agent, therefore only one organizational equilibrium is possible (the vector preferred by agent) and no cycles can occur (because all agents have transitive preferences). This however is the extreme case whereby there is no coordination problem because all the knowledge is embodied in one autocratic ruler, who is in every respect both principal and agent. In some respect, this case resembles central planning: the coordination problem is solved by construction and the performance at equilibrium fully depends on the quality of the knowledge of the central planner itself.

Org. Structure	No. of equilibria	Share of cycles
<b>O8</b>	2.78 (1.22)	0.78
<b>O4</b>	1.89 (0.98)	0.74
<b>O2</b>	1.03 (0.45)	0.58
<b>O1</b>	1.00 (0.00)	0.00

**Table 1: Number of equilibria for different organizations**  
(n=8, 1000 repetitions, standard deviation in brackets)

Structures in which decisions are more finely partitioned (e.g. O8) tend to produce a much higher number of cycles but also, when cycles do not appear, a higher number of local optima. The latter feature confers some important advantages to finely partitioned structure. They can in fact achieve higher level of performance and control (what we defined as best performance and

best control), but also, as we will see, higher levels of learning, because they can experiment with different organizational equilibria. We will see below that this advantage is greatly enhanced by the use of authority that sharply decreases the occurrence of cycles and generates a high number of different organizational equilibria.

## 4.2 Authority

We just mentioned the advantages of highly partitioned structures, but we also reminded that they tend to produce higher numbers of cycles. Authority can indeed prevent the latter.

Table 2 shows the number of optima and cycles and the values of the best attained control and performance for different values of the probability that the principal vetoes a policy change she does not like in the O8 organizational structure. Note that control and performance are measured as losses from the optimum, i.e. as rank distance between the actual policy vector and the most wanted or most fit one. Thus a loss of control 0 means that the principal obtains exactly her most preferred policy vector and a loss of performance 0 means that the chosen equilibrium is the best policy vector in the true ranking.

P(veto)	N. optima	N. cycles	Best control loss	Best perform. loss
0.0	0.94	202.94	-161.20	-159.51
0.3	13.88	146.99	-71.88	-14.45
0.5	27.60	86.45	-65.82	-6.90
0.8	46.67	14.46	-65.74	-3.93
1.0	56.65	0.00	-64.61	-3.16

**Table 2: The effect of veto in O8**

The results change somehow if instead of the mere power to veto changes of the status quo that are against her preferences, the principal can impose by fiat her most preferred subset of policies to each agent. Table 3 summarizes these results. Obviously if the principal always intervenes by fiat she can get full control, but the number of possible equilibria and best performance are considerably lower than when only veto power can be exerted. Also the reduction of cycles is less sharp than when veto is used.

P(fiat)	N. optima	N. cycles	Best control loss	Best perform. loss
0.0	0.94	202.94	-161.20	-159.51
0.3	15.48	192.81	-2.36	-13.91
0.5	29.63	138.20	-0.59	-7.27
0.8	35.13	36.55	-0.03	-6.04
1.0	28.82	0.00	0.00	-7.78

**Table 3: The effect of fiat in O8**

Using fiat in organizations with coarser partitions of decisions makes control even easier, but the outcome is worse in terms of performance (and, as we will see below, also in terms of learning), because coarser organizations produce a smaller amount of possible organizational equilibria. For instance, table 4 presents the results obtained by increasing levels of probability of intervention by fiat in a O2 type organization.

P(fiat)	N. optima	N. cycles	Best control loss	Best perform. loss
0.0	0.99	154.08	-156.86	-161.69
0.3	8.32	164.39	-0.20	-28.65
0.5	9.84	119.49	-0.01	-24.99
0.8	9.47	25.64	0.00	-26.16
1.0	8.29	0.00	0.00	-31.14

**Table 4: The effect of fiat in O2**

Not too surprisingly, throughout our simulation experiments “more power” – in terms of depth and probabilities of its exercise – yields more organizational control over agents’ behaviours. And with that also comes easier coordinating properties of the organization itself.

Interestingly, also organizational performance grows with the exercise of authority, but up to a point. There is no monotonicity here and there appear to be three “phases” in the system, namely, (i) with no or low exercise of authority coordination is difficult and organizational performance is low; (ii) with robust exercise of authority coordination is easy and performance high; (iii) with extremely deep and detailed exercise of authority coordination is easy but performance is worse.

As we shall shortly see, these properties are broadly corroborated by set-ups involving different types of learning.

### 4.3 Learning

In our model learning can only take place through trial-and-error: by experimenting different organizational equilibria the principal and the agents

can acquire information on the relative value of different policy vectors and adapt accordingly their subjective rankings. Therefore, the existence of a multiplicity of organizational equilibria is a fundamental driver for learning. As we have already pointed out, the number of organizational equilibria is higher when decisions are highly partitioned and authority is used in order to prevent cycles. A careful balance between partition of decisions and use of authority is therefore needed to increase learning.

Figure 1 plots the average Spearman rank correlation coefficient for organizations O8 and O2 for different values of veto probabilities when  $\pi_{plearn} = 1$  (i.e. the principal always updates her ranking when new organizational equilibria are tested in the environment). It is worth noting the inverted U-shape of the relation between the use of veto power and principal’s learning in O8: too little use of veto power decreases learning because of the high frequency of cycles, too much use of it because it decreases exploration (many policy changes that would produce good organizational equilibria are vetoed).

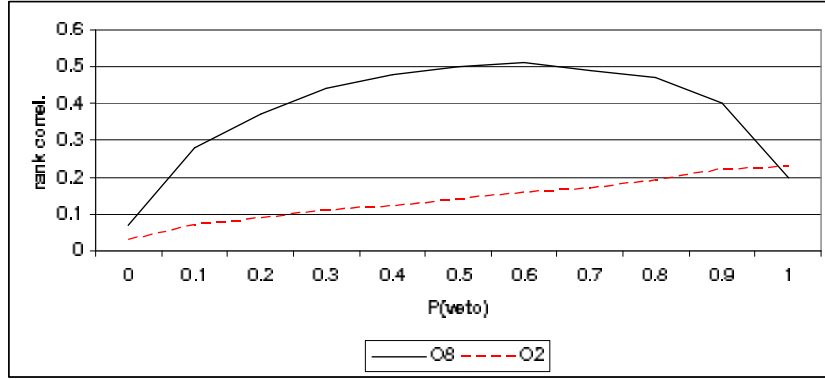


Figure 1: The effect of veto power on principal’s learning in O8 and O2

A similar, but even stronger, result is obtained also when fiat instead of veto power is considered, as shown in figure 2.

A similar inverted u-shaped relation can be found also for the relation between probability of intervention by fiat and average performance, while average control increases, as shown in figure 3 (where  $\pi_{plearn} = 1$ ). Moreover, the impact of fiat power is higher the higher the decentralization of knowledge and decision rights (compare O8 and O2).

Interestingly enough, if we allow learning not only by the principal but also by the agents we do not observe any significant improvement on the principal’s learning in O8, but we do in O2, as shown in figure 4.

The result is even stronger if fiat instead of veto power is considered: in this case allowing agent learning has a negative effect on principal’s learning

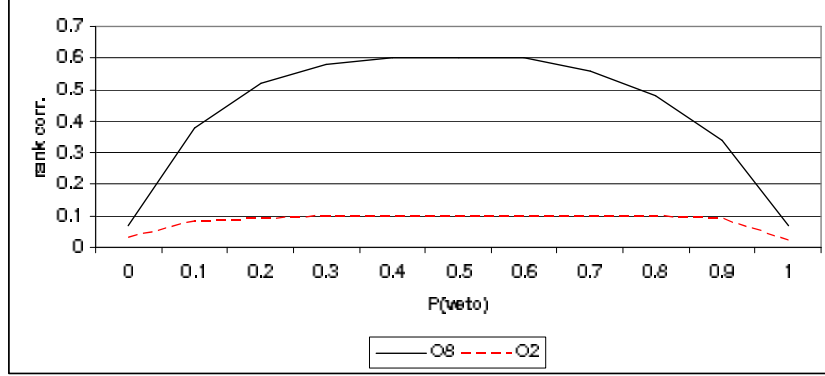


Figure 2: The effect of fiat power on principal's learning in O8 and O2

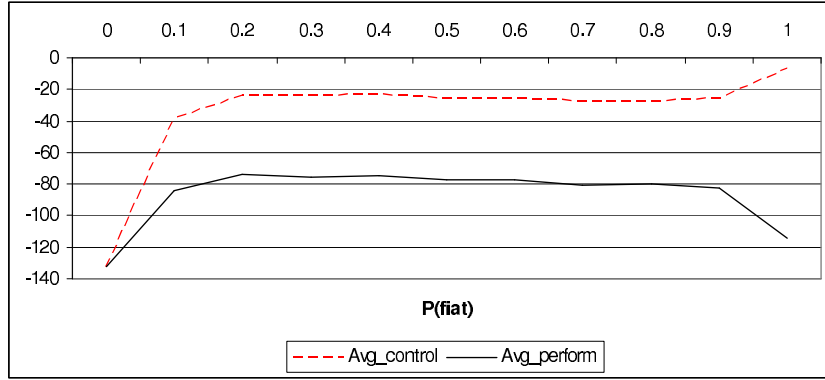


Figure 3: The effect of fiat power and principal's learning on performance and control in O8

(see figure 5).

Indeed, these results appear to suggest that an organizational set-up particularly conducive to learning involves multiple decentralized searches but also a centralized “exploitation” of the outcomes of such exploratory efforts.

Figure 6 shows the effect of veto power on average agents' learning in O8 and O2.

Finally we can introduce agent's adaptation to the principal's preferences, what we called agent's docility. Obviously agent's docility greatly increases principal's control, provided the principal exerts some authority<sup>3</sup>, as shown by figure 7, where we plot average and best control for different values of veto probability when  $\pi_{docil}$  is set to 1 in the organization O8.

<sup>3</sup>Recall that in our model agent's adaptations to the principal's preferences is actually triggered by the exercise of authority, as the latter is the means the principal can use to reveal her preferences to the agents.



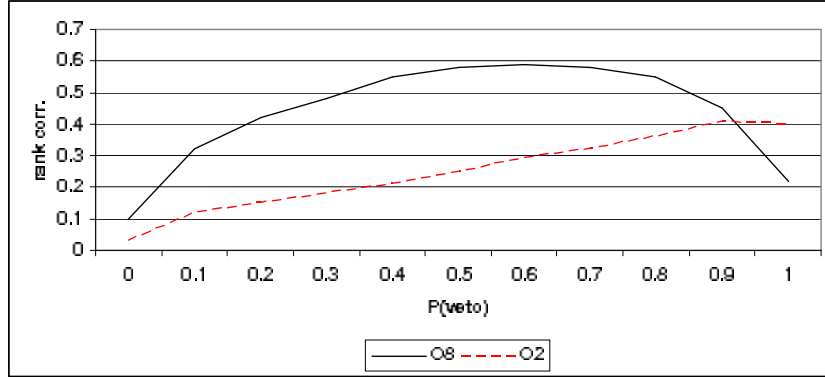


Figure 4: The effect of veto power and agents' learning on principal's learning in O8 and O2

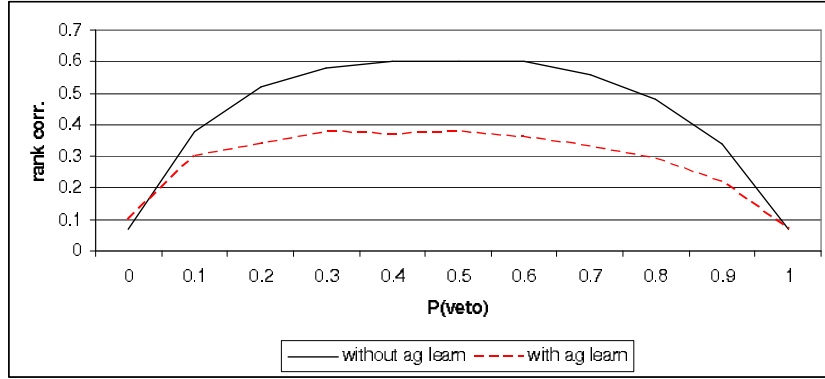


Figure 5: The effect of fiat power on principal's learning in O8 with and without agent learning

However docility decreases learning by the principal and performance: as agents adapt their preferences to the principal's, exploration of new possible equilibria decreases and the scope for learning by the principal is reduced, as is average performance. Figure 8 plots Spearman's correlation between the principal's ranking and the true one as an indicator of principal's learning when  $\pi_{p\text{learn}} = 1$  and in the cases in which  $\pi_{docil}$  is either 0 or 1 and shows that learning by the principal is significantly higher in the former case. Figure 9 plots instead average performance in both cases and shows that also performance decreases with higher values of agents' docility.

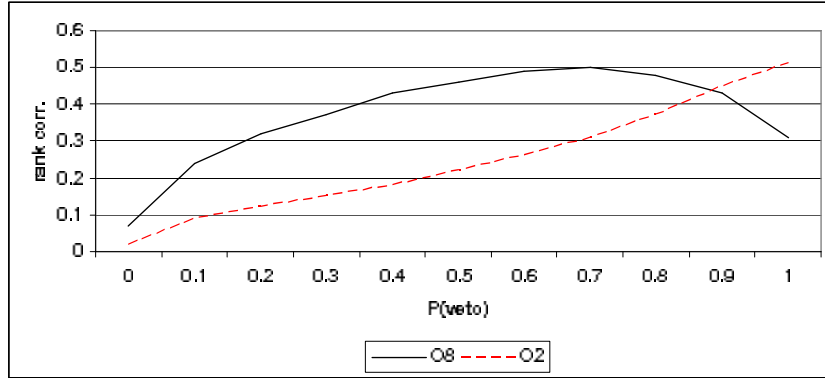


Figure 6: The effect of veto power on agents' learning in O8 and O2

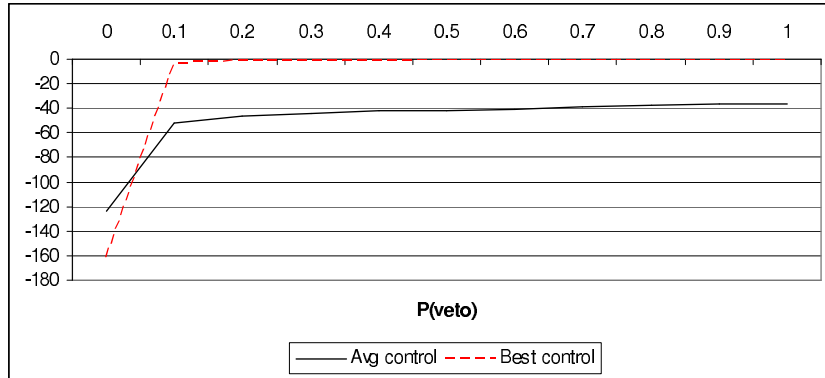


Figure 7: The effect of veto power on control with agents' docility in O8

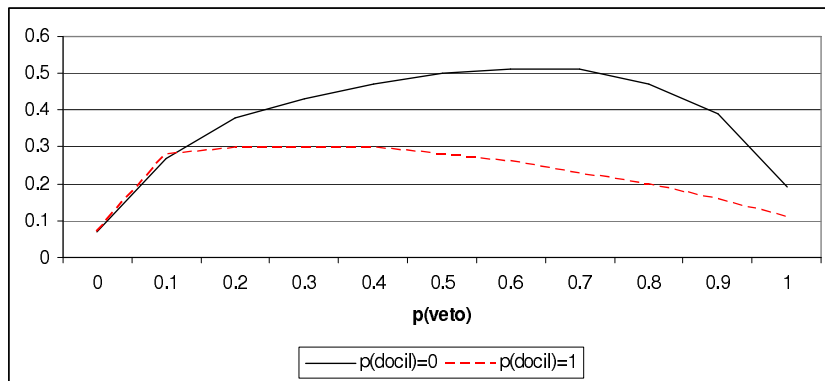


Figure 8: Principal's learning with high or low agents' docility in O8 for different probabilities of veto

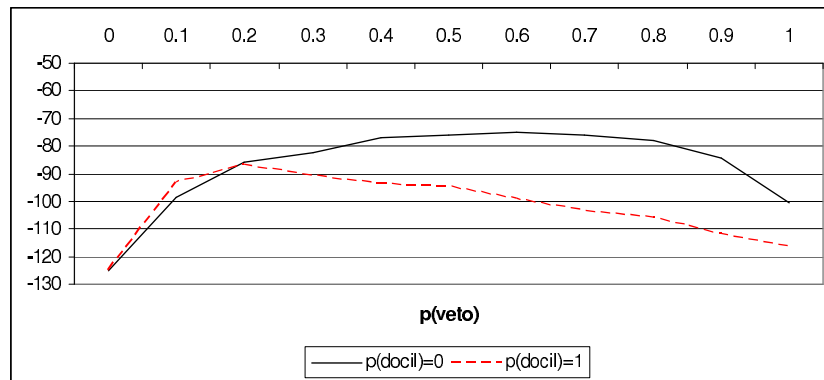


Figure 9: Average and best performance with high or low agents' docility in O8 for different probabilities of veto

## 5 Conclusions

Power and authority, on the one side, and cognitive and behavioural adaptation, on the other, are fundamental dimensions of an economic organization or, for that matter, of all social institutions. However, they are also badly under-researched dimensions, most likely because their study inevitably involves some departure from the individualistic rationality of the *homo oeconomicus* which is dominant in economics and more and more pervasive also in the other social sciences. In fact, as it is argued at greater length in Dosi (1995), one can identify in social sciences two opposite interpretative archetypes, characterized by two different narratives. In turn, behind each specific interpretative story, there is a set of *ceteris paribus* assumptions and also some fictitious tale on a ‘once upon a time’ reconstruction of the theoretical primitives of the story itself. Needless to say, most of (but not all) scholars realize that the tales are just tales, but they still influence the way that interpretative stories are told, the selection of dominant variables, the modeling assumptions, etc.

The first says, more or less, that ‘once upon a time’ there were individuals with reasonably structured and coherent preferences, with adequate cognitive algorithms to solve the decision-action problems at hand, and (in most cases) with self-seeking restrictions on preferences themselves. They met in some openings in the forest and, conditional on the technologies available, undertook some sort of general equilibrium trading or, as an unavoidable second best, built organizations in order to deal with technological non-convexities, trading difficulties, contract enforcements, etc. Here, clearly, the rough ‘primitives’ of the tale are preferences, endowments and given technologies (of production and exchange), while ‘institutions’ or ‘organizations’ are derived entities.

In a second and alternative tale, ‘once upon a time’ there were immediately factors of socialization and preference-formation of individuals, institutions like families shaping desires, representations and, possibly, cognitive abilities. Non-exchange mechanisms of interactions appear in the explanation from the start: authority, violence and persuasion of parents upon children; obedience; tribes; schools; churches; and, generally, the adaptation to particular social roles. Here ‘institutions’ are the primitives, while ‘preferences’ and the very notion of ‘rationality’ are derived entities.

Certainly, with enough refinements, both basic tales become analytically respectable and in many variations observationally indistinguishable. So, for example, in the ‘rational’ tale one can easily admit that preferences, too, are endogenous, but on a longer time scale. However, in principle, institutions and organizations ought to be considered relatively plastic and adapt-

able, while the interests, motivations and menus of strategies available to the agents ought to be relatively invariant. Conversely, in the institutionalist tale it is easy to account for the influence of individual preferences and strategies upon the evolution of social organizations. However, one is inclined to view institutions as the relatively inertial entities and agents' motivations and behaviors as comparatively flexible and adaptive.

Together, in the rationalist tale agents are assumed to somehow possess a kit of algorithmic devices sufficient to adequately represent the environment in which they operate and to choose the appropriate courses of action. Bounded rationality versions - such as agency theories but also Williamson's TCE - relax the assumption by allowing computational and memory limitations, but still tend to define bounded rationality as an imperfect approximation to the 'unbounded' one.

At the opposite end of the spectrum, the institutionalist tale finds intuitive links with all those inquiries, such as cognitive psychology and artificial sciences, which start from the presumption of general (nearly ontological) gaps (a) between what one sees and believes, and what is really out there; and (b) between what one could notionally do, given the environmental constraints and opportunities, and what one is actually capable of doing. As a consequence, in this perspective, the challenge to the theory is to investigate the nature and process of emergence of particular cognitive frames, interpretative categories, patterns of behaviors, routines, etc.

Related issues concern the separability between cognitive and motivational dimensions of decision-making. Clearly, the rationalist tale demands such separation between 'what one desires' (i.e. goals, utilities, etc.) and 'what one knows' (i.e. the assessment of the status of the environment and the means available to achieve given goals). Conversely, the institutionalist tale is comfortable also with blurred coupled dynamics between the two, possibly yielding endogenous preferences, coexisting contradictory models of cognition and action in the heads of the same individuals, phenomena of cognitive dissonance, etc.

In this work we have fully embraced the institutionalist view and explored its implications in terms of coordination, learning and organizational performance. First, we show, not surprisingly, that authority and power exercise significantly facilitates coordination. Second, and much less intuitive, a robust exercise of veto and fiat power by a superimposed authority greatly enhances also organizational performance up to a point: ubiquitous exercise of power yields easy coordination but worsens performance. Hence the third finding: higher organizational performance comes together with some balance between decentralized local coordination on the one hand and centralized authority on the other.

These properties are corroborated and indeed strengthened when one allows for organizational learning, both by the principal and by the agents. Our fourth result is that the exercise of authority not only makes coordination easier, but also collective learning more effective. However the proposition holds as long as some balance between exploration and exploitation is preserved. A too strict exercise of authority degrades the learning abilities of the organization. Moreover, the most effective organizational set-ups appear to be those in which exploration (learning) is decentralized while exploitation (the ensuing coordinating rules) is centralized by the principal.

What about “docility”, that is adaptation by the agents in their cognition, preferences and behavioural rules? Our fifth set of findings shows that docility is the “high powered” version (and indeed largely substitute) of authority. It is more effective than the latter in achieving coordination, but it can kill exploration if too strong and fast. An organization made of fully adaptive members coordinates very smoothly but learns relatively little, since all the learning has to be picked up by the principal, losing all the efficacy of decentralized search.

Putting it somewhat emphatically, the general message of the foregoing exercise is that, even within organizations, the Hayekian “spontaneous order” is difficult to come about, it is rather fragile to disruptive loops and often leads to both static and dynamic (learning linked) low relative performance. Authority and power are essential ingredients of coordination and collective learning. However all this comes with an intrinsic tension with the need of mostly decentralized exploration. Fully hierarchical organization tend to be static, however it is grossly misleading, we suggest, that the dynamism of capitalist economic organizations is due to their lack of hierarchical structure. Rather, the big challenge concerns the understanding of processes in which power and authority play a fundamental role, but exploratory and “deviant” behaviours lead social dynamics within and across organizations.

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