LACHMANN AND THE USES OF CAPITAL THEORY

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1. **Introduction: Lachmann's dilemma**

Post-Hayekian Austrian economics is marked by the works of the triumvirate responsible for the revival of this research tradition in the 1970s: Murray Rothbard, Israel Kirzner, and Ludwig Lachmann. Of the three, the work of the latter is the least known and exploited. Unlike the first author, popular because of its association with the political philosophy of libertarianism, Lachmann has focused on purely technical controversies of economic theory, leaving the reader the task of deriving political conclusions from his theories. Contrary to the second, which in his study of competition succeeded in exposing the differences between the Austrian theory of market process and the neoclassical theory of equilibrium, Lachmann invested in the much more complicated field of capital theory. Finally, among the Austrians themselves, Lachmann takes a heterodox point of view, rejecting in his mature works any use for the concept of equilibrium.

Lachmann is known mainly for his extension of the Austrian theory of capital to situations of disequilibrium, in the development of the Austrian theory of the business cycles. His work, as is well known, explores the consequences of the hypothesis of capital heterogeneity. The "radical subjectivism" professed by the author, however, led him to develop an almost historicist posture

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in relation to economic analysis, thus leading to a departure from the Austrian research program. This distancing is manifested in the debate about the preponderance of equilibrating or disequilibrating forces in the market process. In this article, we do not intend to analyze this well-known controversy. Although Lachmann turns his attention to the descriptive task of understanding past plans, there are nevertheless interesting theoretical contributions on his part, derived from his previous work on capital and these contributions deserve more attention. In this paper, we will explore two of his original ideas, one concerning the economics of knowledge – his parallelism between business and scientific learning – and his suggestion of a theory about the nature and evolution of institutions.

In the three fields mentioned – capital, knowledge and institutions – Lachmann is concerned with the evolution of heterogeneous structures, composed of elements connected to each other. This evolution, in turn, is marked by the progressive complexity, which in turn is related to the number of elements in the structure and the different ways in which they can be connected.

Besides the use of common analytical tool, the themes here are also related. In dealing with capital from the point of view of decisions in disequilibrium, it is necessary to inquire about the knowledge of the agents and the formation of the expectations that inform business plans concerning the uses of capital goods. By emphasizing the fallible character of agents' knowledge in the context of market process, Lachmann is also led to study, in addition to the price system, the complementary institutions that make it possible to coordinate plans in markets.

Thus, in order to study the two mentioned contributions of the author, we must proceed by adopting a roundabout method, possibly more productive. We will begin, in this introduction, with a dilemma that, in our opinion, characterizes all his work. In the following section, we argue that this dilemma and the problems that Lachmann studied are derived from the Hayek´s research program, to which we offer a brief interpretation. This program, which explains the emergence of self-organization in markets as the result of learning processes, requires in our opinion a Popperian solution, which we provide through the use of evolutionary epistemology,

exposed in the sequence. With this interpretative tool in hand, after exposing Lachmann's ideas on capital theory, which will be the basis of his studies on learning and institutions, we will be able to interpret Lachmann's change of opinion regarding the meaning and usefulness of the notion of equilibrium. Finally, the examination of this intellectual evolution enables us to critically examine in the last two sections of the paper the theory of institutions and the economics of knowledge proposed by Lachmann, from the perspective of the Popperian solution to Hayek's problem.

Let us begin with the exposition of a constant dilemma in Lachmann's work. This work is marked by the emphasis on two elements quite typical of the Austrian tradition: subjectivism and the complexity of the fundamental economic problem. The modern evolution of economics, for the author, is represented by the progressive incorporation of subjective elements, such as preferences, plans, learning and expectations. This interpretative element is related to the complexity of the allocative problem, whose fundamentals not only change at every moment, but also are fruit in part of the very entrepreneurial creativity that arises during the market process. In this way, agents must interpret reality. In particular, the complexities imposed by the recognition of the heterogeneous character of capital goods will make the task of coordinating plans especially difficult.

The Austrian defense of the superiority of decentralized allocative mechanisms thus requires a theory that includes both the representation of the complexity of the problem of coordinating individual plans and the representation of the limitations of formal knowledge to deal with these complexities, so that coordination could be achieved only through the use of decentralized learning mechanisms that can take into account details that centralized decisions are not able to contemplate.

However, for Lachmann, an important error arises when the theoretical tools used to represent the complexity of the social phenomenon, complexity which manifests itself in the form of restrictions on human action, are interpreted not as abstract representations of these constraints, but as real entities, possibly operational in empirical terms. Macroeconomic aggregates, for example, are not autonomous concepts, as if they were independent of the individual actions

that generate them. This error of interpretation of abstract theory induces the transfer of the simplicity of the model to the reality studied. This danger is inherent of the modern over-valuation of formalization in economics. Formalism is defined by the author as the use of an analytical tool outside of its original context, ignoring in this way its limitations[1]. In this manner, both the complexity of the phenomenon studied and the subjective elements tends to disappear from the analysis. We thus arrive at our dilemma: explaining coordination requires considering complexity and subjectivism, but theoretical representations of the elements of structures generate the illusion that they are given and known, thus negating the perception of their complexity.

The author's work, in fact, is marked by the fight against this mechanistic tendency present in both micro and macro theories. In particular, the formalist tendency to cling to the notion of equilibrium causes entrepreneurial activity to be ignored and explanations based on the agents' purposeful action replaced by relationships between aggregate variables. Contrary to his critique of this typical "ricardian" tendency of modern formalism, Lachmann seeks in his work to develop a macro theory based not on microeconomic models, but in microeconomic problems. This means an analysis that considers the problems that microeconomic theory should explain, such as the mistakes derived from erroneous perception about the feasibility of investment projects. Capital, in particular, is not treated by Lachmann as a homogeneous abstract entity that automatically generates income, but as decisions to allocate concrete resources whose usefulness must be imagined and tested frequently.

This research program, in turn, cannot be dissociated from its origin in the Hayekian theoretical framework, whose fundamental features we discuss next.

2. **Hayek as a starting point: the knowledge problem**

Lachmann begins his career working with the Austrian theory of economic cycles developed by Hayek. For the latter, economic

[1] Lachmann (1973, p. 8).

fluctuations are caused by monetary disturbances that distort the temporal structure of production. To explain the emergence of these distortions, Hayek (1999) starts from an initial situation that assumes compatibility of plans, represented by the idea of an intertemporal general equilibrium, in which agents correctly anticipate the future trajectory of prices. To describe how variations in the money supply affect the process of making production plans compatible over time, Hayek (2012) is led to represent the capital structure in a somewhat simplified way, in a model that involves the continuous addition of inputs to processes that mature in a point of time in the form of final goods.

While this suffices to explain the existence of rigidities in supply that characterizes Austrian macroeconomics, this simplified representation of the complexity of the capital structure needed to be reformulated to allow the integration of the subjective and complex elements present in the Austrian tradition. Lachmann's task will then be to develop the notion of capital under a subjectivist view, considering the business decisions about production over time. This task will present the same challenges faced by Hayek, which justifies our small digression on how the latter interprets the notion of market equilibrium.

Hayek, as is well-known, wrote on many subjects, seemingly independent of each other, but which in fact are united by a common theme: the problem of coordination, as noted by O'Driscoll (1977). The social sciences, for Hayek, must explain the emergence of compatibility (in some degree) of individual plans. In his writings, this task is attempted in the study of the functioning of markets (price theory), intertemporal plans of production (capital theory), discoordination generated by monetary disturbances (theory of cycles) and coordination of action guides by rules (theory of institutions).

Coordination becomes problematic as economies develop. When the division of labor intensifies, each individual is able to know proportionately less of the total set of information necessary for an economic allocation of resources. This development process, therefore, depends on the use of mechanisms, such as the price system, that enable a process of transmission of information dispersed among agents.

In order for the plans to be harmonized in some degree, knowledge must not only be transmitted, but also created and corrected. Here, hayekian economics takes the form of a theory of agent learning. Hayek (1937) asks, in the so-called "knowledge problem", how the assumptions agents use to interpret the economic phenomena and the information they have access correspond or not to the real fundamentals of the economy.

In equilibrium, with the plans previously made compatible, it is not necessary to discuss the possibility of agents having different and potentially erroneous models or hypotheses about markets and, therefore, it is not necessary to inquire how these hypotheses are created and corrected. In an explanation of the emergence of this equilibrium, however, it is necessary to consider the process of discovery of this knowledge. In Hayek's work, this process is part of the very essence of competitive activity. This involves, in addition to the mechanism of correction of errors provided by the price system, the presence of the freedom to act according to individual beliefs. Agents act based on assumptions they formulate relating the local conditions of the markets. This freedom is necessary for the discovery and creation of conjectures about which goods could best meet needs, what would be the technical forms of production, what are the inputs and how to obtain them.

Learning by decentralized mechanisms of competition between rival alternatives is necessary when we need to circumvent the limitations of the knowledge necessary to coordinate actions in progressively more complex systems. This theme is recurrent in his work, present in his economic, philosophical and political theses. We may even say that the Hayekian research program can be condensed by the following statement: "... the case for individual freedom rests chiefly on the recognition of the inevitable ignorance of all of us concerning a great many of the factors on which the achievements of our ends and welfare depends" (Hayek, 1979: 29).

The recognition that we need a theory of learning to explain the emergence of coordination does not imply acceptance of Hayek's particular theory of learning, which can be inferred from many of his works. Lachmann, in particular, will move away from Hayekian theory throughout his career. In order to describe this movement, in the next section we shall present the thesis that the Hayekian

solution to the problem of knowledge coincides in many respects with the theory on the growth of knowledge developed by his friend, Karl Popper.

3. **The Popperian solution: evolutionary epistemology**

The market, for Hayek (1978), must be valued as a mechanism for discovering new ways of meeting needs. As the fundamentals of the economy change continuously, markets should be valued more in terms of adaptability to change than in terms of the ability to generate efficient allocations at a particular point in time. In his work, the description of the competitive mechanism assumes an evolutionary form, presenting the elements of variation (freedom) and selection (profits and losses), which invites new modifications of business hypotheses.

This description, Bartley[2] notes, is similar to the way Popper (1972) describes the growth of scientific knowledge, according to which this growth occurs through conjectures (variation) and refutations (selection). Both assume an evolutionary basic structure; hence the common classification as two examples of evolutionary epistemology. In this view, learning processes in several areas require these two common elements, both crucial when we recognize the fallible nature of human knowledge. If knowledge is indeed fallible, whether in the context of general scientific theories or in the context of business hypotheses, individuals learn by rejecting hypotheses perceived as incompatible with reality.

Popperian philosophy contemplates both the recognition that hypotheses are creations of the human mind and not inductive generalizations derived from the impression in the mind of pure sensory data, as well as the recognition of the existence of an underlying reality independent of mental phenomena. Hypotheses do not automatically correspond to reality but are progressively less inconsistent with it if there is room for critical activity in science (or competition in markets).

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[2] Bartley e Radnitsky (1987).

A fundamental aspect of Popperian philosophy, crucial to our understanding of Lachmann's views, is its non-justificationist character. The rationality of scientific thought is not identified with the ability to establish proven knowledge. All knowledge, including criticism of hypotheses, is liable to error. Thus, the philosophy of science does not provide rules for assessing the veracity of any particular conjecture but describes an institutional environment conducive to the progress of science, such as the existence of rules that facilitate the exposition of conjectures to critical examination.

Similarly, it would be foolish to criticize the theory of competition in terms of its inability to generate a formula for personal gain: this theory provides only a conjecture on the relative efficiency of different institutional environments in terms of their ability to induce coordination and growth. For Hayek, equilibrium theory should be understood only as a pattern explanation: something that describes some of the general principles of how markets work rather than something that can be used in an operational way that would enable the determination of the magnitudes of costs and benefits involved in each concrete situation. In other words, the theory does not say what should be done, but indicates how the fundamentals of economics and the institutions limit the choices of agents. Popper and Hayek present both non-justificationist theories about the evolution of knowledge.

The last aspect of evolutionary epistemology useful for the analysis of Lachmann's theses is the treatment of knowledge as an objective entity; or, in Popper's words, as autonomous objects of the "world 3" of ideas. If criticism is fundamental for the exploitation of the fruitful consequences of ideas, we must make hypotheses clear, regardless of the intentions, feelings, physiological characteristics, social and political environment of the people who formulated them. This means the rejection of a subjectivist approach to epistemology.

Each set of hypotheses contains an infinite set of tautological consequences and its empirical content includes even propositions about implications of the theory that conflict with rival hypotheses not yet formulated. For Bartley (1990), this implies that the development of knowledge is unfathomable, that is, ideas,

and not just actions, have unintended and potentially innovative consequences, which makes the path of scientific progress indeterminate.

In the rest of the paper, we will examine Lachmann's intellectual trajectory in the light of the compatibility of his methodological postures with the ideas outlined above. To begin this task, we now turn to his contributions to the theory of capital, which will form the basis of his institutional analysis and contribution to the economics of knowledge.

4. **Lachmann and Capital Theory**

Let us now revisit some elements of Lachmann's contribution to capital theory[3], which shapes his view on institutions and learning. For Lachmann, the development of capital theory was excessively marked by the need to explain the existence of interest rates. In addition, in a Ricardian analysis of the distribution of national product it is natural to treat the concept of capital from the perspective of the accountant, in terms of the present value of aggregate quantities of goods. So, in equilibrium, capital is reduced to a common measure in monetary terms. In this way, capital is usually represented as a homogeneous mass, in which each unit is replaceable by another. According to the metaphor suggested by Lachmann (1947), each unit of homogeneous capital is like a drop of water in a lake.

On the other hand, in the Austrian tradition, informed by the allocative problem, the temporal plans of production are always modified due to the presence of continuous changes. This requires an entrepreneurial perspective. Echoing Hayek's knowledge problem, Lachmann argues that in disequilibrium the value of capital goods depends on the different conceptions held by agents about the future. The occurrence of frustration of plans requires recombination of capital, which is composed of goods that are specific in its use.

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[3] For a detailed summary of this theory, see Lewin (1997). See also Lewin (1999) for an application of Lachmann´s ideas.

Unexpected changes and heterogeneity of capital led Lachmann to develop a disaggregated conception of capital. For Lachmann (1978: 4), "... we must regard the 'stock of capital' not as a homogeneous aggregate but as a structural pattern. The Theory of Capital is, in last resort, the morphology of the forms which this pattern assumes in a changing world"[4].

The elements that characterize theories about spontaneous orders in the Hayekian tradition are thus present: fallible disperse knowledge and complexity of reality to which this knowledge refers. This complexity arises in Lachmann through the concept of heterogeneity of capital goods. This refers not only to physical heterogeneity, but heterogeneity of uses over time: each capital good can be used in a limited number of purposes, due to the multiple specificity of capital goods. These goods are seen as complements in each entrepreneurial plan, which seeks their best joint use. Unexpected changes will lead to changes in the pattern of use of capital goods – these will have to be reallocated to other purposes. The value of the stock, therefore, will vary with such changes, undermining the possibility of a theoretical meaningful measure of the amount of capital. Although we cannot aggregate it into a capital stock, there is a capital structure or order, characterized by the constraint imposed by the fact that only some modes of complementarity are economically viable.

Entrepreneurs seek combinations that reconciles the elements of this structure. Those goods that do not fit in a plan should be regrouped with complementary capital in an alternative use or scrapped. The theory of capital should study the forces that lead to the integration of the structure of capital, as well as the forces that cause disturbances in this structure. A profitable investment opportunity should therefore look for "holes" in the existing pattern and not simply repeat previous investments. For this reason, Lachmann criticizes the macroeconomic theories of investment that disregard the form of investment in favor of its total value.

This microeconomic perspective on the uses of capital is compatible with the Austrian theory of market process. The equilibrium

[4] Besides his book on the subject, see also Lachmann (1941) and (1947).

analysis only poses the problem of verifying a priori the consistency between courses of action. It could not, as in a process analysis, study how inconsistencies are removed over time. Lachmann's theory, on the other hand, admits the inconsistency of plans and studies their effects. The failure of the plans leads to their revision and to what Lachmann calls regrouping of capital. As time passes and changes take place, capital goods are allocated to uses different from those originally intended. In that sense, regrouped capital goods are like "fossils" from earlier plans: palaces of merchants become hotels and theaters become cinemas.

Revisions of the plans are not determined by the existing data, as they depend on the evolution of agents' knowledge. If an idea arising only in the future influences actions after its discovery, we cannot now logically anticipate these actions, which make the future indeterminate[5]. Expectations then reflect particular interpretations of reality.

In his book on capital, Lachmann describes a learning process analogous to our Popperian solution to Hayek's knowledge problem. The conjectures created by entrepreneurs are tested by the price system, tending to reflect to some degree the underlying reality of the markets, despite the discoordination that arises, for example, when delays and changes in the opposite direction occur. Since multiple changes happens in any moment, business hypotheses are never definitively refuted, as in science due to the classical methodological thesis exposed by Duhem and Quine. The same signals that are manifested in prices will then be interpreted differently by different agents.

Due to the presence of unexpected changes, there is a need for a reserve, which Lachmann calls supplementary capital. This reserve in cash is different from a sum used to acquire capital goods in the original plan. A cash reserve whose purpose is to deal with changes in plans is a necessary condition for the success of

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[5] This will be a favorite subject in Lachmann's later work. The argument is the same used by Popper (1957), which shows that it is impossible to predict future knowledge. This argument is a fundamental critique of deterministic models of learning. Boulding, quoted in Grinder (1977), calls the application of this proof in Economy "Lachmann's Law".

the action and it does not make sense, therefore, to call it idle money, as is common in the conventional approach to capital. The decrease or increase in reserves serves as a barometer of success or failure of the business plan. These changes in the reserves cover the differences between the value of the capital goods sold and bought in the process of capital regrouping of the various firms when capital goods are seen as substitutes over time.

It is necessary at this point to distinguish between the internal structure of capital that exists as a consequence of each plan and the structural complementarity of the economy as a whole, the latter brought (or not) by the interaction in the markets. Lachmann seeks a description of the capital structure of the economy in terms of a permanent pattern that has shifting parts. The structure of connections between capital goods forms a pattern that is defined in the same way as Hayek defines equilibrium, i.e., in terms of plan coordination, compatible with a growth situation where changes are anticipated. The structure is defined in terms of the agents' correct prediction about which changes will occur in the actions of the other agents and in the elements of the structure of capital. This leads the author to distinguish between consistent and inconsistent capital shifts, as they are predicted or not.

Inconsistent changes are called by Lachmann structural maladjustments. Given these definitions of structure and structure change, Lachmann analyzes the forces in the market that generate a consistent or inconsistent change in the structure of capital. Although aware of potentially disequilibrating factors, such as price rigidity and information delays, Lachmann in his book on capital believes in the preponderance of the equilibrating forces resulting from the functioning of the price system.

After studying how a structure of capital changes, generating compatibility between its parts, it remains to analyze how this structure develops towards greater complexity in the scenario of growth. The simplified representation of Böhm-Bawerk in terms of stages of production is replaced by an interpretation that preserves the spirit of the concept. Lachmann draws a parallel between Smith's division of labor and Böhm-Bawerk's division of capital. The growth of capital leads to its greater specialization, which allows us to abandon the hypothesis of diminishing returns. New

combinations of capital evolve to greater complexity. In this way, more stages of production are created, allowing the use of indivisible resources.

It may become profitable to install indivisible resources because of the greater number of complementary goods that justify them. For example, poorer societies use more expensive transportation systems at the margin because of the lack of complementary resources that justify a more capital-intensive alternative. This indivisibility allows greater returns to capital as it is accumulated. This would be, in Lachmann's view, the explanation for Böhm-Bawerk's thesis on higher productivity of indirect means of production. Growth takes the form of new and more complex combinations of capital.

5. **Lachmann's Transformation**

Lachmann adapted his ideas about capital to the study of other subjects, both in the outline of an Austrian theory of institutions and in the investigation of the evolution of the knowledge of the agents. In order to understand the situational logic faced by him, however, it is necessary to examine his departure from the Popperian solution to Hayekian knowledge problem.

Just as Hutchison (1981) divides Hayek's work into two phases, separated by an alleged adoption of a Popperian philosophy from *Economics and Knowledge*, we can adopt an inverse division, with the gradual transformation of a Lachmann I, characterized by the adoption of our Popperian solution to the knowledge problem, into a Lachmann II, marked by the adoption of a justificationist epistemology. Like Caldwell (1988), who interprets the same article as the landmark of Hayek's transformation into a researcher skeptic regarding utility of the notion of equilibrium, we can speak of a Lachmann's transformation, characterized by the same motive.

Although Lachmann's entire work is marked by the consistent application of the Austrian principle of methodological subjectivism, there is, however, a shift of emphasis throughout his career. Lachmann I gives a clear impression that in the market process the forces leading to equilibrium prevail, whereas Lachmann II, driven

by his "radical subjectivism", emphasizes the preponderance of disequilibrating forces in the market process.

Lachmann I, like Hayek, believes in a selection mechanism that leads to a convergence of expectations, compatible with the underlying realities (Lachmann, 1950, 1956, 1966). In his first book, for example, he states that "[w]e may thus conclude that via knowledge transmitted through the price system economic change tends, in general, to give rise to expectations consistent with itself" (1978: 62).

In their later study of expectations, however, this approach is abandoned. Expectations, for Lachmann, cannot be reduced to data about the outside world. In a world of unexpected changes, the future is uncertain and must be imagined by the agents. In this sense, choice is original (Lachmann 1994: 247) and expectations will diverge because they are dependent on the agents' world-views. They learn, but we cannot know what. An entrepreneur may be wrong in the first three attempts, but getting it right in the fourth, or a successful businessman can go wrong. "How can we be sure?" Lachmann asks. Selection of hypotheses and learning, which marked his first phase, now play a minor role.

In seeking to deny reductionist theorization, which ignore the autonomous character of choices, Lachmann II is led to emphasize, as Keynes, the lack of objective basis for expectations. At this point, his ideas coincide with those of Shackle. We find in their work a clear distinction between the nature of knowledge about present and future facts (or expectations). Knowledge of present facts is seen as valid knowledge, justified, while expectations are uncertain propositions, therefore unproven, unjustified. Shackle (1976) book on epistemic s and economics can be summed up as the development of the implications of the fact that the passage of time makes the knowledge of economic agents uncertain. Practically in all the chapters of this book we can find quotations distinguishing knowledge and expectations in terms of the criterion of justified knowledge. The same thing is often found in Lachmann (1977: 61): "what are the criteria of *valid knowledge* at his [the agent] disposal?" Contrary to the recognition of the fallible character of all knowledge found in Popper's philosophy, for Lachmann and Shackle, the absence

of proven knowledge would frustrate any attempt to theoretically address the learning of agents[6].

Lachmann emphasizes the autonomy of the human mind: the phenomena studied by economics are not determined by material forces but are the fruits of the inventive action of men. But what is the nature of economic theorizing if prediction is in fact impossible?

Lachmann II does not emphasize in his writings the existence of economic limitations that could generate negative theoretical results, what Hayek (1967) calls pattern predictions. Barred by the possibility of negative predictions, Lachmann argues that the positive tasks left for the economists would be two: the understanding of the intentions of the agents who shaped their economic decisions in the past and the guiding role allowed by institutions. Lachmann's later work consistently follows this program. Lachmann (1986), in his latest book on the market process almost slips into a form of historicism[7], describing historical categories of agents and types of markets existing in modern times.

6. **Capital Recombination I: theory of institutions**

If, following Lachmann II, the social sciences must study human action not from the abstract point of view of the restrictions imposed by the external world on choices, but from the perspective of the description of concrete actions guided by plans, it is natural to deal with institutions as factors guiding planning. The orientation provided by institutions facilitates the study of concrete plans. Institutions make human behavior more predictable and are important for reducing the uncertainty inherent in creative action. But, instead of Weberian ideal types, Lachmann proposes to use the praxeological notion of action guided by plans. The task of social sciences is then the understanding of concrete plans.

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[6] Shackle (1976: 49) also believes that time divides things into a part that we can reason about and other part which we cannot.

[7] Eicholz (2017) discusses whether Lachmann can be considered a member of the German historical school.

In spite of this program, the Lachmannian institutional analysis is marked by the use of the tools used previously in the Hayekian tradition. For Lachmann, like the price system, institutions function to overcome the obstacles posed by the division of knowledge: "They are nodal points of society, coordinating the actions of millions whom they relieve of the need to acquire and digest detailed knowledge about others and form detailed expectations about their future action." (1971: 50).

In addition to Weberian and Hayekian influences noted above, Lachmann uses in his theory another Austrian feature, present in Menger and Hayek: an evolutionary explanation of the emergence of institutions, viewed as unintended fruit of purposive action. With these elements, Lachmann suggests a theory of institutions in which they are part of a complex structure of norms. Thus, the core of the explanation comes from the author's own work in the area of capital theory. In fact, Lachmann argues that a theory of institutions must study "the nature, functions, and structural relations between institutions" (1971: 50).

The existence of institutions poses some problems, parallel to those exposed in relation to capital. In this later matter, we faced the problem of defining a complex structure with functional relations between elements that change continuously. Analogous questions arise in the theory of institutions. First, we have the problem of change. To serve as a guide, rules must be stable. At the same time there must be institutional changes in which agents adapt to new realities. How to reconcile these two needs?

Next, we have the problem of institutional order, or complementarity of institutions. The institutions present in society interact and together form a structure, in the same way that the structure of capital is composed of heterogeneous elements. Is there a structure of institutions that show some degree of coherence or unity? Are there forces that bring coherence between the elements of this structure? Finally, linking the two problems, can new institutions that replace others or fill holes in the structure bring coherence and at the same time serve as a stable framework for action (1971: 51)?

As in the theory of capital, the institutional structure must combine permanence and coherence of its elements as well as some

flexibility, since the institution-led actions informed by plans extend into the future in a constantly changing world.

For Lachmann, the institutional structure is composed of an external substructure, the legal order, in the interstices from which the elements of the internal substructure evolve, which are unintentional fruits of individual successful actions that crystallize through an evolutionary process involving trials and errors.

The issues of permanence/coherence and flexibility vary as we consider each of these substructures. Legal institutions and the institutional structure as a whole differ in terms of consistency of their elements, being greater in the first case. The most significant contrast, however, occurs when we compare them in terms of the existence of "general complementarity" or gaplessness: while the legal order with its hierarchy of norms excludes the possibility of situations in which there are no applicable rules, the broad institutional order does not presents such completeness, which opens space for institutional changes that would increase their capacity to coordinate individual actions.

The process of institutional evolution, faced with the dilemma between permanence / coherence and flexibility, must be gradual in order to fulfill its role as guide for action. At the same time, the existence of norms guaranteeing a wide sphere of contractual freedom is necessary for the existence of a process of experimentation, which results in spontaneous institutions that change more frequently. At the same time, there must be a set of few immutable external institutions, complementary to the former, which provide the basis for their development.

Another aspect of the problem is brought about not by the creation of new institutions in the interstices of existing ones, but by the "extension" of existing institutions to new uses without affecting the original plans that use them, such as a modification in the scope of property rights. Finally, the institutional structure must contain safeguards against changes that threaten to break the social order based on the existing set of institutions, if the speed of modifications in the structure is very high.

This brief outline of institutional analysis clearly reveals its inspiration in the theory of capital. The Lachmannian study of the institutions was motivated by a skepticism about the usefulness of

an economic theory centered on the notion of equilibrium. In his last book, Lachmann (1986) defends the thesis that markets should be studied case by case, according to the institutional peculiarities surrounding each market process. Although his radical subjectivism led him to reject some elements of traditional Hayekian analysis, such as the notion of pattern predictions and an evolutionary model of learning aided by the price system, we can say that the author developed the Austrian institutional analysis in a direction compatible with the original research program. Although Lachmann II intends to offer a descriptive or positive analysis of actions guided by rules in different types of markets, using his theory of capital to study institutions he offers elements of an abstract explanation about the evolution of institutions. In this analysis, we find again on equal footing the subjective element of expectations and a representation of the complex structures that limit action, both necessary for a theory of emergency of coordination.

In dealing with the interaction between limited knowledge and external obstacles for an explanation of the coordination of actions, Lachmann develops Austrian institutionalism, introducing the notion of institutional structure, which opens up interesting possibilities for the development of institutional economics in general.

7. **Capital Recombination II: economics of knowledge**

The second recombination of Lachmann's intellectual capital, to which we now turn, explores in an original way the parallelism between agent learning in markets and scientific research. This contribution can thus be classified as an effective contribution to evolutionary epistemology.

Bartley (1990), in a provocative tone, states that the separation between economics and philosophy of science is artificial, the latter being only a branch of the former, concerned with a particular form of growth. Lachmann I, in similar fashion, explores the similarities between learning processes in both disciplines. Particularly, in capital theory, dealing with expectations, Lachmann (1978: 23) draws an explicit parallel between scientific and business learning:

> "The business man who forms an expectation is doing precisely what a scientist does when he formulates a working hypothesis. Both, business expectation and scientific hypothesis serve the same purpose; both reflect an attempt at cognition and orientation in an imperfectly known world, both embody imperfect knowledge to be tested and improved by later experience."

This perception of a common structure of learning in both fields allows us to affirm the compatibility of his early point of view with Popperian philosophy, with its emphasis on the limitations of knowledge and institutional mechanisms of learning through trials and errors.

If, as Lachmann wants, a learning theory does have the same structure – hypothetical knowledge and an error correction mechanism – then we can imagine both a philosophy of economics and an economics of philosophy. As regards the application of the philosophy of science to the learning of agents, Austrians can criticize[8] the inductivist empiricism that still characterizes many of the models of learning in economics, according to which the agents differ only by the information sets known by each agent and not by the formulation of rival business hypotheses that clash in competition.

This situation can be clarified by Lachmann's dilemma exposed in the introduction of this article: if not interpreted as abstract pattern explanations, formal models of learning can induce the risk of transferring their simplicity to the object studied. Specifically, because the model lists the variables that influences the learning processes, it excludes the crucial aspect of competition as a mechanism for discovering previously unimagined solutions, in the form of variables not contemplated in the model.

In addition to Philosophy as Economics, Lachmann (1986) also explores parallels in the opposite direction, the Economics of Knowledge. Here, the particular economic tool used is again his theory of capital. Thus, in spite of the radical subjectivism professed by Lachmann II, for which the knowledge of the economic agents would be subjective and private, and for this reason could not be studied as a

[8] See Harper (1996), Thomsen (2006) and Barbieri (2006).

function of anything, the tool employed is again his contribution to capital theory, which investigates the coordination of different parts of a changing structure. Thus, considering the unfathomable nature of knowledge, we have as a result a non-radical subjectivist contribution to the philosophy of science, in spite of Lachmann's own preferences. This happens because his capital theory contains at its center the interaction between fallible rival hypotheses and the underlying reality which these hypotheses seek to represent. This interaction, as we have seen, limits what can be imagined, thus imposing regularities on the object studied, in this case, knowledge.

In studying the economics of knowledge, Lachmann poses some interesting questions: how is the marketing of ideas possible, since ideas are nonrival goods? Or, considering the Hayekian framework, how can knowledge be both decentralized and diffusible? What bars perfect diffusion? To answer this last question, Lachmann uses the Hayekian distinction between abstract theoretical knowledge and practical knowledge concerning particular situations. This distinction points to the heterogeneity of knowledge. If so, would this imply complementarity, as in the theory of capital?

We have learned from Popper that science is based on prior conceptions that inform problems. Every information that comes from an empirical observation is interpreted according to these conceptions. Using the concepts employed by Lachmann, this idea is an example of the complementarity of agent's knowledge inventory. Each "investment" (information) has meaning only in light of the structure of theories already adopted by the researcher. In addition to the stock of knowledge, we must also consider the flow of information, related to learning.

Lachmann does not simply identify knowledge with stock and information with flow, since this distinction presupposes uniformity of such stock. The definition used by the author blends the above distinction with the differentiation between the objective vehicle of the information and its content. For Lachmann (1986: 49), information refers to the exchangeable materials that contain the flow of information, and knowledge concerns the thoughts that an individual uses in his planning.

The objective flow of information must be interpreted by the agent holding a particular stock of knowledge. This interpretation,

distillation of the meaning of information, is a problem solving activity: each new information must be embedded in the stock, changing this stock of knowledge in the same way that investment changes the structure of capital: For Lachmann (1986: 48) "It is less a question of improving one's existing knowledge by marginal doses than of monitoring one's total stock of knowledge and replacing those parts that have become obsolete by up to date items".

Deepening the parallelism, new information complementary to other already belonging to the stock is more rewarding than isolated new information. As for the problem of the maintenance of "intellectual capital", knowledge of particular circumstances is more affected by obsolescence than general knowledge, requiring, therefore, a greater flow of substitute information. On the other hand, the depreciation of a piece of general knowledge brings greater consequences in terms of the restructuring of total knowledge, as it affects a larger number of complementary knowledge sub-sets. This restructuring of intellectual capital is what occurs, for example, in scientific revolutions.

But how often do agents review their plans over time? The answer varies depending on the agent. Lachmann refers to Boland (1978), who says that such a review period varies according to the methodology adopted by the economic agent: an instrumentalist entrepreneur revises his plans less than a critical rationalist, for example.

Studying the evolution of patterns of complementarity and substitution of ideas, Lachmann once again adapts his work on capital theory to another field of knowledge. Again, we are faced with the phenomenon of unintended consequences of ideas: although philosophically Lachmann II prefers a subjectivist, hermeneutic approach, the adoption of capital theory as an analytical tool results in a contribution compatible with evolutionary epistemology, which privileges both the creativity of the hypotheses and the study of their compatibility with the external world.

8. **Conclusion**

In this article we examine the recombination of theoretical capital developed by Lachmann in two areas: his theory of capital was

adapted to the study of the evolution of institutions and knowledge. In order to appreciate these contributions, we have taken a roundabout route, dealing first with methodological issues and the theory of capital. Initially, we discuss a methodological dilemma present in his work. The study of the evolution of complex orders requires the simultaneous presence of subjectivism and complexity. Both the ability to imagine alternatives and the ways in which the outside world limits this creativity are necessary. The formal representation of these restrictions, however, undermines the perception of the importance of subjectivism and complexity, as the alternatives come to be considered as known data and Lachmann, throughout his career, has always been opposed to reductionist or mechanistic views. Next, we situate Lachmann's contribution to the theory of capital in the context of Hayek's research program, emphasizing the so-called knowledge problem and discussing a Popperian solution, known as evolutionary epistemology, which proposes a learning model as a solution for the methodological dilemma presented. After that, we describe Lachmann's growing skepticism about the ability of markets to generate coordination and interpret it in philosophical terms: we argue that the author adopts a justificationist epistemology, incompatible with evolutionary epistemology. Finally, we argue that, despite his methodological beliefs and research program, Lachmann develops contributions to the economy of institutions and knowledge compatible with evolutionary epistemology, insofar as, by using his theory of capital as a tool, he privileges both the creative aspect of human action, as to the description of the restrictions on this creativity imposed by the external world. These factors are combined in a model of learning by trial and error in the institutional sphere and in the growth of scientific knowledge.

Lachmann's work is full of fascinating suggestions, scattered in the numerous writings. These suggestions deserve more study. Perhaps with the development of computational tools, such as network analysis, which deal with structures, we may be able to recover his ideas, centered on the evolution of complex structures. Combined with the Austrian theories themselves, this type of investment could increase the value of a complementary stock of knowledge.

In the field of institutional analysis, we can imagine gains from the combination of Douglas North and neoinstitucionalism in general and the framework developed by Lachmann. The concept of capital structure, for instance, can be used in the literature on the dilemma between shock treatment versus gradualism in institutional transition processes.

In the economics of knowledge, the notion of knowledge structure could be developed through the Lachmannian distinction between an individual researcher's structure and the general structure between ideas. In this way, we can rescue Lachmann's subjectivist contribution, preoccupied with the structures of the first type, combining it with Popper's objectivist tradition. The concept of unfathomable knowledge, for instance, fits perfectly with the notions of substitute and complementary capital of a set of scientific or business hypotheses. Again, Hayek functions as a bridge, through his methodological writings.

9. **Bibliographical References**

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