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Brief Encounter. The Distant Co-evolution of Régulation Theory and Evolutionary Economics

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ABSTRACT

Between the late 1980s and the mid-1990s, the perception of many contributors to régulation theory and evolutionary economics was that, because of a certain proximity in the issues and presuppositions of each approach, it might be fruitful for both to engage in a scientific dialogue that could lead to what Chris Freeman imagined might be an original synthesis. More than three decades later, it has to be said that the synthesis has not taken place and that the dialogue has lost much of its intensity. This article analyses the reasons that have led the two approaches to move further apart rather than closer together, by examining how régulation theory has integrated the problems of technology and dealt with agents' diversity at the micro level, and how evolutionary theory has tackled the issue of macro-level institutions. It emerges that structural reasons relating to each of the approaches prevent genuine convergence, but that this does not represent a problem for which a solution should necessarily be sought.

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1. Introduction

Régulation theory (Aglietta 1976; Boyer 1990; Boyer and Mistral 1978 [1983]; Lipietz 1979) and evolutionary economics[1] (Dosi 2023; Dosi et al. 1988; Nelson 2018; Nelson and Winter 1982) are two heterodox economics approaches with different origins, but whose main contributors once agreed that they had a common preoccupation to understand economic change as a historical, institutionally embedded, process (Coriat and Dosi 1995). The initial ambition of Régulation theory (RT) was to 'characterise the factors behind the crisis of the 1970s by placing them in the context of the social compromises that had been formed to support the remarkable viability of the Fordist accumulation regime […] and then its erosion, leading to an endogenous crisis' (Boyer et al.

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[1]Evolutionary theory is a broad church (Hodgson and Lamberg 2018; Dopfer et al. 2024). In what follows, the terms 'evolutionary economics', 'evolutionists' and 'neo-Schumpeterians' will be used indifferently to designate the research paradigm influenced by Nelson and Winter (1982), featured in Dosi et al. (1988) and presented in Dosi (2023). These contributions represent only part of what is commonly referred to as 'evolutionary economics', but it is an important part given the scientific contribution of Giovanni Dosi.

2023, p. 3). To this end, it developed a series of concepts: structural forms, accumulation regime, mode of régulation, etc. Evolutionary economics ventured to explain economic change with a microfounded approach that emphasised the selection environment in which interfirm competition took place, with heterogeneous boundedly rational agents discovering new technologies, new behavioural patterns and new organisational set-ups.

Would there be a possibility of cross-fertilisation between evolutionary and regulationist approaches? Freeman (1988) thought so when presenting the concept, originally developed by Carlotta Perez (1983), of *techno-economic paradigm*, which goes 'beyond engineering trajectories for specific product or process technologies and affect the input cost structure and conditions of production and distribution throughout the system' (Freeman and Perez 1988, p. 47). The concept recognises 'the influence of the economic selection environment in shaping and crystallising the new technology within the realm of the technically feasible' (Freeman 1988, p. 10). The techno-economic paradigm is defined as a cluster of interrelated technical, organisational and managerial innovations. In this perspective, Schumpeter's long cycles are viewed as a 'succession of "techno-economic paradigms" associated with a characteristic institutional framework, which, however, only emerges after a painful process of structural change.' (Freeman and Perez 1988, p. 47). Institutions play a role in the depression phase of a long cycle, when 'the established social and institutional framework no longer corresponds to the potential of the new techno-economic paradigm' (Freeman 1988, p. 11).

Freeman (1988, pp. 11–12) pointed out the 'important points of correspondence' between the Freeman-Perez model of the role of institutions and that of the French "régulation" school and argued that the two approaches were 'sufficiently complementary to offer *scope for an original synthesis*'.[2] However, this would demand that the French *régulation* school pay more attention to technical change, and that the Freeman-Perez approach develop their analysis of institutional forms or of aggregated formal models of the economy.

A similar assessment was made by Coriat and Dosi (1995, p. 14) when they evaluated the possibilities for régulation theory and evolutionary economics of a '*potentially fruitful complementarity*'. The largely microeconomic orientation of evolutionary theories had led them to focus their attention to specific organisational forms and routines. Conversely, régulation theory's main attention had centred on the macro institutions 'capable of shaping markets' dynamics and agents' behaviour' (Coriat and Dosi 2002, p. 308). Coriat and Dosi also pointed out that the evolutionary approach had almost exclusively dealt with the cognitive aspect of routines, neglecting issues of power and control that have been at the core of *régulation*'s view of institutions (Aglietta 1976 [1982]). The challenge for both theories was therefore to find a common ground where micro analyses of routines and technology would be linked with macro institutions regulating capital accumulation and social conflict. This issue is classically described as a problem of finding the analytical level at which régulation theory and evolutionary economics would meet.

The way forward was therefore presented as a bilateral effort. RT would move in the direction of incorporating more micro and technological elements in their analytical framework, and the evolutionary theories of economic change would move

[2]My *emphasis*.

up to the macro/institutional level while sticking to their microfounded/technology roots. But even without aiming for a convergence, a more modest 'theory-informed dialogue' between the two approaches would constitute a formidable challenge (Coriat and Dosi 2002).

An objective assessment of the situation more than three decades after the first expressions of the possibilities for cross-fertilisation leads to the conclusion that the progress made in the dialogue between the two approaches has been relatively modest and that the hopes placed in the possibility of a synthesis have been largely disappointed. Interactions between researchers working in one or other of the two approaches, relatively frequent until the late 1990s, have tended to become rarer. The influence of one research programme on the other has been relatively limited, as can be seen from the relatively low level of cross-citations in two recent books reviewing the evolutionary approach (Dosi 2023) and régulation theory (Boyer 2022a) respectively, which reflects that the influence that one approaches exerts on the other one is now marginal. The latest *état des savoirs* (state of the art) on the theory of *régulation* (Boyer et al. 2023) has one of its four parts (8 chapters) dedicated to cross-fertilisation with other disciplines or approaches: post-Keynesian theory,[3] Marxism,[4] sociology, geography, cultural political economy[5] … Evolutionary economics is not featured.

Analysing the reasons for this lack of convergence, despite the wishes of the main contributors to both approaches, is of interest in several respects. Firstly, both neo-Schumpeterian economics and the *régulation* approach have continued to produce abundant work since the late 1980s, exploring a variety of research avenues. However, after a few contributions attempting to realise the promise of dialogue and cooperation in the 1990s, no work has investigated the reasons that led to the situation described above. An examination of these reasons can help us to better understand the dynamics specific to each of two important research programmes in heterodox economics. Secondly, this investigation is also a way of providing some answers to the more general question of what heterodox theories have in common beyond their critique of the dominant theory (Lavoie 2005). Finally, the analysis of the divergences between the neo-Schumpeterians and RT also raises the question of the relationship between heterodox economics and the other social sciences. While evolutionists and RT both claim close links with history, RT seeks to build bridges with sociology and political science, while evolutionary economics is closer to social or cognitive psychology.

It should be pointed out that the evolutionists discussed in what follows are only part of evolutionary economics. As Witt (2008, p. 548) remarked, there is no 'no agreement about the specific features associated with the label "evolutionary" in economic analysis, not to speak of a commonly accepted paradigmatic "hard core"'. If the whole of evolutionary theory were to be taken into account, the elements of convergence and divergence within this theory would have to be highlighted before a comparison could be made with RT. This would far exceed the ambitions of this article. Moreover, it seems more sensible to compare RT with the elements of evolutionary economics that had expressed a closeness to it rather than with authors who had never mentioned it.

[3]Marie (2023) even speaks of a hybridisation between post-Keynesian theory and regulation. Indeed, the proximities between the two approaches are blatant (Lavoie 2023; Nishi 2023).
[4]Durand (2023) emphasises the necessity to tighten the links between Marxism and RT.
[5]Jessop and Sum (2023).

This paper is organised as follows. It first addresses the issues mentioned by Freeman (1988) and Coriat and Dosi (1995) regarding the possible evolution of RT towards evolutionary economics. A first section shows how the issue of technology has been integrated in RT analyses of developed economies' innovation and production systems. Although this work deals with themes close to neo-schumpeterian work on innovation systems, it has aroused little interest among them. The following section looks at the integration of microfoundations in RT. Contrary to a widespread opinion, regulationists have carried out work that takes into account the level of micro agents and the heterogeneity within them. That section exposes Frédéric Lordon's introduction of the concept of conatus in a theory of the agent's action, and Robert Boyer and Michel Freyssenet's concept of 'productive model'. Here again, these extensions of RT have not had any influence on neo-Schumpeterian analysis. Finally, a section investigates how evolutionary economics has dealt with macro institutions. It shows that in spite of having incorporated macro-level institutions in agent-based models, evolutionary theory does not address the issue of the endogeneity of institutions and is therefore ill-suited to analysing institutional change. The final section looks at the absence of the fruitful complementarity between the two approaches that was initially hoped for, and suggests some possible explanations. The paper concludes with the observation that the lack of convergence between RT and the neo-schumpeterians did not seem to harm the vitality of either approach.

2. Integrating Technology in Régulation Theory

The way in which RT approaches the question of technology is given in Boyer (1988a). It involves looking at long-term issues and structural change, and not considering technology in isolation from the rest of the economic and social system. Questions relating to technology were not absent from the first contributions to RT, but they were integrated into the central (intermediate) concepts, in particular the accumulation regime. There is no need to insist on the central role played by the Taylorist organisation in the various contributions of RT to the analysis of Fordism (e.g., Coriat 1979). But the way in which technology is integrated into the overall analysis is summed up in this quotation from Boyer (1988a, p. 83):

> [T]here is no doubt that technology and industrial organisation play very important roles in long-run economic change. But the 'régulation' approach does not adopt a purely deterministic view of technological factors: everything depends on the compatibility with the basic institutional forms and the ability of the mode of 'régulation' to deal with the kind of disequilibria or conflicts that accompany accumulation.

The research agenda set out in Boyer (1988a) revolved around four points: (i) confronting the basic hypotheses of régulation with the findings of science and technology research; (ii) formalising various accumulation regimes besides the Fordist one; (iii) searching for the roots of the present crisis: what role dose technology play? and (iv) what could the next accumulation regime and technological system look like?

The way in which points (ii) to (iv) could be treated from a regulationist point of view was already indicated in Boyer (1988b). Many subsequent contributions followed, up to Boyer (2000) where the simple formalisations of Boyer (1988b), a six-equation model,

gave way to a more complete 13-equation model. However, the role of technology in explaining the crisis and investigating new post-Fordist regimes of accumulation has tended to diminish over time, or at least not to occupy the central place it does in neo-Schumpeterian economics.[6] Other influences have been incorporated in the analytical investigation of the new accumulation regime(s) (Boyer 2018): financialisation, socio-political compromises, natural resources …

This does not mean, however, that RT has totally neglected questions of science or technology, far from it. Coriat and Weinstein (2002) started from the observation that the 'institutional' and the 'organisational' dimensions remained for the most part separated in the analysis of innovation at the firm level, and attempted to bring these dimensions together. Coriat and Orsi (2002) tackled the issue of the changes in the US intellectual property rights (IPR) regime and its consequences for innovation in biotechnology. Biotech was at the centre of Coriat, Orsi, and Weinstein (2003), who considered that this emerging sector could be regarded as a new type of science-based[7] technological regime. The role of the intellectual property rights system in contemporary capitalism was analysed in Orsi and Coriat (2006) with an emphasis on the complementarity between the new IPR regime and financialisation as well as the role of these evolutions in the emergence of a new international regime.

Another body of work bears witness to the incorporation of science and technology issues into a regulationist perspective. But this work has found little echo among the neo-Schumpeterians, belying Freeman's (1988) expectations of an original synthesis between the two currents. Most of the work in question related to point (i) above and concerned the way in which the themes of science and technology could be incorporated more precisely than had hitherto been the case in regulationist work, by relating science and technology to the other elements of the mode of régulation. A similarity could be detected with the work of the neo-Schumpeterians which focused on the question of innovation systems.

The question of innovation systems has been addressed at several levels in the evolutionist/neo-Schumpeterian literature, notably sectoral, regional and national. For the sake of simplicity and relevance, we will focus on the national level (Freeman 1987; Lundvall 1992; Nelson 1993). Smith (2020) distinguished between two levels of analysis. The basic level focuses on the company and its local environment. Innovation takes place with complex interactions between a firm, its network of suppliers and customers, and sustained interactions between users and producers of technology. Institutions affecting the pattern of interactions between economic units are to a large extent national and hence all interactions in the same country will have common determinants. The other level concerns broader contexts conditioning innovative activities such as cultural aspects, social customs, national traditions and regulations. Freeman (2008) refers to the higher level when he mentions the elements that define the national innovation system: the generation of scientific knowledge, technology, economic elements defining the organisation of production and income distribution, the political and legal structure, and culture broadly defined. As we can see, this definition is by no

[6]There is no entry for technology nor for science in Boyer (2015) and the latest edition of régulation's *Etat des savoirs*, Boyer et al. (2023), has no chapter on technology whereas the first edition, Boyer and Saillard (1995) had one.
[7]This is a reference to Pavitt (1984)'s typology of sectors.

means restricted to the narrow field of science and technology, but establishes many links with macro-institutionalist approaches such as régulation.

One of the ways in which RT has deepened its consideration of scientific and technological fields has been to consider how these fit into a broader view of the economic structure. A series of works on the social systems of innovation and production (SSIP) have thus proposed an analytical framework and compared the main countries of the OECD (Amable 2000; Amable, Barré, and Boyer 1997a, 1997b; Amable and Boyer 2001; Amable and Petit 2001). The work carried out from this perspective differed from that of the neo-Schumpeterians working on national innovation systems in several ways. Firstly, in line with the regulationist vision of technical change mentioned earlier, the institutions considered included a wider set than just science and technology institutions, hence the term innovation and production system. Six institutional subsystems formed the SSIP: science, technology, industry (forming together the production and innovation system), as well as the financial system, the wage-labour nexus and the education and training system Secondly, empirical analyses were performed with a wide set of internationally comparable statistical indicators relevant for the institutional areas concerned, an element whose importance was stressed by Patel and Pavitt (1994) and that Archibuggi (1996) found lacking in Nelson's (1993) book on national systems of innovation. Thirdly, an institution was viewed not only in terms of its direct impact on a particular area or on its final effect on technology, but also, and perhaps above all, in terms of how it complemented other institutions in their specific domains.

The idea of institutional complementarity, present in the early work on régulation without being explicitly named as such, was brought to the fore by Aoki (1986) in his comparison between the United States and Japan. It went beyond the type of interactions between different elements of the national system of innovation that the neo-Schumpeterian literature took into account. Finally, although the institutions and the economic performances with which they were supposed to correspond were apprehended at national level, the structure of institutional complementarities made it possible to identify systems that could characterise groups of countries rather than isolated nations. Amable et al (1997) thus identified four ideal-types of systems among the twelve countries studied: market-based (the United States, Great Britain, Australia and Canada), social-democratic (Scandinavian countries), mesocorporatist (Japan), and, for lack of a better term, 'European' (France, Germany, Italy and the Netherlands).

This work met with little response from neo-Schumpeterians.[8] It was not until 2002 that a major contributor to the study of national systems of innovation (NSI) mentioned the work on SSIPs, and then only in a footnote. Noting that '[s]o far, the studies of national systems of innovation have given too little emphasis to the subsystem related to human resource development', Lundvall et al. (2002, p. 224) added a footnote stating that '[a]n exception is Amable et al. (1997) where the labour market and training systems are integrated in the analysis of what they call "social systems of innovation"', not mentioning that the financial system was also included in the analysis of SSIPs.

There are undoubtedly many reasons for this lack of cross-fertilisation between the work of neo-Schumpeterians working on innovation systems and that of regulationists

[8]One might think that this lack of interest in work on SSIPs is due to the fact that the main contribution is a book written in French and not in English. However, causality probably worked in the opposite direction.

analysing SSIPs, but two interrelated ones can be identified. Firstly, there was a certain reluctance on the part of NSI scholars to leave what Lundvall (2007) calls the 'narrow' definition of innovation system, which limits itself to the areas of science, research, technology, and in some cases education and vocational training and government' promotion and regulation of technological change (Patel and Pavitt 1994), opposed to the 'broad' definition which extends to all economic structures and institutional set-up affecting the production system and innovation. Most neo-Schumpeterians, coming from the economics of technical change, were comfortable with the idea of focusing on the narrow definition of systems of innovation, and considered the areas covered by the broad definition (wage bargaining, financial system, social protection …) to be uncharted territory. By contrast, most regulationists came from a macro-institutional background and were not particularly enthralled by the perspective of a narrow focus on science and technology. Yet, it would have been possible for each side to focus on its area of specialisation while importing the findings of the other side, which was the basic idea of cross-fertilisation, but this did not happen, which brings us to the second reason.

Lundvall (2007, p. 98) points out that '[p]olicy implications have been worked out on the basis of a narrow definition of innovation system where the focus is on science based innovation'. It was this version of the innovation system that met with some success with policy makers in the 1990s:[9] 'Both policy makers at the national level and experts in international organizations for economic cooperation such as OECD, Unctad, the World Bank and the EU Commission have adopted the concept' (Lundvall 2007, p. 97). Under these conditions, it is easy to see that neo-Schumpeterians had little incentive to change a concept that was gaining ground in a policy domain that mainstream economists largely ignored or had no comparative advantage in, at the risk of losing influence by being associated with heterodox economists whose Marxist roots were likely to frighten off the decision-makers that innovation system scholars wanted to advise and who, through their research, were in direct competition with mainstream economists.

One may argue that this tactical victory over neoclassical economics in the area of economic/technology policy influence through the adoption of the narrow innovation system perspective was a strategic defeat, because mainstream economists soon reclaimed the field of science and technology on the basis of the 'new' growth theories (Aghion and Howitt 2009; Romer 1986, 1990) and reinvented themselves as continuators of Schumpeter's work (Aghion, Akcigit, and Howitt 2014). They provided policy makers with policy recommendations corresponding to a broad vision of the factors influencing technology and growth: liberalisation of the labour market, deregulation of finance, strengthening of competition policy … The neo-Schumpeterians had little to oppose to these neoliberal 'structural reforms' (Amable 2004; Amable, Demmou, and Ledezma 2009), especially since mainstream economists and evolutionists were more or less on the same line as far as competition policy was concerned (Metcalfe 1994).[10] In the

[9]B.A. Lundvall was deputy director of OECD's Directorate for Science, Technology and Industry (DSTI) between 1992 and 1995.

[10]"Our results are broadly in line with the evidence discussed in Aghion and Howitt (2007): *other things being equal*, the easiness of entry and competence of entrants bears a positive impact upon long-term growth, mitigates business cycles fluctuations and reduces average unemployment." (Dosi, Fagiolo, and Roventini 2010, p. 1762). Dosi et al. add that "the ceteris paribus condition is equally important: the same aggregate growth patterns can be proved to be equally guaranteed by competent cumulative learning of incumbents". But Amable, Demmou, and Ledezma (2010) show that the Aghion-Howitt model too can too be modified to have its pro-competition/entry conclusions reversed.

meantime, régulation scholars that used to work on SSIPs had moved on to the development of a political economy of socio-economic models and institutional change (Amable 2003, 2017) which found among scholars of comparative political economy a more welcoming environment.

3. Integrating the Micro-Level into Régulation

The possibility to reconcile the microfounded approach of evolutionary economics and the macro-institutional focus of régulation has been at the core of the discussions around the possibility of finding a common ground (Coriat and Dosi 1995). The importance of microfoundations is constantly emphasised in evolutionary manifestos: '[t]heories ought to be microfounded, in the sense that they ought to be grounded explicitly (though perhaps indirectly) in a plausible account of what agents do and why they do it […] note also that *not* all "macro-propositions" should be necessarily microfounded. However, the theories pertaining to each level of description should not be in open conflict with each other.' (Dosi 2023, p. 14).

The idea that RT has kept itself at the macro-institutional level for too long and has not paid sufficient attention to what happens at the micro level was one of the most frequent critiques addressed to régulation mentioned by Lordon (2003). From this would follow that RT borrowed concepts taken from Pierre Bourdieu, notably *habitus*, to construct its theory of action at the micro level. It is true that Bourdieu is a major reference for at least some of the régulation scholars (Amable and Palombarini 2005; Boyer 2003, 2008). Habitus, which refers to the incorporation of social structures into agents' behaviour, establishes a link between the micro level and the institutional structure without the restrictions of a purely holistic or a purely individualistic approach and away from a theory of the 'rational' actor. It aims to explain how the subjective views are influenced by the objective social structures. There is no strict determinism of agents' actions and habitus encompasses a set of dispositions to act in a certain way or adopt certain attitudes, depending on their position in the social structure and the types of capital (economic, symbolic, etc.) that they possess.

In an effort to enrich this vision of micro behaviour, Lordon (2003) has put forward the concept of *conatus* (the effort by which each thing, as far as it can by its own power, strives to persevere in its being) and the notion of *affect*, imported from Spinoza, as elements to incorporate in a dynamic theory of individual action.[11] The conatus is 'the force of existence […]the fundamental energy that inhabits bodies and sets them in motion […] the fundamental energy that shakes up the body and sets it on the course of pursuing some object' (Lordon 2014, p. 10). The institutional structure of a society establishes limits to the range of objects that an individual will pursue. From this perspective, social life is a 'collective passionate life […] organised through institutional forms' (Lordon 2014, p. 7) and, congruent with Bourdieu's sociology, an agent's position in the social structure will determine the directions taken by individual desire, which means that the structure of domination will be reflected in the objects of desire.

Coriat and Dosi (1995, p. 17) thought that the hypothesis of institutional embeddedness of social behaviours could be pushed to the 'dangerous borders of

[11]See also Kniou (2024) for a discussion of conatus and régulation theory.

some renewed functionalism' and that regulationist interpretations fell into that trap when resorting to some 'functional representative agents' such as the Fordist firm or the unionised worker. Although acceptable as 'rough first approximations', such notions demanded microfoundations, the absence of which leading to a theory where micro diversity was absent.

Aware of the limits imposed by the consideration of representative agents such as those mentioned by Coriat and Dosi (1995), régulation scholars attempted to find a bridge between macro institutions and micro diversity which would stay true to the original inspiration of RT. The main step in this direction was taken by Robert Boyer and Michel Freyssenet when they elaborated the concept of 'productive models' (Boyer and Freyssenet 1995, 2000a, 2000b, 2002a, 2002b, 2016; Boyer et al. 1998; Freyssenet 2004, 2005, 2008; Montalban 2023a).

The concept of productive models has its roots in the analysis of the automobile sector and was elaborated to answer a question that neo-Schumpeterians could have addressed too: how can a firm like Toyota succeed in the world market whereas Ford failed outside of the USA? More generally, what concept(s) could explain the observed differences in strategies and trajectories of corporations operating a priori on the same market? The empirical observation was that there existed not one best way of organising management and production but a diversity of adaptation to the market and the institutional environment, not one model adopted by every competing firm but a diversity of modes of organisation. The answers lied in the way a corporation reacted to its environment and how the company governance compromise could be established. A company's survival supposedly depending on its profitability, the productive model approach focused on the different profit strategies that firms could develop. Firms do not exploit the same sources of profit and the environment in which they operate influences the way they construct their profit strategies: macroeconomic income distribution will shape market demand and influence the choice of products the firm will want to sell, the skill profile of the work force will present constraint and opportunities for different firm strategies, etc. 'The firm becomes a productive model when it combines a profit strategy adapted to (or coherent with) its macro-institutional environment and coherent with its internal resources and routines […] such micro institutional arrangements and adaptations are the outcomes of a compromise over the internal conflicts within the firm' (Klebaner and Montalban 2020, p. 184).

Boyer and Freyssenet (2002a, p. 43) give the following definition of a productive model:

> a fixed point in the interdependencies which govern the problems to be resolved by companies, the visions which guide their actions, the strategies adopted in the face of ever-changing hazards, the organisational and institutional arrangements which derive from them, the ways in which management performance is assessed, and last but not least, the general context of work and markets, which themselves evolve, partly under the influence of the production model, but partly autonomously.

Boyer and Freyssenet (2002a, p. 2) mention the compatibility with an evolutionary perspective for industrial dynamics: 'For evolutionist and neo-Schumpeterian theorists, the production model would rather be the ex-post description of the result of a selection process in an environment constantly disrupted by innovations.' They speak of a 'co-

evolution between production models and modes of régulation'. Montalban (2023a, p. 67) emphasises that productive models do not come straight out of managers' thought but result from a learning process involving trials and errors in trying to obtain a coherence between the organisation and the type of uncertainty it faces.

The competitiveness of firm, its ability to survive in a competitive market, does not depend on its internal resources only, be it 'factor endowments', the knowledge base, or routines. It hinges on the compatibility with the institutions which shapes the mode of régulation. A given institutional environment can prevent the emergence or survival of certain productive models. Boyer and Freyssenet (2002a) mention the case when the internal organisation of the firm is unable to offset the deficiencies of national institutions or infrastructures regarding the skill or education level of the work force, transport, the credit system, etc. A certain institutional structure may also allow several different profit strategies to develop because no single firm is able to exploit every profit strategy and, conversely, similar profit strategies can be implemented in different institutional contexts. Therefore, the heterogeneity of firms is to be expected[12] and is indeed observed in the numerous analyses making use of the concept of productive model beyond the case of the automobile industry (Boyer 2022b).

If we go back to the objectives originally set for RT by Coriat and Dosi (1995) or Freeman (1988), i.e., to take account of the micro level and the heterogeneity that manifests itself there, while integrating concerns relating to technical change, we can say that they have been achieved. However, none of the above-mentioned works has had the slightest resonance with evolutionary economics scholars.[13]

4. Integrating Institutions into Evolutionary Economics

Having seen how RT has integrated technology and the micro level into its theory, we can now turn to the efforts made by evolutionary theory to address the issue of macro-level institutions. Even apart from the work on the national systems of innovation, evolutionists have always placed their microfounded theory within an institutional framework. Dosi, Marengo, and Nuvolari (2020, p. 18) links this institutional preoccupation with an endogenous determination of technical change, different from the mainstream view of exogenous technology: '[t]he standard view is that technology is exogenously determined and sets the constraints which organizations optimally adapt to […] Contrast this view with the alternative one […] that these techno-economic changes are largely influenced by the institutional arrangements at all levels: national and international institutions, scientific and technological communities, organizational forms, work relations, etc.'. Dosi (2023) emphasises the socio-institutional embeddedness of economic processes and returns to Freeman and Perez (1988)'s characterisation of techno-economic

[12]In the specific Japanese context of the 'lost decade', see Lechevalier (2007).

[13]To discuss the possibilities of cross-fertilisation between RT and the totality of evolutionary approaches would go far beyond the limits of this article. However, we can mention the conceptualisation of Business Models (BM)within the framework of Generalised Darwinism by Brette and Chassagnon (2021). It is significant that, when they address the question of the institutional framework in which the BMs are situated, Brette and Chassagnon see a complementarity with the varieties of capitalism approach of Hall and Soskice (2001) rather than with the productive models approach of Freyssenet and Boyer, whereas the micro foundations of Hall and Soskice are mainly derived from mainstream economics (transaction costs, "new institutional economics", etc.).

paradigms, a notion whose proximity with the contributions of the French 'Régulation School' he reiterates.

The socio-institutional framework considered by neo-Schumpeterians 'refers to the social arrangements that ensure a broad consistency among the dynamics of productivity and key macroeconomic aggregates, including patterns of consumption and investment, income distribution, capacity utilization, etc.' (Dosi 2023, p. 47). The analysis of a techno-economic paradigm requires thus a 'detailed depiction of the configuration of the institutional set-ups'. The institutionalism relevant for evolutionary theory is 'strong' (Coriat and Dosi 1995; Dosi, Marengo, and Nuvolari 2020) which differs from its 'weak' cousin by the role attributed to individual rationality in the development of collective institutions, the degree of inertia and path dependency of institutions, the relative importance of choice vs. constraints in individual and collective behaviours, the importance of history in shaping these behaviours and the nature of hierarchy and organisations in which agents operate.

There are two crucial notions in evolutionary theory that are at the core of the micro/agent-macro/institutional relations: emergent properties and co-evolution. Silverberg (1988, p. 531) describes the relations between the former and the latter as follows:

> [t]he theory of self-organisation deals with complex dynamic systems […] and composed of a number of interacting subsystems. Thus the 'behavioural environment' and *the individual subsystems are conceived as undergoing a process of mutual coevolution* which may admit a determinate joint outcome […] Many such systems have been shown […] to lead to *the spontaneous emergence of coherent macroscopic structures* […] from the seemingly uncoordinated behaviour of the component parts at the microscopic level. Moreover, self-organising systems can undergo a succession of […] structural transformations in response to generalised changes in outside conditions coupled with internal fluctuations at the microscopic level. (my *emphasis*)

From the evolutionary perspective, collective, structural phenomena are conceived as emergent properties stemming from interactions between multiple heterogeneous micro agents; the subsystems within the overall structure are co-evolving. One thus understands that these elements characterise macro regularities such as growth, economic fluctuations, unemployment … as well as forms of organisation and institutions. Indeed, Dosi (2023) speaks of coevolution of technologies and organisational forms, of a 'co-evolution of knowledge and capabilities, on the one hand, and of "capitalist institutions", on the other' (p. 33) and states that '[t]he relation of the "higher level" regularities manifested in institutions, rules, and organizational forms to "lower-level" evolutionary processes in technologies, production patterns, etc. is a complex one of co-evolution across levels of analysis and timescales — and ought to be properly understood and possibly modelled as such.' (p. 16). Dosi, Marengo, and Nuvolari (2020, p. 18) had identified that 'the major challenge ahead [was] to develop and operationalize a rigorous theory of the nature and dynamics of institutions which […] addresses the coevolution of organizations, "forms of rationality", preferences and technologies'.

Regarding modelling, this usually involves agent-based models (ABMs) where a multiplicity of heterogeneous agents interact 'without any ex ante commitment to the reciprocal consistency of their actions' (Dosi 2023, p. 17). The evolutionary economics literature is rife with such modelling exercises but only a limited subset of these address the issue of macro-level institutions. These models are among the most recent

(Dosi, Fagiolo, and Roventini 2010, 2013, 2015, 2017, 2018, 2022) and are called 'Schumpeter meeting Keynes' or 'Keynes meets Schumpeter' or more simply 'K + S'. They establish a bridge between Keynesian demand generation and Schumpeterian technology creation and exhibit typical 'non-Walrasian features' such as non-clearing markets or involuntary unemployment and offer the possibility of assessing the impact of various economic, monetary or budgetary policies. The way macro-level institutions are featured is through system parameters reflecting the impact of productivity growth, unemployment or inflation on wage rate growth (Dosi, Fagiolo, and Roventini 2010), or more generally the type of labour market adjustments including search intensity, firing rule for firms, the existence of a minimum wage and unemployment benefits (Dosi et al. 2018). This allow to distinguish between different labour market regimes.

A first remark is that such a modelling strategy is not much different from the one used in the older and simpler models of RT (e.g., Boyer 1993) where a flexible labour market corresponded to a high impact of unemployment on the wage rate and other labour markets characteristics reflected in the magnitude of certain model parameters. Indeed, the results of the K + S models are not much different from older RT models when it comes to the general conclusions regarding the impact of labour market institutions on aggregate variables such as the growth or unemployment rates. The value added of K + S models lies in their consideration of agents' heterogeneity which makes it possible to draw conclusions regarding inequality for instance, or of different types of innovation strategies. To put it another way, the value-added, as well as the drawbacks, of K + S models can be found in their agent-based nature and the ensuing possibilities for dealing with heterogeneity, not in the way they are able to deal with institutions.

A second remark is that despite the claim to 'strong' institutionalism,[14] macro-level institutions are exogenous in the K + S models. The conclusions regarding the effect of labour market reforms (Dosi et al. 2018) are drawn from a comparison of the behaviour of the agent-based model with different institutional parameters: '[t]he model is simulated for 500 periods […] Structural reforms are implemented at time t = 100, by *changing all relevant model parameters* from the Fordist to one of the Competitive regime scenarios' (Dosi et al. 2018, p. 700, *my emphasis*). In other words, contrary to the hopes of Coriat and Dosi (1995, p. 14) who thought that the 'the aggregate functional and institutional regularities which are the starting point of most Regulation models' could be shown to be emergent properties of an explicitly microfounded evolutionary model, not only does institutional change not 'emerge' out of the interactions among micro agents but results from an exogenous change in parameters whose origins are justified by reference to elements outside evolutionary theory (this is where RT is mobilised[15]), but also institutions do not (co-)evolve at all because they are represented by parameters. One may object that institutional change occurs on a different time scale to that of 'ordinary' economic variables such GDP or employment. This is perfectly true, but this issue of multiple time-scales dynamics was addressed in an older and

[14]Dosi (2023, p. 49): "In the latter view, which we can label as 'strong institutionalism', institutions do not simply play a parametric role".

[15]"We comparatively study two archetypal types of decentralized labour markets, which we call the *Fordist* regime and the *Competitive* regime . The two regimes capture alternative wage-labour nexus in the words of the Regulation Theory." Dosi et al. (2017, p. 168).

simpler regulationist model (Lordon 1997), where the parameters of the technical progress functions changed slowly compared to other variables and where structural change and crisis appeared as long term and *endogenous* outcomes.

The treatment of institutions such as those concerning the wage-labour nexus in K + S ABMs is all the more surprising when one considers that the endogeneity of institutions is regularly emphasised in the neo-Schumpeterian literature (co-evolution, emerging properties …). For instance, Dosi (2023, p. 49) criticises Acemoglu, Johnson, and Robinson (2005):

> most of the recent research on institutions has tried to document the connection between different institutional forms and economic performance, mainly by means of econometric exercises […] most of the efforts have been devoted to 'identification' strategies that could overcome the potential endogeneity of the institutional variable of interest with respect to economic performance […] However […] the emphasis laid on the issue of endogeneity is bound to be a dead end: endogeneity is there to stay as an essential part of co-evolutionary processes!.

Even if one sets aside formal modelling exercises with their constraints and limitations, and turn to what neo-Schumpeterians call 'appreciative theory',[16] a fully-fledged endogenous theory of institutions is still missing, even when parts of it may be distinguished among the different narratives of specific historical events. When co-evolution is mobilised for a narrative of the British industrial revolution that involves changes in science, technology, the economy, politics, and culture (Dosi 2023, pp. 60–84), it is used to rebuff monocausal explanations of the phenomenon, quite justifiably so, and emphasise that there is an interplay between the evolution of different elements rather than to propose a theory of what causal links exist between these elements, especially when one considers areas other than science, technology and the economy. The lineaments of a theory of endogenous institutions can be distinguished, but they are all linked to an origin in the changes affecting science and technology.

5. Complementarity, Substitution, or Peaceful Coexistence?

As established so far, the relative situation of the two approaches, regulationist and evolutionist, seems a long way from achieving the original synthesis envisaged by Chris Freeman at the end of the 1980s. Although both approaches have taken steps in the directions envisaged at the outset, integrating micro-level diversity for Régulation and macro-level institutions for evolutionary theory, they have not succeeded in bringing their respective points of view closer together, quite the contrary. This raises the question of a possible incompatibility between the central elements of the two theories (Table 1). One of the issues at stake in the dialogue between RT and neo-Schumpeterians was to see whether it was possible to base the structural/institutional forms taken into account by régulation theory on the micro-founded approach of evolutionary theory. Ideally, the macro-level institutions central to the analysis of an accumulation regime

[16]'Appreciative theory' refers to situations "when economists are undertaking applied work that is of interest for policy reasons or are explaining, to an audience interested in that question per se, why certain economic events happened, theoretical ideas tend to be used less formally and more as a means of organizing analysis." (Nelson and Winter 1982, p. 46). "It is to a considerable extent inductive in nature, and is less logically fleshed out than general theories and formal models" (Nelson 2018, p. 10).

Table 1. A comparison of evolutionary economics and régulation theory fundamentals.

Themes	Evolutionary Economics	*Régulation* Theory
Science and technology	Central role	No technological determinism
	Most important and sometimes only cause of economic dynamics	Important when linked with the social structure
History /time	Parallels with biological evolution	No repetition of the same; importance of context and period;
	Multiple time scales	Slow/fast dynamics
Crises	Punctuated equilibriums	Logical consequence of the evolution of contradictions Multiple types of crisis
Institutions	Social technologies; constraints to growth (mismatch institutions/ technology)	Structural forms Institutionalised compromises
	Institutions as environment	Institutional complementarity and hierarchy
Politics	Very little about politics beyond saying that it's important	Endogenous institutions / Political economy of institutional change, determines the hierarchy and complementarity of institutions
Social innovation	Emergence/complex interactions	*Trouvaille*; result of conflict local compromises; no system engineer; ex-post compatibility
Micro agent interactions	Adaptation and learning routines	Habitus and conatus
	Learning	Social conflict
	Competition and selection	Political conflicts and alliances, compromises
Competition	Schumpeterian process; same economic policy conclusions as the mainstream?	Institutional form; different forms throughout history
Micro/macro	Micro → macro	Macro → micro
	Firm as the central agent in economic dynamics: profit/survival-guided	Meso-level: Productive models
	Interactions and emerging properties	Institutional forms shape agents' behaviour Social compromises shape institutions
Conflict	For the most part internal to the organisation (allocation of decision)	Central role of social and political conflict

would have been modelled as an emergent property of a micro-founded agent-based evolutionary model. This was the ambition of Coriat and Dosi (1995), who were nevertheless aware of the inherent limitations of what they called the 'emergence philosophy' expressed in the 'parable of the cow': 'If anyone is asked to describe what a cow is, it would be silly to start from a quantum mechanics account of the atoms composing it, and then move on to the levels of atoms, molecules, cells ...all the way to the morphological description of the cow.' (Coriat and Dosi 1995, p. 14).

If the parable of the cow applies in full, it is illusory to try to microfound all the elements of a regime of accumulation and a mode of régulation starting from the level of the micro agent, in which case it is pointless to ask both RT and the neo-Schumpeterians to make any effort in this direction. On the other hand, if the parable of the cow only partially applies, the failure to achieve anything meaningful in terms of an original synthesis or even a more modest theory-informed dialogue between the two approaches perhaps reveals a fundamental incompatibility in the constituent elements of these theories. It might also be thought that the failure is due to the fact that the principal parties involved have not made sufficient effort to achieve the result initially envisaged, but it would be in keeping of the spirit of both approaches to ask what the structural reasons are for this behaviour.

Evolutionary economics remains marked by a strong technological determinism to which RT has always remained alien. Science and technology are the first two of the five domains considered by Dosi (2023) to account for the socio-economic dynamics of capitalism, and the order of these domains is not random. One fundamental reason

is certainly the fact that evolutionary economics stems from Schumpeter's theory of capitalist dynamics, with its emphasis on technological change. Evolutionary economists share 'the conviction of […] that continuing change, *largely driven by innovation*, is a central characteristic of modern capitalist economies' Nelson (2018, p. 2–3, *my emphasis*). Freeman (1988, p. 5) may have proclaimed that Schumpeter was not enough, but subsequent developments of evolutionary economics have seen it following a guideline according to which Schumpeter was more than enough: 'quite a few of us (not me, I must say) equated 'evolutionary economics' with the 'economics of innovation' […] [a]nd the 'economics of innovation' has become increasingly a niche that is tolerated or even welcomed as a source of insights in a newly normalized paradigmatic panorama.' (Dosi 2023: x).

On the other hand, a fundamental idea for régulation theory is that there is no strict technological determinism and that, moreover, markets are a social construct, so that it is not possible to analyse the process of technical change outside a certain institutional context. Firms such as Uber or Airbnb do not simply innovate by creating new markets or disrupting existing ones, which corresponds to the forms of competition in the regulationist analytical apparatus, they can only exist thanks to the evolution of certain institutional forms (Montalban 2023b). Financialisation, venture capital and accommodating monetary policy make it possible to finance in the long term firms which are unprofitable in the short term but for which 'the market' anticipates rapid growth; and these firms develop by modifying certain other institutional forms, the wage-labour nexus in particular (Frigant 2023).

When Dosi (2023) regrets that, for some of its contributors, evolutionary economics is limited to the economics of innovation, he is hoping that it will instead achieve something more ambitious and reach the status of a science of complex evolving socio-economic systems. The fundamental elements of this approach (micro-diversity, interactions, emergent properties, etc.) have already been discussed at length above. The question is whether these elements can be so easily integrated into a historical and institutionalist approach to the social sciences. The reservations expressed by Hors and Lordon (1997, p. 372) about the capacity of phase transition formalisms to represent the transition from the micro to the macro level apply to the complexity models frequently used in evolutionary economics: '[t] he temptation of building macroeconomics as social statistical mechanics seems to us more dangerous than fruitful. We believe that the existence of numerous intermediary levels, such as organisations and institutions, is a crucial characteristic of the functioning of economies. This point makes the passage micro–macro much more complicated than in the case of thermodynamics'; and one is tempted to add biology to this observation.

One problem may lie in the micro foundations specific to evolutionary economics. Dosi (1995, p. 8–9) presents how formal organisations and institutions 'emerge and change over time' with the help of a dichotomy between two archetypes. The first one 'is based on the idea of intentional interactions among purposeful, forward-looking agents who try to establish ground rules for their cooperative endeavors'. By contrast, the second archetype conceives institutions 'in terms of collective, largely unintentional outcomes of interactions' and is 'the self-organization model'. If Dosi thinks that 'empirical processes of organizational formation are likely to involve different mixtures between the two modes', it is nevertheless clear that the self-organisation mode is more

representative of the micro foundations of organisation and institutions that evolutionary economics considers, what he calls 'strong institutionalism'.

But the self-organisation mode of institutions creation/'emergence'[17] and change does not sit well with a conception of institutions that is based on the conflictual nature of social relations and sees institutions as the result of compromises that temporarily neutralise these conflicts. Régulation theory does leave a place to unintentionality, what Lipietz (1989) calls '*trouvaille*' but this lies more in unintended consequences and the combination of institutions resulting in a stabilised mode of régulation than in the total absence of a strategy on the part of social actors seeking to ensure that their interests prevail without having a clear vision of all the consequences of their actions, or even necessarily the will to achieve a stable growth regime or to get out of a crisis. While it is understandable that evolutionists reject the rationality of the economic agent in mainstream theory, it is not possible for regulationists to follow them in rejecting intentionality *tout court*, since this would prevent institutionalised compromises from being analysed. In fact, one of the tasks would be to explain intentionality, to analyse the structural determinants that make not only individual but also collective agents adopt the strategies they follow and support certain policies and political actions.

The contradictions in some basic elements taken into account by the two approaches in their respective theories of action worsened over time, as regulationist theory moved towards a political economy of institutional change that emphasised conflicting interests and the strategies for making them prevail politically (Amable 2003, 2017; Amable and Palombarini 2005, 2009, 2023; Palombarini 2001). As Nelson and Winter (1982, p. 44) admitted, 'the play of political power [has not] much of a role in the formal evolutionary models developed in this book'. More than four decades later, this situation has not much improved as far as evolutionary economics, formal or appreciative, is concerned.[18] For regulationists, institutional change resulting from the implementation of neoliberal reforms is less an emerging property out of interacting individuals than the outcome of a political strategy looking for the support of a certain social bloc.

6. Conclusion

A sober look taken at the 'co-evolution' of régulation theory and evolutionary economics leads to the conclusion that neither did the theory-informed dialogue envisaged by Coriat and Dosi (1995) go as far as they hoped, nor did the original synthesis that Freeman (1988) thought possible 'emerge' out of the interactions between regulationists and evolutionists which, as time went by, grew increasingly few and far between. It seems a good idea to look for explanations using the theories themselves. From an evolutionary perspective, it seems that path-dependency characterised the history of both approaches. The shadow cast by Schumpeter on evolutionary economics is indeed very long, and the routines developed by neo-Schumpeterian scholars on the path did not lead them towards the domains that regulationists thought central for the analysis of capitalism. There were some fruitful interactions as far as science and

[17]The frequent use of the term 'emergence' in evolutionary economics is very telling of the predominantly micro to macro approach as well as the general neglect of intentionality in institutions creation.

[18]In fact, there are political aspects included in the discussions of empirical cases (e.g., the Clean Air Act) presented in Nelson and Winter's book. The following evolutionary literature did not really did not really pursue this line of thought.

technology were concerned,[19] but the reluctance of evolutionists to tread into the unchartered territories of the wage-labour nexus, financialisation, social conflict or the links between the economy and politics prevented further developments. The traditional neo-Schumpeterian knowledge base did constrain the directions taken by evolutionary economics. On the other hand, régulation theory was never interested in technological change *per se*. Regulationists wanted to analyse the dynamics of capitalism, and the domains of science and technology were only interesting as far as they were integrated into a broader structure which included other institutions and organisational forms interacting. The growing separation of the two approaches could even be thought in terms of Schelling (1978)'s segregation model, also reinterpreted by Kirman (2011, p. 186): '[w]hat happens at the macro-level may not reflect individual wishes'. In spite of the absence of strong will to go their separate ways and with even the desire to follow a common path, distinct clusters of research did appear.

But the elements of the macro/micro approach of régulation, especially those influenced by Pierre Bourdieu's concept of habitus and field and the concept of conatus used by Frédéric Lordon, may be useful too. The field of economics is dominated by the mainstream approach, which dictates the criteria determining what is good research and consequently decides of the hierarchy between different approaches and individuals. The integration of the field's constraints by individuals is revealed by the position they occupy in the field and the positions they take. In this respect, the ambition of neo-Schumpeterians not to limit themselves to 'appreciative theory' in order to compete with mainstream economics in terms of 'formal theory' is characteristic of the habitus of an economist. The structure of the field conditions the desire for a certain respectability, and the existence of a 'tall ambition' (Dosi 2023: viii) to compete with Arrow and Samuelson, to write a Manual 'whose basic contents are shared by the pertinent communities of scholars, practitioners, and teachers and are increasingly taught to successive generations of students.'. However, the agent-based models developed to satisfy this ambition may be more of a straightjacket than its promoters realise when it comes to building bridges with other heterodox approaches such as régulation. The latter's position within the economics field is different from that of evolutionary economics. Its *primum mobile* is not so much the desire to replace the mainstream economic paradigm than to occupy a position within the broader field of social sciences.

In the family of heterodox economists, régulation and neo-Schumpeterians have become distant cousins who see each other at funerals and sometimes exchange New Year's cards. This does not seem to be detrimental to the development of one or the other approach, which leads to the reassuring conclusion that the fact that the hopes placed in a fruitful dialogue have been largely dashed and that the original synthesis envisaged is not forthcoming is perhaps not so serious.

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[19]Quite logically, Benjamin Coriat's work falls into this category.

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