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Why Meso? On "Aggregation" and "Emergence", and Why and How the Meso Level is Essential in Social Economics

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Abstract Simplistic aggregation in idealized "markets" versus structural emergence in complex and path-dependent processes have always marked a "continental divide" between neoclassical mainstream economics and all kinds of evolutionary and institutional social economics. This paper deals with institutional, or structural, emergence and argues that the meso level (to be specific) is the proper aggregate level for social economic analyses of complex systems and processes. Also, neo-Schumpeterian economists have stressed recently the issue of an "institutional trajectory" taking place on the meso economic level. This paper argues that the creative ideas of a Schumpeterian entrepreneur are not a sufficient explanation in this case. Using an evolutionary interpretation of a simple game-theoretic formalism (the Folk Theorem), the paper strives to demonstrate that the meso level, as the proper level of institutional emergence, must and can be endogenously explained from a process of interactive problem-solving of interdependent agents, in their struggle for coordination under strong uncertainty. It will be illustrated that a meso-sized socio-economic group co-evolves, and is constituted, together with the institution that in turn serves as the solution to the coordination problem. The practical and policy implications of the argument are discussed.

Keywords Emergence · Institutions · Microfoundations of macrobehavior · Folk theorem · Group/network size

This paper deals with the question of why and how complex processes, characterized by direct interdependencies and interactions among individual agents, lead to the emergence of "structure" at some "meso" level. Structure is considered in this paper as some

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aggregate outcome which, because it "emerges," is not just the sum of isolated individualist actions and cannot be traced back to "rational" individual decisions.

Using a simple game-theoretic framework, it is argued that the basic coordination problem can be solved through the emergence of structure, specifically a social institution, which in turn requires the simultaneous formation of the institution's "carrier" group. This co-evolution of an institution and its carrier group formation process typically will take place at some meso level, i.e. in mid-sized groups. The concrete size of which, as will be illustrated, can only be determined in specific models or numerical simulations, depending primarily on the given incentive structure and the perceived importance of the common future.

Neo-Schumpeterian economists have considerably elaborated recently on this question in terms of innovations in social rules and the processes of their adoption and diffusion (Dopfer et al. 2004; cited as DFP in the following). They have argued that the adoption, diffusion, and retention of a social rule takes place in a meso-sized frame, i.e. a meso group of carriers with a meso-sized population of actualizations of the rule. The originator of a new rule, however, appears to be some isolated Schumpeterian creative inventor, and meso appears to be just some given entity. While we highly welcome the basic meso idea that this paper argues for and the neo-Schumpeterian argument that the emergence, adoption and diffusion of the social rule has to be traced back to defined complexity and uncertainty problems which have to be solved both individually and collectively, it will be argued in this paper that the meso group is not just an ontological "given" but must be comprehended as both the cause and effect of a defined collective problem-solving process. The meso level is determined and constituted together with the institution, as a second dimension of an emergent process. The paper is intended to underpin and extend that neo-Schumpeterian argument in favor of a more general meso-economic perspective.

On "Aggregation" and "Emergence," and on Meso as an Essential Level of Socio-Economic Analysis

The aggregation problem in economics has apparently been smoothly solved in conventional neoclassical textbook economics. While the classical *invisible-hand* idea had really never been meant by the classics as a tenable micro-to-macro model (e.g. Rothschild 1994), neoclassicism refers to it when constructing a world of autistically maximizing individual agents coordinated solely by prices. The individual equilibrium supply and demand quantities can just be statically added up to macro aggregates, whether into demand and supply functions of a partial-equilibrium market or a general-equilibrium system.

There is little acknowledgement in the mainstream that the aggregation of individual decisions into some macro structure may be more problematic than just a static summation. Notably, the only textbook to mention the idea of a *fallacy of aggregation*, called there "fallacy of composition," is Samuelson and Nordhaus' book, in which it is discussed in the first pages (Samuelson and Nordhaus 2005, p. 6). This may be interpreted in general as a counter principle to the neoclassical interpretation of the invisible hand and, an indication of the fact that decisions which may be right

and "optimal" from an isolated individualist point of view, may collectively, and often also individually, turn out to be "wrong" or inferior.

Since the aggregate has to be understood in this perspective as some societal result of an ongoing process of interactions, it would be non-additive (an old Sraffa argument). More generally, evolutionary institutional and social economics have comprehended the aggregate outcome of complex situations and processes as an *emergence of structure*, which has some institutionalization at its core. Hodgson (2000), for instance, has given a broad overview of the micro-macro relations and their mutual interactions under the heading "emergent properties." This includes the theoretical efforts on the *micro-foundation* of macro (institutional emergence from processes of interactions) as well as the *macro-foundation* of micro (the shaping of individual behavior through existing institutions). The shift, in this case, is from "mechanism" to "biology" and to complex organization rather than simplistic aggregation, as Hodgson (2000, p. 113) cites C. L. Morgan that structural emergence implies an "entity [that] has properties which could not be deduced from prior knowledge of the elements." Butterfly effects, contingent bifurcations, and self-organization, the latter being an example of an equilibrium out of multiple equilibria (or attractors) of complex systems, have been frequently discussed in instances of emergence in complex modeling. If the aggregate has an existence apart from a summing up of the "rational" decisions of the individual agents, a simplistic micro-foundation is not feasible.

Some economists have come to suggest that the macro-level, conventionally understood as the national level, has become less relevant in an emergence perspective, i.e. in explaining the emergence of informal institutions, and therefore should be substituted by a meso conception in the context of processes with emergent properties. It has been argued that the meso level has to be considered as *the* critical level of institutions and knowledge emergence. The meso level is considered the proper aggregate level of the production and reproduction of systems of institutions, i.e. culture. Institutions are considered here as devices used to solve coordination problems and thus carry new and jointly learned knowledge, however, in an informal and tacit way.

Pioneers introduced meso conceptions long ago, with different meanings; for instance to account for industry-wide differentiated representative behavior (e.g. Ng 1986), for "big business" (e.g. Holland 1987) and for complex interactive oligopolistic competition and cooperative network forms of industrial coordination (e.g. Ozawa 1999). With the introduction of these concepts they paved the way for evolutionary industrial economics and approached a similar understanding to evolutionary institutional economists. For the connection between industrial economics/industrial policy and evolutionary institutional meso-economics, see e.g. Elsner (2000, p. 440 ff.).

Also some evolutionary-institutional and social economists have contended that institutional emergence is a meso-level process, i.e. institutions and culture emerge on an intermediate level with informal institutions effecting middle-sized groups, etc. (e.g. van Staveren 2001, p. 179; Elsner 2000, Section "What's it All About: Meso-Economics"). However, evolutionary-institutional and social economists (maybe with the exception of those evolutionary economists working with complex formal

models) have rarely delved deeper into the *logic* of structural emergence at the meso level, i.e. the *why and how of meso*.

A Recent Neo-Schumpeterian Approach to "Meso"

Some neo-Schumpeterian economists have recently dealt with the meso-existence of emerging new knowledge that is embedded in social rules. However, they only *assume* a meso existence of social rules rather than *explain* it from a defined problem and a defined solution. It will be argued in this paper that we have to proceed to a more causal, "genetic" explanation. We refer to the recent neo-Schumpeterian approach entitled *Micro-meso-macro*. Particularly, Dopfer, Foster, and Potts have been working for some time on this approach, and continue to do so, both theoretically and experimentally (e.g., Potts 2000; Dopfer 2005a, b, 2006; Foster 2005; Dopfer and Potts 2007, Ch. 4). Therefore, the DFP paper (Dopfer et al. 2004) may be considered as a paradigmatic formulation of neo-Schumpeterian evolutionary economics as a meso-centered process.

First, we consider the DFP paper as a major step towards a more detailed, though qualitative, description and understanding of the *meso character of a social rule*, which cannot come into existence except if shared, or "carried," by a group of agents. These, DFP argue, adopt the rule, but also adapt it locally, according to their individual experiences, learned expectations and beliefs, current conditions and aspirations. In this way the agents generate a whole *population of actualizations* of the rule, while the rule as such is generic. A generic rule and its population of actualizations is defined a *meso unit* (Dopfer et al. 2004, p. 267).

Second, we also consider the DFP approach a major step towards a detailed description of the mechanisms of the *life-cycle* of that meso-unit, from origination to adoption/diffusion through retention/maintenance, in sum called by DFP a *meso trajectory*. Our understanding of emergence would be equivalent to the phases of both origination and adoption/diffusion.

Third, the understanding of the rule is broad in DFP, in the sense that it describes both *effective behavior* and learned knowledge, beliefs and values as *cognitive patterns* (Dopfer et al. 2004, p. 266); these seem to be consistent with what Veblen had coined patterns of thought and systems of beliefs.

Fourth, it is not discussed in DFP whether these cognitive patterns are based on "true" or "false" knowledge, e.g. behavior and thought that is either warranted instrumentally or ceremonially. Also left unclear is whether the patterns are fully deliberate or only semi-conscious and tacit. DFP basically agree that the very *raison d'être* of social rules is *instrumental*, i.e. *problem-solving*. We will not delve into a Veblenian discussion of the ceremonial dimension of institutions, or the general past-bound character of institutions as condensed experiences from previous interactions. Let us assume here that uncertain and searching individuals (they may be called "Schumpeterian entrepreneurs") will always (have to) combine the *past experience* of problem-solving with mental models, aspirations, search, experimentation, fantasies of alternative futures etc., in a word: *combine past and futurity* in a striving for

continuous social problem-solving in the *present*, as J. R. Commons has elaborated (see e.g. Commons 1934, pp. 401, 619).

Fifth, DFP also generally agree that *coordination* is the core problem and that problem-solving results in rules (Dopfer et al. 2004, p. 264, 269). However, the *problem structure* which is to be solved through coordination appears not very well-defined yet.

Social Rules Do Solve Problems

We agree with DFP that there is a need for coordination among agents who carry fragmented portions of knowledge, and also populations of rules need to be coordinated and re-configured in a changing economy (Dopfer et al. 2004, p. 277). However, "[o]ur use of meso...is more in the ontological...sense" (Dopfer et al. 2004, 268) rather than causal. Some economists might blame the DFP approach for being *too* ontological, at the expense of a substantial problem definition, which they assume to be an "ill-structured problem situation" (Delorme 2005) that social rules remedy. This paper, different from Delorme, will use some comparably easy-to-handle complexity with a comparatively "well-structured" problem situation.

A critic in the same vein, Dolfsma (2006, p. 164) has pointed out the weak explanation of meso, referring to Dopfer (2005b) and asks if it suffices to argue: "The meso-trajectory has the same analytical skeleton as the micro-trajectory, but its multiplicity of actualizations means that it extends to the macroscopic domain" (Dopfer 2005b, p. 43). Emergence may require that the meso structure be considered as qualitatively different from an individual micro unit, although there certainly is a static similarity between the meso-level social rule and its micro-level actualisation of an individual member of the population.

We share the DFP stance that many evolutionary economists mistakenly focus on selection as a purely microeconomic story (Dopfer et al. 2004, p. 266) and that economic coordination and change has to be redefined from the meso perspective. However, in the DFP approach, meso appears more as an independent, given, and explaining factor on its own than an explained variable; it is more a cause than effect. There are indications in the DFP approach that at the *micro* level the rule carriers do *interact* (Dopfer et al. 2004, p. 267), and new rules involve new interactions (Dopfer et al. 2004, p. 273). But *why* do they interact and *what* are the interactions *about*?

A new rule in the DFP approach originates from the micro level, but it comes from an *isolated* Schumpeterian *agent* (Dopfer et al. 2004, p. 269). The creative destroyer has the *idea* for the rule (Dopfer et al. 2004, p. 271) and he/she continually explores new ideas because their mind is restless (Dopfer et al. 2004, p. 273). But again, what is the specific problem that he/she is considering and solving with these ideas (of new rules)? Of course, in Schumpeterian macrocycles, we know of systematically changing conditions that involve *changes of the structure of incentives* to search, explore, experiment, or imitate (e.g., profit squeezing, accumulation of unexploited basic inventions, among others). The DFP approach indeed refers to *macro conditions* that may drive and shape those creative micro activities. Nevertheless, there remains the requirement to underpin the DFP approach

with a well-defined problem that interdependent and interactive agents cannot solve unless they *interactively learn* to generate rules. This does not rule out *individual creativity*, as it will be seen below.

In the same vein, in a section of the journal *Industrial and Corporate Change* celebrating S. G. Winter's seminal paper on the neo-Schumpeterian theory of the firm, dating back to 1968, Gibbons (MIT) discussed routine production recently, and advocated "bring[ing] interests back into our thinking about...routine production" (Gibbons 2006, p. 381). Gibbons (2006) refers, as we will do in the following, to the prisoners' dilemma supergame and the Folk Theorem as prototypes for connecting an interdependent collective-good incentive structure with individual creativity and the generation of ideas.

However, before we reconsider the substantial relevance of the Folk Theorem, let us briefly reflect on its methodological status and its potential net gain for the explanation of social rules. This has been discussed extensively and controversially among heterodox economic schools and we will mention some relevant issues in the context of our argument.

On the Use of an Evolutionary Game-Theoretic Argument

An easily accessible illustration of a complex problem leading to institutional emergence is the game-theoretic incentive structure of a *social-dilemma* type, namely the well-known prisoners' dilemma (PD). In this case, what individually seems optimal in the short run to all agents, turns out to lead to an individually frustrating and collectively Pareto-inferior situation if chosen by all agents.

This in turn indicates the existence of a directly-interdependent situation with a problematic social structure. "Autistic" decision-making leads to inferior results, i.e. a complex situation where markets and prices fail. Markets may even not come into being, and a superior result requires a *process of repeated interaction*, with joint learning of a higher form of rationality and of coordination than represented by market prices.

This higher form of coordination can be comprehended only as an institutionalization of coordination through a learned social rule of behavior in the face of a ubiquitous dominant individualist incentive to defect. In a dilemma-prone societal coordination problem this incentive can be suppressed only by *habitualized* and *semi-conscious* behavior, i.e. following an *institutionalized rule*. So far, this is the general coordination story of evolutionary institutional economics, equivalent to the Folk Theorem of repeated game theory (for a recent formulation from an institutionalist perspective on the Folk Theorem, see Cayla 2006).

However, to consider the logic of institutional emergence as a meso phenomenon, we will have to embed the simple game-theoretical social-dilemma/Folk Theorem argument in a *qualitative evolutionary* framework, which can be formalized in more complex models. In this way we may investigate how a game-theoretic argument can be supportive of a broader evolutionary social-economic understanding of emerging meso structures and meso-economics in general.

Generally, we agree with those heterodox economists who consider game theory, if put in a proper evolutionary interpretative context, as basically non-neoclassical (e.g. McCartney 2005). The key difference with neoclasicism is *direct interdependence*, in contrast to equilibrium-price mediated indirect interdependence between the collectives and aggregates on the supply and demand sides. Direct interdependence immediately involves complexity, initial strategic "strong" uncertainty and the requirement for repeated interaction, in historical time, to create the space for joint learning, emerging expectations, and a process to solve the defined problem. This also implies complexity, path-dependence, openness, and eventually multiple equilibria (or attractors), if any equilibria at all exist. It renders ideal, optimal, equilibrating, and stable market solutions infeasible. In this way, game theory appears to be open for a variety of problems, situations, contexts, and resulting organizational forms (McCartney 2005, p. 16). We will try to illustrate the efficacy of such an approach in more substantial terms below.

Following Foster's (2005) definition of *simplistic* theories, i.e. those based on *isolated agents* performing *constrained optimizations*, and thus being only indirectly interdependent, while entering the world of direct interdependencies we use a simple but certainly not simplistic model with the repeated PD. Admittedly, it represents a *deterministic* framework, but it can be transformed into a stochastic frame. In addition, we will not formalize the historical and evolutionary dimension of the model, but deploy a most simple *static single-shot* solution. The Folk Theorem itself is not very elucidating about the process and history. History and path-dependence will have to be reflected as an additional "story" about the PD supergame.

This story is also about expectations and beliefs, aspirations and imagination, i.e. about "futurity." In this sense, the PD supergame may become *complex* in Foster's sense since it is about *reflective behavior* and interactive knowledge generation (Foster 2005, p. 877). The PD supergame approach is also about emerging institutions of *cooperation* (cooperation as a kind of coordination with some potential sacrifice), i.e. a rude form of what Foster (2005, p. 885) coins a *network* approach, a complex system of elements and connections. So it appears to belong to the class of theories "derived from network representations in which value is created through the establishment of new connections between elements" (Foster 2005, p. 873). Admittedly, it is a low-level type of complexity (Foster 2005, p. 885).

Does the PD supergame represent a simple problem or is it a simple model? In the PD supergame, agents may interactively learn to develop cooperative forms of coordination, in spite of an incentive structure that would normally prevent them from doing so. It does not seem to be a "very ill-structured problem" according to Delorme's (2005, p. 3) approach to complexity, where such a problem does not have a definite formulation and cannot be reduced to a "satisfactory level" of complexity. Whether a very ill-structured problem or not, the PD supergame is represented here in a simple way. The explanatory "level of aspiration" is pragmatically reduced in this case to obtain a result for a specified question (Delorme 2005, p. 9). It is in this sense that we hope that the simple single-shot solution of the symmetric 2×2 PD normal form with only pure strategies will suffice to promote our argument.

Also the non-cooperative game-theoretic argument applied here contains considerable presuppositions. The basic rules of the game are given and agents have a basic

common "culture" which allows them to unambiguously comprehend their mutual actions; furthermore, agents within this framework are not seen as diverse from the onset. They all are the same short-run maximizers in the beginning, a worst-case condition and it is only in a population approach with a given distribution of diverse strategies that we can assume agent variety from the outset. Also, they are well-informed about the pay-off structures of both players. However, agents are directly interdependent, stuck in a problematic decision setting, the solution of which requires infinite or indefinite recurrence of interactions, which in turn creates room for a potential *change of behavior*. If those initial worst-case maximizers can change their behavior through learning and can create coordination/cooperation through establishing a social rule, something is gained through the Folk Theorem and at least there exists a "satisfying level of explanatory aspiration" that may be met.

The Problem, a Static Solution and a Story About an Evolutionary Process

The relevance of the PD/collective good problem, as an everyday problem, appears to be paramount, although it often exists more or less in the background. More visible are the "stage-front" institutionalized everyday solutions, however locked-in or ceremonially encapsulated (Elsner 2005, p. 2006).

The idea of framing (e.g. Callon 1998) contends that there is a *ubiquitous* PD/collective-good problem involved in everyday economic decision-making, even in the most simple and standardized supermarket purchase of a loaf of bread. Even, in this case, we contribute to the reproduction of institutions, of generalized trust, and of general expectations of the cashier, for instance, by our conforming to the general rules. However, there is also a basic and ubiquitous incentive not to contribute, but to take a potential short-run extra chance. People, particularly those living in an individualist culture, are incited to defect if the situation is not completely governed by norms, enforced law, a reputation mechanism, hierarchical monitoring or other societal solutions, how instrumental or ceremonial and informal or authoritarian ever.

Along these lines, we have tried elsewhere to demonstrate that *any* production, information, and innovation system can be modeled as a system of mutual externalities and collectivities that can be reconstructed as a PD. This occurs specifically under conditions of fragmented value-added chains, net-technologies, and an increasing collective-good character of information (Elsner 2005). In this case, the repeated PD seems to be an adequate and highly relevant reconstruction of the problems, although remaining in a deterministic frame.

Put theoretically, if there is a full-blown social rule already existing, or at least the chance that other agents will contribute to the coordinated situation through cooperation, and thus are willing to sacrifice a potential short-run maximum pay-off, then there will always be a basic incentive to defect and exploit others, and in this way get an extra gain. This holds provided, as said, there are no strong norms, controls, formal sanctions or reputation mechanisms at work which may prevent defection. Put reversely, there is a ubiquitous *necessity to contribute* to the emergence of new social rules or to the reproduction of existing rules, if coordination is to be achieved, diffused or retained.

The simplest formal solution comprehensible is the static single-shot solution and it provides a most basic logical condition for the superiority of cooperation over defection. It stands as so:

$$\begin{matrix} a,a & d,b \\ b,d & c,c \end{matrix}$$

with $b > a > c > d$, and $a > (d + b)/2$. The pay-offs P, in a supergame, for the well-known tit-for-tat (TFT) players encountering other TFT players, which is identical to what ALL C-cooperators would gain with each other, and for non-cooperative players, playing ALL NC, encountering TFT players are:

$$\begin{aligned} P_{C/C} = P_{TFT/TFT} &= a + \delta a + \delta^2 a + \ldots \\ &= \tfrac{a}{1-\delta}. \end{aligned}$$

$$\begin{aligned} P_{NC/TFT} &= b + \delta c + \delta^2 c + \ldots \\ &= \tfrac{c}{1-\delta} + b - c. \end{aligned}$$

Cooperation pays, if

$$\begin{aligned} &P_{C/C} > P_{NC/TFT} \\ &\Rightarrow \delta > (b-a)/(b-c). \end{aligned}$$

What does this condition tell us? To be sure, the Folk Theorem in general does not tell us anything about the *process of emergence* of a cooperative equilibrium, except through *complementary story-telling* (Gibbons 2006, p. 383). In this way, however, it provides us with some basic but important insights into evolutionary interaction processes and institutional emergence. We will mention but a few results extensively discussed in the literature on social network emergence and group formation.

First, under certain conditions – namely a given quantitative dilemma-prone incentive structure, i.e. a given strength or weakness of the collective good problem; a, b and c, relative to the importance of the *common future* (δ) – the emergence of a social rule becomes logically possible, according to the inequality above, as a potential equilibrium of the PD supergame different from the Nash solution.

Second, as the problem is of a collective-good type, this rule needs to be an institution, where coordination needs to assume the stronger form of cooperation, i.e. coordination plus sacrificing the chance for a short-run extra-shot gain. The institution is a social rule endowed with an endogenous sanction mechanism. To be exact on this point we will define an institution as a problem-solving device related to the PD problem in the above paragraph: an *institution* is a rule (or custom) for the decision and/or behavior of individual agents for infinitely or indefinitely recurrent and multi-personal (i.e. directly interdependent, genuinely social) situations (i.e. repeated direct interactions), with social coordination problems involved (behavioral alternatives existing, collective good problems, social dilemmas), which has gained, through a process of social learning, a general approval so that it informs the agents about mutually consistent expectations of behavior and about the fact that with

unilateral deviation from the rule, i.e. defection, other agents also will deviate in the future so that all will be worse off in comparison with general rule-conforming behavior (i.e. the endogenous sanction mechanism).

Third, viewed as a process, this solution cannot come about through narrowly rational agents, i.e. short-run maximizers. These agents are only capable of generating a series of one-shot Nash solutions. Thus, the institution can only emerge as a *habituation*, a semi-conscious phenomenon. It will be pursued more or less unconsciously as long as expectations of conformity are met by others and the incentive structure and the importance of the common future remain unchanged. It might be changed through more or less deliberate consideration in situations of surprise and phases of changing conditions. The social rule thus follows a broader and more long-run rationality.

Fourth, in a process, the rule may emerge out of *repeated frustration* from aspiring *b* and receiving only *c*, the motive to learn and to increase knowledge and particularly exploring what common cooperation may yield. The pay-offs from common cooperation would not even necessarily be known then, i.e. no knowledge of the upper left pay-offs in a matrix is needed. Thus, the institution may emerge out of an *imagination* that there is more to be gained than uncertain *b*'s or *c*'s. So agents who make serious contributions to coordination and cooperation need to be somehow imaginative, and creative. Brette and Mehier (2005, p. 8), for instance, in a discussion of the DFP approach, mention Veblen's *instinct of workmanship* as a motive, and as such it feeds the rule origination back with the objective problems to which the instinct of workmanship is oriented. However, different from the DFP view, agents here only contribute to rule emergence in a myriad of single decisions, they cannot set a rule alone, just as the idea of a generic rule (note also that learning implies leaving the world of fixed given strategies).

Fifth, in that process, agents have to be *risk-taking* and not be *envious*. The first to send out signals for a potential better common future, i.e. to try cooperative decisions, will have to take the risk of being exploited at least once. In a stringent model, he/she will never be able to compensate for this, in comparison to the other one, even in a future of common cooperation. This agent thus needs to be exclusively focused on his/her own gain which he/she compares only to the continuation of an unsuccessful common defection that the agents have experienced in the past. Compared to this he/she would be better off over time, although being somewhat worse off compared to the other one.

Sixth, an emerging cooperative equilibrium requires a path-dependent process. Particularly, this is cumulative in the sense that all agents must repeatedly contribute to its emergence. Depending on the history of interactions, a cooperative equilibrium other than the non-cooperative Nash equilibrium can emerge. In more complex models or simulations equilibria may assume the function of attractors where the process may fluctuate between, rather than straightforwardly proceed towards, a defined equilibrium. A path-dependent process may be modeled in a *population approach* with a given initial distribution of different strategies and with probability distributions for cooperative or non-cooperative contributions over random encounters among representatives of the different strategies. With a growing experience from earlier interactions, expectations and beliefs will emerge, namely regarding the probabilities of cooperative or non-cooperative behavior of the next interaction partner. This may switch over to a *generalized trust*, i.e. an expectation from experience of a certain probability that the next interaction partner will be cooperative.

Seventh, against this background, the system has an obvious complex endogenous dynamic, such as a certain force towards destabilizing the rule once it is established. The probability of gain through one-sided deviation and exploitation, at least for some time, will increase for any individual. The incentive first to contribute to the emergence of the rule, and then to deviate from it as soon as it is established, is large for a very "rational" agent (although perhaps not very successful or evolutionary stable in a larger population with a certain minimum proportion of cooperators and with replications, as has been vividly illustrated in the Axelrod tournaments).

Eighth, in the formal solution above it is only the experience and expectation of a certain probability to meet the same agent again in the next interaction (δ) that counts. This depends on the *size of the relevant group* and on the mobility in and out of this group, both of which can be experienced. Also, this applies both to a two-person as well as an n-person setting, where each two agents interact at a certain point of time. In this simple but fundamental and highly relevant frame, it is just this probability (relative to the incentive structure on the right side of the single-shot equation), experienced from past interactions and projected into the future, which determines the present decision to cooperate or not (determined by the potential quantities of the in-equation above). In this way, "optimal behavior today depends on beliefs about how future behaviors will be conditioned on current ones" (Gibbons 2006, p. 383).

Finally, we have to address the question of what the specific implications of this logic for the explanation of "meso" are, to which we turn now.

Meso as Cause and Effect: On the Co-evolution of Institutional Emergence and Group Constitution

Game theory still struggles with the problem of the emergence of a social rule as an institution, since it "is a very tricky business" (Gibbons 2006, p. 384). As argued above it is both the subjective beliefs and the objective interests (incentives) that count in explaining the emergence of the rule. "[B]uilding an equilibrium means that interests creep in; one cannot analyze just the evolution of beliefs" (Gibbons 2006, p. 385). The agent indeed is a generator of ideas, but at the same time the expectations, visions and related ideas on future rule behavior appear to be path-dependent; that is, it is bound to the agent's experience from repeatedly dealing with a problematic incentive structure, and with the behaviors of the other agents within this structure. Institutions are sustained by subjective ideas in the heads of agents and also by the objective structures faced by them (Hodgson 2000, p. 118 referring to Searle 1995). Also, as has been argued, the rule emerges from an interrelation between the past history of interactions and the future. In sum, the rule's emergence depends on two critical interdependencies, interests/ideas and past/future.

Again, essential is the perceived probability to meet the same agent again in the next interaction. As is well-known, the discount factor δ can be interpreted to indicate this very probability, which, in turn, depends on the size of the "relevant" group, or subpopulation, and the mobility among subpopulations. The subpopulation is the population of rule carriers according to DFP; this group may be based on a system of spatial neighborhood/proximity, maybe even with fluid boundaries, or on

other homogeneous conditions (physical, professional, etc.). For recent overviews of game-theoretic modeling of group formation, see the articles in Demange and Wooders (2005), specifically Fafchamps (2005), Jackson (2005, p. 19 ff.) and Goyal (2005, pp. 127 ff., 158 ff.).

Obviously, the smaller the group, the larger the probability to meet the same agent again; therefore, the group constitutes the locus of cultural emergence, reproduction and change, and it obviously is not the *very* large group that generates institutional emergence and change. On the other hand, the very small group seems irrelevant, or not powerful enough to function as a carrier group of a sustainable culture. Thus, it appears to be the meso-sized group that is relevant. The institution seems to come into being with the highest chance in a meso group, or "meso platform," however defined in quantitative terms in concrete mathematical models, simulations, experimental or statistical studies.

The meso-group also seems capable of utilizing the supporting mechanism of *reputation*, which in turn increases the probability of meeting again in the next round, if not the physically same agent, an agent who knows about my earlier behavior through one of my earlier interaction partners. Note that we always assume "correct" knowledge and therefore also assume "correct" reputations, i.e. ones which are not conveyed subject to strategic use by the conveyor.

If we put this in a *population* frame as described above, the perceived probability (expectation) can be transferred into the expectation to meet a cooperative agent next time – the famous trust-question nowadays is put regularly to a large worldwide panel by the World Bank, OECD, EU etc. For instance, in empirical terms, it has been discussed whether a high empirical trust level in a relatively cooperative society (with layered and overlapping networks), such as a country of the size of Denmark, is due to its capability to effectively mobilize a reputation mechanism ("I know someone who knows someone who..."), and thus maintain a high average probability to randomly meet a cooperative interaction partner next time.

In sum, we may say that it is the meso group and the incentive structure of the micro-interactions among its members that combine to generate the meso entity of an institution (again, as reflected by the single-shot solution above).

The size of the group of carriers, in fact, is determined in the same process by which the institution emerges. The group size is an important condition (an explaining factor) of the micro interactions (that condition represented by δ), and thus of the emergence of the rule. While at the same time as it is being constituted, it thus can be explained, from the incentive structure and the subjective requirement to meet agents again, or trust and belief structure (meso size as cause and effect).

In the framework of the simple logic of the single-shot solution, we may think of the group size, in a myriad of single interactions, adapting according to the subjective needs of agents for "meeting again," or for proximity, trust, or interaction "density." The latter is the number of interactions with the same agent or a "knowing" agent in a given unit of time, in their striving to establish a cooperative solution. The broader evolutionary understanding of the simple logical single-shot solution thus relates (1) the problem structure and (2) the strength of the striving of agents for institution-building to (3) the (adapted) group size in a co-evolutionary process.

We may also expect the problem structure to change with the group size, given the striving for institutions building. Obviously, the incentive structure may also be

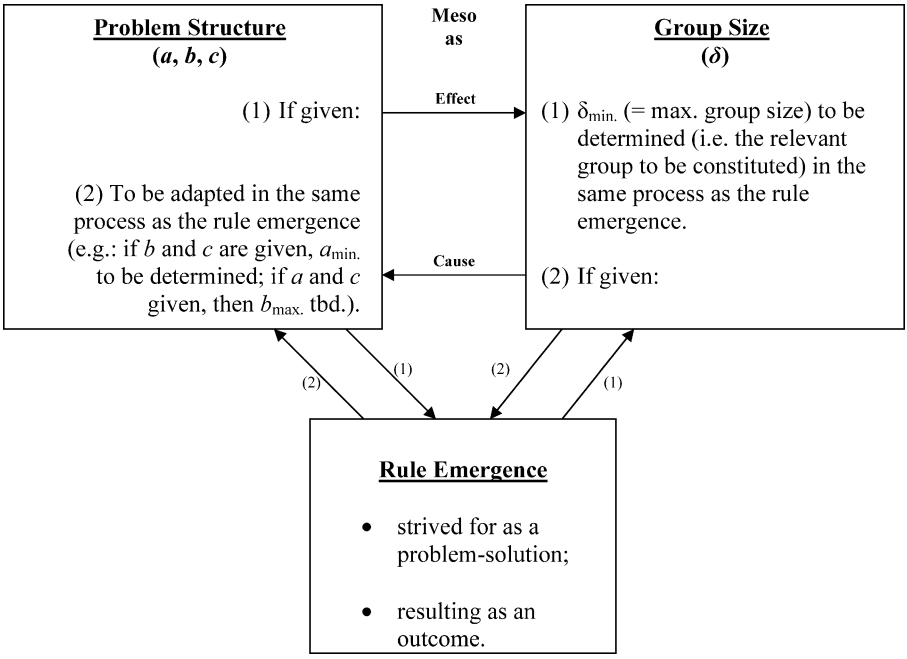

Fig. 1 The simple logic of co-evolution of rule emergence and group size: A schematic representation

subject to policy intervention in order to support institutional emergence (for the policy implications and the conception of an "interactive policy," see Elsner 2001).

The logic of this co-evolution, referring again to the inequality of the single-shot solution above, is illustrated in the following figure. Note that the minimum value of δ which still allows for institutional emergence at a given quantitative problem structure is equivalent to the maximum group size allowed for this problem solving (Fig. 1).

Conclusions

In the framework of a simple (though not simplistic), formal reconstruction of both a collective-dilemma problem and a static single-shot supergame solution, embedded in a qualitative evolutionary social-economic interpretation, a social institution has been investigated as an emergent structure and a jointly learned problem solution. Institutional emergence has been illustrated to be a contingent and path-dependent process, depending on the micro structure of recurrent interaction with both subjective experience and objective interest and incentives, and also with both past process and future expectations. In this way, the focus on individual creative ideas and aspirations as discussed in recent neo-Schumpeterian arguments and models (namely the DFP approach) is included. Distinctly from this neo-Schumpeterian argument, however, our approach refers back to a defined complex social problem, and therefore can be anchored to the growth of knowledge from the interactions based on the given

problem. Therefore, while in the recent neo-Schumpeterian argument, meso appears as a given ontological entity, the meso character of the social institution has been underpinned through, and bound to, a defined micro problem and process in our approach.

The approach developed in this paper appears to be able to explain why and how the meso level is constituted as the adaptive size of the relevant group of carriers of the institution. Thus, meso is both a condition and a result, cause and effect of a co-evolution of (1) group constitution and group size determination, (2) the strength of the strivings of a critical mass of agents for institution-building and the later factual emergence (or not) of the institution, and (3) the specific quantitative structure of the dilemma, i.e. the incentive structure. Meso, thus, turns out not to be just a given entity or a simple aggregate for the mere existence of an institution, but a condition and a result of the process of institutional emergence and is determined in that very process. The simple formalism used has been supportive of the qualitative evolutionary social-economic argument and has helped work out the most fundamental logic of that co-evolution.

The complex processes, of course, cannot be fully reflected by a simple deterministic formalism. While the simple solution used here, properly embedded in theoretical considerations, appears to be supportive of the basic logic of "meso-economics," a full-fledged modeling may require mathematical techniques, simulation models, experimentation, or empirical-statistical analyses, and would involve open, perhaps stochastic, and non-linear models of system-dynamics or the more recent social-fabric-matrix brands (e.g. Hayden 2006). More specific modeling may include a population approach to address questions such as the minimum proportion of cooperative "doves," carrying along certain proportions of defecting "hawks" in a population, i.e. specify critical thresholds of defections that institutions are capable of carrying while still being workable.

The basic logic, explanation, and evolutionary interpretation of the very socio-economic process discussed in this paper suggest a general meso-economics as an economic aggregate level, frame, and conception. Its applications in economic areas of culture, trust, production, innovation, information (in the "new economy"), spatial organization ("globalization", agglomeration and local clustering), and networking have been discussed elsewhere (e.g. Elsner 2005).

Also, since there is no contention in this paper about a non-trivial, automatic emergence, or a fully self-sustaining character of institutions as problem-solvers and social stabilizers, there is no space for conceptions of a completely state-free private self-organization of the economy. On the contrary, the unsolvable (or at least so far unsolved) problems of initiation, acceleration, and stabilization of the meso processes discussed, not only require public policy but also are accessible to policy design (for a most recent discussion of external enforcement of institutions, see Hodgson (2006, pp. 13–15). It has been discussed elsewhere that the very basic logic deployed in this case not only offers basic strategic variables for policy but also involves a new role for public policy as a leaner approach, focusing interactively on the conditions of the private interaction processes (e.g. Elsner 2001, 2007).

The co-evolutionary context of the meso-economics developed in this paper is far from being elaborated even in its basic logical interrelations. Social group size has always been a question not only explicitly of heterodox economics but also of formal game-theoretic modeling (Schelling 1973, 1978; Pyka 1999). In order to strengthen

social economics (broadly understood) in its applied and policy-oriented meso-economic impetus, which has always been there, requires a further elaboration as do the basic logical interrelations, i.e. the relations that exist between problem structure, group size, and the emergence of institutions.

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