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The Origins of Meso Economics Schumpeter's Legacy

by

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The Origins of Meso Economics

Schumpeter's Legacy

Kurt Dopfer*

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Abstract

The paper unravels the subversive nature of Schumpeter's proposition that entrepreneurs carry out innovations (the micro level), that swarms of followers imitate them (meso) and that, as a consequence, 'creative destruction' leads to economic development 'from within' (macro). It is argued that Schumpeter paved the way for a new micro-meso-macro framework in economics. Centre stage is meso. Its essential characteristic is bimodality, meaning that one idea (the generic rule) can be physically actualised by many agents (a population). Ideas can relate to others, and, in this way, meso constitutes a structure component of a 'deep' invisible macro structure. Equally, the rule actualisation process unfolds over time – modelled in the paper as a meso trajectory with three phases of rule origination, selective adoption and retention – and here meso represents a process component of a visible 'surface' structure. The universal macro measure with a view to the appropriateness of meso components is generic correspondence. At the level of ideas, its measure is order; at that of actual relative adoption frequencies, it is generic equilibrium. Economic development occurs at the deep level as transition from one generic rule to another, inducing a change of order, and at the surface level as the new rule is adopted, destroying an old equilibrium and establishing a new one. The final third of the paper discusses a few of the rich set of major contributions to the Neo-Schumpeterian – micro-meso-macro - programme

Keywords: Mesoeconomics - Micro-Meso-Macro-Framework – Schumpeterian Economics – Evolutionary Ontology

JEL Codes: A11-12, B12, B52-53, E11, M13, O11-12, O31-33.

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1. Schumpeter's Age

The 20th century brought forth a number of great economists, among them Joseph A. Schumpeter. Yet, the work of none of these giants could attract an interest similar to that of Schumpeter's over the last two decades. There are two main reasons for this. The first has to do with the growing impact his theory has had and is having on economics. As we shall argue, his simple proposition that entrepreneurs carry out novelty, luring swarms of followers, contains in its core an analytical category - we call it *meso* - that prompts a breakdown of the traditional distinction between micro and macro and aspires to the reconstruction of economics on a *micro-meso-macro* basis. The extraordinary and increasing interest in Schumpeter's work today, and likely in the foreseeable future, is part of what may be called a meso revolution. (1).

The second reason the game belongs to Schumpeter is closely related to the fact that his work can provide, as that of no other economist, solutions to the most pressing problems of our times. His approach appears to be tailor-made when calling for solutions to the complex problems of a highly dynamic, innovative knowledge-based economy. This view is paralleled by the recognition that his work provides guidance for economic policy. (Hanusch and Pyka 2005).

This paper attempts a fresh look at Schumpeter's theoretical edifice. The purpose is not to give a comprehensive or complete account. There are magisterial works providing exactly this, for instance by Stolper (1994), Swedberg (1991), Perlman and McCann (1998), and Shionoya (1997). Instead, we investigate the theoretical corpus of Schumpeter's economics with a view to examining the skeleton, which - through our analytical screen - will turn out to be micro-meso-macro. Building on Dopfer (2001, 2002, 2005), Dopfer, Foster and Potts (2004), and Dopfer and Potts (2006), we shall, on the one hand, unveil the generic architecture of economics as inspired by Schumpeter's work, and, on the other hand, discuss Schumpeter's specific theoretical positions against this background. Turning to the latter, we shall not draw only on Schumpeter's theoretical work directly, but also try to get an understanding of his theory by looking at the way in which he criticizes competing positions, in particular those of classical and neoclassical economics. This will provide us with an idea of what Schumpeter thought a good theory to be. Schumpeter inspired the construction of a micro-meso-macro framework, and an important further question will be how he scored in terms of filling it with valid theoretical propositions. The contours of a Neo-Schumpeterian program will emerge, and

some of the works of the program in progress will be discussed in the final part of the paper.

2. The Benchmark

The assertion that Schumpeter triggered a meso revolution invites a discussion as to the benchmark used. In fairness we mention here that the reader should be prepared to make some production detours, much in the sense of Böhm-Bawerk's capital theory, in order to arrive at a reliable benchmark for assessing Schumpeter's work. As in any venture of this kind, the outcome is uncertain and the reader is invited to accept the role of a risk taker.

A principal benchmark relates to the boundaries of the discipline, and we may all agree that what lies outside will not qualify as scientific advance in economics. This sounds much like a tautology, but it is instrumental in that it obliges us to specify what actually these boundaries are. Here, we would expect that mainstream economists and students of Schumpeter hold quite different views.

While it may, in general, be difficult to agree on what economics is all about, there may be considerably more agreement on what it is not. This suggests that we frame our definition of economics in a way that we can state explicitly what we do *not* consider as within its scope. Acknowledging this criterion of exclusion, we define *economics as the science that studies the causes and consequences of the behavior of many individuals dealing with commodities in a macroscopic system*. We contend that this definition is all-inclusive, and that it allows us to exclude sufficiently what economics is not. First, the disciplines of psychology and sociology both deal with human behaviour, but they do not relate it in any systematic way to quantities, prices and other attributes of commodities. They differ from economics, not because they abstain from dealing with rationality (they often do), but because they do not deal with commodities. By implication, the rationality assumption alone does not qualify an enquiry as an economic one. Second, physics and the technical sciences deal systematically with objects, but these objects are not yet commodities. They *become* commodities when they are related to a value measure, as, for instance, in the subjective and objective value theories of economics. (2). Finally, the management sciences are not economics. This appears as quite evident, but it is not always recognized that Lionel Robbins's often cited definition of economics as the science that deals with the relationship between ends and scarce means which have alternative uses fails to acknowledge exactly this. Managers and management scientists alike will consider Robbins's problem as theirs, but they will relate it to the firm, not to

the economy as a whole. There is no criterion of distinction in Robbins's definition. Economics studies the behaviour of individuals (as component parts) dealing with commodities in the economy as a whole (macro system), while management science studies it in the firm (micro system), and failure to distinguish this will confuse the subject matter of economics.

3. Conventional Economics Revisited: The Operant Level

Having demarcated the domain of inquiry, the issue is how to define a set of analytical categories upon which theoretical questions can be asked and answered. Our definition of economics has introduced the key categories of individual(s) and commodities, and a principal question centers on how these connect. In mainstream economics, the connection between the two is established on the basis of decision theory. Classical economics, in turn, describes production and consumption on the basis of objective laws. It operates with aggregates, but micro phenomena may be inferred by way of disaggregation, and the individual units conceived in their specific economic activities as producers and consumers (a distinction not endogenous to neoclassical economics which, *ex post*, has to specify institutionally the areas to which the decision calculus applies). Finally, institutional economics deals with transactions, and the focus is usually not on a single transaction but on repeated ones, which calls for an explanatory account that individual decision theory cannot offer. There is an array of theoretical approaches to deal with the connection between individual and commodities.

The issue is whether it is appropriate to single out a particular one, and then assume its universality. As is well known, this is the research strategy that neoclassical economics has adopted when postulating that decision theory can serve as a universal platform for the solution of all theoretical problems. There is a similar tendency of assuming universality also in the other approaches, but we reject all these claims on grounds that they deal only with a special, not general, aspect of economic reality. Let us assemble the various special aspects and refer to them generally as operations. We say, then, that individuals perform operations (or operate) in a commodity space. Individuals connect with commodities by operations.

Operations are domain-specific; and as such, they refer to the domains of production, consumption and (market) transaction. Individuals perform, for example, the operation of production. Within domains, operations are action-specific; and, as such, they refer to decision making as well as to the search of information or to organizing social and technical entities. For instance, individuals are said to perform the operation of

organizing in the domain of production. All operations performed in the commodity space can be described on the basis of domain- and action-specificity.

The term “operation” makes sense only when related to “commodities.” To be effective, operations require that there are opportunities. These represent a pre-operational state of the commodity space. Second, operations lead to outcomes in terms of a commodity reallocation or redistribution. These outcomes denote the post-operational state of the commodity space. All commodities are either in a pre-operational state (as opportunities) or in a post-operational state (as outcomes). All operations, in turn, are specified by a combinatorial, stated in terms of domain- and action-specificity. The static and dynamic properties of the system can, in this way, be derived completely from statements about the (pre- or post-operational) state of the commodity space and the dual specificity of operations.

Let us take stock. Economics studies individuals as they deal with commodities. To connect the two, the concept of “operation” has been suggested to serve as a connecting principle. The various theoretical approaches specify the general principle quite differently, and much of the competition among economic theories takes place on the plane of claiming a superior specification of operation. For instance, mainstream economics claims its superiority by emphasizing that its decision theoretic basis is universal, and institutional transaction approaches try to score on grounds that they are realistic. These are important issues, and much of theoretical progress in economics will depend on coping with them adequately.

However, the whole theoretical corpus rests on a set of presumptions. It is tacitly assumed that operations are useful, since, otherwise, they would not be performed, but why should they be useful? What furnishes operations with a rationale in the first place? If this issue is settled, how then are individuals in a position to perform operations? What factors account for their ability to do so? These questions relate in a fundamental way to the scope, content and extent of the operations in the commodity space, but the theoretical answers they prompt lie at a different level. In contradistinction to the operant level, we have, what can be called a generic level composed of a set of variables explaining operations and changes in the commodity space. (3). It is important to acknowledge that there are two different levels of an economic system. They are, respectively,

operant level

generic level.

The primary interest of evolutionary economics and of its various strands, such as Neo-Schumpeterian economics, lies in the analysis of the generic level. An inquiry into that level provides us, first of all, with a cue as to why operations are necessary and why they are possible.

4. From Operant to Generic Analysis

The issue of the necessity of operations relates intrinsically to the phenomenon of entropy. Humans and their cultural systems, of which the economy is a sub-system, are living system, and, as such, they are thermodynamically open. To survive, develop and evolve, human systems require that they maintain a temperature difference to their environment. They 'consume' low entropy from their environment; and, in this way, generate order that we associate with life. (4). They have a metabolism that transforms nutritional intakes, allowing them to maintain a required temperature difference. The archeocortical areas of the brain not only regulate the metabolic transformation, but they also provide a signalling device in the form of hunger that drives them to eat in order to avoid the consequences of entropic decay. Economically, this means that humans have needs which they must satisfy on the basis of economic operations. The consequences of the entropy law are effective not only at the biological, but also at the level of activities that we associate with human culture. Machines, buildings, cars or instruments all degrade and require maintenance, repair and replacement. There is an absolute necessity - a need - to perform operations in order to avoid economic loss. Operations are, in an absolute, entropic sense, governed by needs. Different humans may have different preferences as to how they satisfy their needs -- for instance, one person prefers wine, another beer -- but they both share the need to drink something. There may similarly exist a variety of instrumental devices that serve a specific productive purpose, but they all must be designed to counter entropic loss.

We have highlighted the necessity of operations, and the question now is how these are possible. The evolutionary response to the thermodynamic challenge, or rather chance, is *knowledge*. It would be wrong to interpret this as meaning that knowledge solves only the entropy problem, since this would mean that evolution has stopped at the lowest level possible. The hallmark of knowledge is that it can generate new knowledge that, in turn, generates new knowledge, and so forth, self-perpetuating a continuous path of cumulated knowledge growth. In contemporary economics, this knowledge accumulation has been applied to objects and developed into an elaborate capital theory. Organisms have evolved biological knowledge on a massive scale and with increasing variety at the

level of genes and genomes. Economics is interested in biology only insofar as the brain of *Homo sapiens* represent a product of biological evolution. *Homo sapiens* moves also in economic contexts, and we get – taking methodological realism serious - the construal of *Homo sapiens oeconomicus*. (Dopfer 2004). The upshot of *Homo sapiens oeconomicus* is that it has the extraordinary ability continuously to generate, adopt and retain new knowledge. Operations and commodity space are subject to permanent endogenous shocks and generally highly unstable. For analytical purposes, it is useful to keep knowledge constant, but to treat it generally so means to ignore a most characteristic feature of economic reality.

Generic analysis does not deal with the problem of how operations are performed, but rather inquires into the nature of the knowledge base that enables such performance by agents. Keeping the knowledge base constant, the operations and induced changes in the commodity space can be analyzed. For instance, the optimum of a relative choice on the locus of an indifference or iso-cost curve and its consequences with a view to a restored allocation equilibrium can be ascertained. The central categories in this type of analysis are operations and opportunities. In generic analysis, we do not have opportunities that are consumed by operations, but rather have knowledge potentials that are actualized for operations. To be precise, we have ideas, which turn into knowledge when they are actualized by an agent. Knowledge is a carried idea. The differences between the operant and generic levels and analyses can be summarized as follows:

Operant level: <i>commodities</i>	Opportunity	Operations
Generic level: <i>knowledge</i>	Potential	Actualization

We may conclude that an economic theory that claims completeness must deal with both the operant and generic level. What, then, are the specific questions of economics?

5. Coordination and Change

All sciences resemble one another in that they deal, on the one hand, with relationships among elements, and, on the other hand, with the behavior of the whole over time. Economics is no exception, and, most generally, the questions of economics are how the economic activities of many individuals are coordinated and how the economy changes over time.

The birth of modern economics in the second half of the 19th century was largely a response to two grand revolutions, and the general questions of coordination

and change got a particular historic mark. The first revolution was a *politico-economic* one, and brought individuals high degrees of freedom in their operations. The founders of the discipline had a natural curiosity with respect to the theoretical treatment of coördination under conditions of a free, rather than regulated, market economy (as had prevailed in the ancien regime). The other revolution was *technological-industrial*. Epochal inventions, such as the steam engine and the mechanical loom, led to a path of unprecedented economic growth and broad structural change. Both the bourgeois-liberal and the technological-industrial revolution set the stage for economics as a modern science. In a metaphoric nutshell, economists gained interest in the “invisible hand” (Smith) and, in the forces that changed by “creative destruction”, the economy “from within” (Schumpeter).

The two grand disciplinary questions inspired to various theoretical answers. From the point of view of the history of theory development, we can broadly distinguish between classical and neoclassical economics. In the following, we shall first briefly discuss Schumpeter’s “vision”. We shall see subsequently that his vision not only guided him in the construction of his own theory, but also in the assessment of the works of others.

6. Schumpeter’s Vision

It is often as early as childhood that the great minds of science first display a keen interest in a single question, which later becomes the primary source of a major scientific discovery or insight. Their focused curiosity equips them with lenses of uncommon imagination and observational accuracy. In the case of Albert Einstein, his deceptively simple question was this: what is light? In a subsequent phase, the life of great minds is marked by the search for a scientific platform which provides them with precise and reliable cues in the answer to their question. In this phase, the proto-scientific enquiry is translated into science, expressed in the language of a specific discipline. The genius of great minds is demonstrated first by their remarkable capacity for comprehending the entirety of the knowledge representative of their discipline at that time. In Einstein’s case, this meant having a thorough grasp of physics and the nature of its underlying mathematics. From this he transformed his original question into a momentous scientific discovery.

Joseph Schumpeter’s proto-scientific interest concerned social life rather than nature. Social life being, arguably, more complex than nature, his original question cannot be formulated with comparable simplicity, but most students of Schumpeter would agree that his proto-scientific interest can be encapsulated in the question: what

determines change in social life? We may, furthermore, recognize that Schumpeter associated his early curiosity with the preconception that change is brought about primarily by energetic personalities, and then phrase his proto-scientific question more specifically: How do energetic personalities bring about social change? By ‘change’ Schumpeter did not mean change in ongoing social life under given conditions, but rather changes in these conditions themselves. This type of change involves new ideas, and in this way makes the energetic agent an innovator. The primary ‘agens’ of change is the energetic drive of the individual, and new ideas are his powerful tool. An agent who brings about change in social life by introducing novelty is termed an entrepreneur by Schumpeter. All important change, whether in political, economic or cultural life, is brought about by entrepreneurs. The notion of the entrepreneur is an archetype for a primary source of energy that changes social life.

7. The Received Doctrines

As we shall see in the subsequent section, Schumpeter translated his proto-scientific vision into a powerful economic theory with the entrepreneur granted center stage. Dealing in the following with Schumpeter’s assessment of classical and neoclassical economics, it is relevant to recognize that he took his position to be a yardstick for the assessment of the work of others. He missed few opportunities to make it clear that a theory that failed to acknowledge the central role of the entrepreneur was fundamentally flawed.

Using this lens, Schumpeter brought the works of the classical economists into particularly sharp focus. The proponents of the classical doctrine worked with aggregate resource magnitudes, and they proposed looking for objective laws in their relationships. The activities of individuals had no role to play in this objective machinery, and were at best epiphenomena, explained by, but not explaining, the aggregate relationships. Schumpeter, for one thing, objected to the view that all economic development was bound to terminate in a secular stationary state. In this way, David Ricardo and Thomas Malthus conceived economic development as a process whereby population increases led to decreasing marginal returns from agriculture, collapsing eventually into the stationary state of a secular subsistence equilibrium. This ‘dismal vision’ enjoyed a revival in the works of the stagnationists of the times, who held – confirming the predictive conjectures of their classical precursors – that “the capitalist system has spent its powers, ...that our economy is, amid convulsions, settling down to a State of Secular Stagnation” (Schumpeter, 1954, p. 570). Contemporary authors such as Alvin Hansen failed, in

Schumpeter's view, to recognize that individuals had the power eventually to counter the alleged immanent objective forces, and that these could never force the system into a secular stationary state.

Schumpeter's objectivist critique was not targeted specifically at the stagnationists but included all strands of the classical canon. His critique did not concern the particular direction of the developmental course, or the differences in weight given to its determining factors, but merely the notion that economic change could be explained on the basis of objective laws. The nature of those laws was irrelevant – that is, they could be associated either with entropic forces or with new ideas and knowledge growth. For Schumpeter, the essential point was that development was always propelled by the 'agens' of the entrepreneur, and that "in technical or organisational progress there is no autonomous momentum which carries in itself a developmental law, which would be due to progress in our knowledge. [...] There is no automatic progress" (1912, p. 480). It is impossible to understand Schumpeter's disregard of Adam Smith's work unless one realizes that his criticism was not aimed at the categories of the proposed determinants as such but, rather, at their presumed objective nature. From his anti-objectivist platform, Schumpeter issued an indictment of several authors, such as Friedrich List, but the central target was Smith. There is "nothing original" in his writings, Schumpeter says, except that

"nobody, either before or after A. Smith, ever thought of putting such a burden upon division of labour. With A. Smith it is practically the only factor in economic progress. [...] Technological progress, "invention of all those machines" – and even investments – is induced by it and is, in fact, just an incident of it... Division of labour itself is attributed to an inborn propensity to truck and its development to the gradual expansion of markets – the extent of the market at any point of time determining how far it can go. It thus appears and grows as an entirely impersonal force, and since it is the great motor of progress, this progress too is depersonalised". (Schumpeter 1954, p. 188)

Schumpeter highlighted innovations as the central driving force of development, and Smith analogously emphasized the power of innovations unlike any other classical writer, but still no other economist of that strand had to suffer a comparable disregard. It was, arguably, precisely this close congeniality that prompted Schumpeter to take Smith's work as an exemplar for demonstrating the essential difference between his and the classical approach.

8. Methodological individualism

Neoclassical economics ushered in a wind of change. In Schumpeter's view, it introduced a major innovation by acknowledging that the individual agent was central in the formation of economic theory. Its pioneers, such as Walras, Stanley Jevons, Heinrich Gossen and Vilfredo Pareto, understood that a proper theoretical account of economic phenomena was inconceivable on the basis of objective laws, but was bound to be premised on an understanding of individual cognition and behavior. Schumpeter did not merely endorse this view but also made a significant contribution to its methodological underpinnings. Inspired by the writings of Karl Menger, he introduced into the project 'methodological individualism' (Heertje, 2004). He gave a name to what already united the neoclassical writers and what made them distinct with respect to their classical precursors.

The question that arises is whether Schumpeter actually belongs to the neoclassical camp. After all, he is usually considered to represent a major heterodox figure of contemporary economics. A look at the origins of the concept provides us with the essential cue. The neoclassical economists set out to solve the problem of Smith's "invisible hand". Their problem was static, and Pareto's construal of *Homo oeconomicus* was designed to serve this purpose. *Homo oeconomicus* only reacts to opportunities, but in no way changes them. Schumpeter's theoretical problem, in turn, was not static, but dynamic. *Homo oeconomicus* was designed to solve the problems of static analysis, and, because it was successful in doing so, it proved inherently inappropriate for solving the dynamic problem.

It is here that Schumpeter's entrepreneur enters the scene. Methodological individualism can thus be interpreted as having two distinct components: one that deals with passive individual behavior, and another that deals with active individual behaviour. There is, in this way,

- **passive** methodological individualism, and
- **active** methodological individualism.

While Schumpeter was not explicit with regard to this distinction, he left no doubt in his writings that neoclassical economics was flawed because it featured only passive methodological individualism - ignoring its active counterpart. Schumpeter was not only

an innovator with regard to the concept of methodological individualism; he also completed it.

9. Methodological Individualism Goes Generic

The complete form of methodological individualism allows us to view the agents not only as responding to given opportunities, but also as engaging actively in the economic process. This, however, can be given two meanings. Agents can engage in activities at the operant and at the generic level. The hallmark of Schumpeter's theoretical proposition is that the active agent engages not only in activities at the operant but also at the generic level. The entrepreneur carries out innovations, and in this way changes the generic knowledge base of the economy. There will be changes in the operations and the commodity space, but these are induced by changes in generic knowledge.

The significance of Schumpeter's proposition is apparent, if we contrast the agent who is active at the operant with the one who is active at the generic level. Austrian economics is a good exemplar, since it deals with both. We can distinguish between a 'standard' operant and a 'progressive' generic model of this strand. The Austrian standard model, as advanced by Mises, Lachmann and, most clearly, Kirzner, reject the orthodox assumption that agents possess all relevant information for operations. Instead, they conceive individuals as being actively involved in the search and discovery of operational information. The search activities of individuals result in the discovery of new opportunities, leading to arbitrage profits and rents. Advanced neoclassical models include in the decision function information search costs, but the Austrians highlight the involvement of the agents in an open process in which marginal equivalences of information costs and benefits can never be known in advance. There is Knightian uncertainty even at the operant level. Essentially, the Austrians do not build their theoretical reasoning on decision logic. However, the Austrian standard and neoclassical models share common ground in that they are both confined to the operant level of an economy. The search for information does not relate to generic knowledge, and, in the occasional passages where this is considered, the theoretical consequences are not worked out systematically. In contrast, Schumpeter's entrepreneur searches and introduces into the system new generic knowledge. Here is the watershed between Schumpeter's approach and those that deal with the operant level.

The distinctions between active and passive individuals and between operant and generic levels yield a 2 x 2 matrix that is useful for clarifying the multi-faceted concept of methodological individualism and for demonstrating in what theoretical fields they can be

employed. In a more speculative mood, we can conceive the various items of the matrix as steps of a ladder that signals theoretical advance as we ascend it.

- * In a first step, theories work with *aggregates*, and Schumpeter provided good reasons why their explanatory power is limited.
- * In a second one, individuals are introduced but, being born as *homines oeconomici*, they only *respond* to given opportunities rather than create them.
- * In a third step, individuals equipped with *Austrian* genes become *active* and can arbitrage profits.
- * In a fourth step, the perspective is further extended bringing us onto the *generic* level. Here the *Schumpeterian entrepreneur* is active.

With respect to theoretical advance, the ladder suggests that various building blocks are added one after the other to an existing theoretical corpus. But, by doing so, this can also imply that the whole structure and fundamental characteristics of that corpus changes. It is not the place here to investigate this in any general sense, but an exposition of the salient features of Schumpeter's approach that constitute a paradigm shift will be attempted here.

10. Meso Economics

The story, alluded to already, is simple. The entrepreneur carries out innovations, and by doing so destroys and newly creates the structure of the economy "from within". The Schumpeterian entrepreneur introduces new knowledge, reconfigures generic rules, and enables the agents to use a new set of operations inducing a reallocation in the commodity space. These propositions, in themselves, do not yield a theory of the economy, but they do furnish the stuff from which the elementary theoretical unit can be derived.

We start with an *'idea'* and its *actualization* by many agents. Ontologically speaking, we have "oneness" and "manyness". (5). Ideas are time- and space-less. They are potentials that can be (*qua* idea) actualized. Knowledge - defined as ideas 'carried' by agents - does not degrade if used; in fact, the use of ideas is instrumental for maintaining a store of knowledge. Opportunities, in turn, are consumed. An idea is physically actualized by (possibly) many agents in time and space. A single agent is a member of a

population of agents that actualize an idea. This all sounds very philosophical (and rightly so), but it is of immediate practical relevance for theory formation.

Theoretically, we look for an *elementary unit* that can explain *structure and process* at the generic level. Conventional economics takes the individual as a micro unit, and constructs macro types by aggregation under restrictive assumptions. This course is foreclosed in the present case. To explain actualization, we must acknowledge both the population and the individual (as the micro unit). We cannot categorise this as either macro or micro, since it is a generic conceptualisation. Within the micro-macro dichotomy, the unit proposed is homeless; it is an intermediate category that gets its place as *meso*. Schumpeter's depiction of entrepreneurs adopting new technological and/or organisational rules that spread and become generic are of this character and it is no surprise that they are invisible in standard economic theory. Schumpeter himself, as a scientist, deserves the attribute of entrepreneur since he "creatively destroyed" the traditional framework of the discipline "from within". He set in train a new architecture for economics that is *micro-meso-macro*. (Dopfer (2001, 2002, 2005), Dopfer, Foster, and Potts (2004), and Dopfer and Potts (2006)).

How, then, can meso explain generic structure and process? The key is *bimodality*. There are, on the one hand, ideas, and, on the other hand, matter-energy that is actualized in time and space. To explain structure, we require a definition of its component parts in terms of quality (Foster (1987)). Quantities can be aggregated, but cannot define the component parts of structure. It is perhaps painful for economists, who are used to thinking so much in quantities, to recognize that the only valid expedient here is the recourse to ideas. There is a high degree of abstraction with this ontological term, so let us define it in more specific, analytical terms. Clearly, ideas relevant for economic analysis are a specific manifestation of this ontological abstraction, that is to say, ideas that are contained, for instance, in a picture hanging on the wall are not relevant, but ideas that can be employed for economic operations are. We call any idea that represents a deductive format for economic operations a *rule*. (6). The structure of an economy can thus be conceived as a rule structure. Rules to be 'real' must be physically actualised (with matter-energy) in time and space. Thus the rule component represents a process, and the rule structure constitutes a process structure. We shall define subsequently this process in terms of a three phase rule trajectory which shows how rules are created, adopted and retained. At this point, it is important to recognise that rules *qua* ideas are the analytical unit that allows us to deal with economic *structure* and that physical actualisations are the analytical unit that allows us to deal with economic *process*. In

combination, we get an *integrated elementary unit* that can serve as an instrument for the description of both structure and process of an economy.

The term meso is employed variously in economics and other sciences. This is indisputably an advantage since, in this way, the term becomes a member of natural scientific language and we do not require any word coinage. Its broad inclusiveness, however, calls for a clear specification of the term - if it is to be useful scientifically. The term meso has been used often in instances where a reference to micro or to macro seemed to be inappropriate or ambiguous, as for instance, in the areas of industry, sector or technology studies. The use of the term meso is in these studies of obvious *practical* relevance, and any analytical clarification of the term provides these investigations with additional analytical rigour and precision.

We encounter a different problem, if we employ the term meso in the context of *theory making*. Here, the term is a conceptual building block of a theoretical edifice, and it derives its meaning from a specific task in a theoretic whole. We have seen previously that meso cannot be derived by simply aggregating micro units, and that, therefore, conventional economics cannot capture meso. But this is evident; both approaches seem ontologically worlds apart. More interesting is the case where approaches resemble each other and qualify as what may be interpreted as *quasi-* or *proto-meso* approaches. These approaches may offer theoretic elements that can be integrated into the meso approach proposed, and if ruled out, they will help us to draw the boundaries between the approaches more clearly. Let us take up as important cases first classical, then Marshallian economics.

Classical economics approaches meso with its concept of natural and actual price. The natural price is the market price under 'normal circumstances' to which the prices of all commodities are continuously gravitating. Particular circumstances may keep the actual market price above the natural price. We may interpret this in a way that these particular circumstances represent an introduction of a novelty, and the entrepreneur has (as monopolist) an innovation rent. The actual price would then initially differ from the natural price. Subsequently, there would be a tendency of the actual price to gravitate to the natural price. This is a good approximation of what indeed can be observed in real economies. However, the classical economists interpreted this differently. First, they reckoned, under the particular circumstances that cause a price deviance, factors such as natural disasters, governmental price regulations or organized monopoly power, but they did not make any systematic reference to technical (or other) innovations. The natural price represents a static datum, defined by the market form of competition. This market

form itself is not an emergent property of a meso process. Furthermore, individuals are not introduced into the theory, and in fact are not required given the objective 'law of gravity'. However, the dynamics of meso can be explained only on the basis of a process of interactions among individuals and not in terms of a commodity aggregate attracted by a center of gravitation. The deficits of the theoretic construct show up in essentially two ways. On the one hand, there is no explanation of the dynamics of market forms, which figured prominently in Schumpeter's work. (e. g. Schumpeter 1934). On the other hand, the classical model fails to tackle adequately major aspects of the meso process, such as diffusion, macroscopic adoption, selection and path dependence.

Another important case of quasi-meso is provided by Marshall's distinction between short and long run demand and supply schedules. Marshall introduced time into analysis, and showed how equilibria shift over time due to certain factors. These include economies of scale internal to an industry, demand shifts, and classical factors such as population and capital accumulation. Technological progress again figures not as a key factor. There is no systematic assumption about an initial innovation that evolves along a technological or other knowledge trajectory. A difference to the classical canon, however, exists in that Marshall employed methodological individualism. This provides an explanatory potential, but again, when specifying the concept, he introduced the construct of the 'representative firm'. An account of meso relies crucially on the premise of heterogeneity of agents. Schumpeter's distinction between the entrepreneur and the 'statische Wirte' (e. g. managers) is an exemplar for this essential kind of heterogeneity in meso. As a consequence, Marshall failed to explain the meso process, and his analysis eventually drew on classical factors and the operant notions of elasticities and shifting schedules. There are objective determinants on the one side, and shifting quantities on the other, but no generic process. Marshall had an evolutionary vision, and from all what we know about his life, he was frustrated when attempting to match it to his actual work.

11. Schumpeter's Meso

Schumpeter has challenged the received doctrine with his simple proposition that entrepreneurs carry out innovations that are then adopted by a population of followers. This proposition led to an elementary unit that is composed of, on the one hand, an idea, or generic rule, and, on the other hand, many physical actualizations of it. The idea can serve as structure component, the set of physical actualizations as process component. The bimodal nature of the elementary unit breaks up the traditional micro-macro dichotomy, and, introducing meso, leads to the new framework of micro-meso-macro.

While this in itself is a significant contribution to economics, the question of further interest is Schumpeter's particular contribution to the multi-faceted concept of meso.

As structure component, meso relates necessarily to the whole of structure, and we shall take up Schumpeter's contribution in the subsequent section on macro. As process component, meso deals essentially with the individual agent and a population of adopters of which (s)he is a member. An idea or generic rule is actualized along a three-phase trajectory of origination, adoption and retention. To ease the discussion of Schumpeter's contribution, we shall sub-divide each of the three phases, specifying the trajectory on the basis of six (sub-) phases. In the initial phase of origination, the distinction is between the creation and the discovery of a new idea. In the next phase of adoption, it is between the first and the many following adoptions, and in the terminal phase of retention, the distinction is between stabilizing and destabilizing forces determining the generic rule regime. The six phase dynamic was introduced originally as a schema for a comparative theory study which included neoclassical, Austrian and evolutionary-Schumpeterian economics (Dopfer 1993). In the following, the discussion shall be confined to the contribution that Schumpeter made to the theoretical elucidation of the six trajectory phases. These can be summarized as follows:

I Origination

Sub-phase 1: creation of novel idea, innovative potential

Sub-phase 2: search, discovery and recognition process,
microscopic selection

II Adoption

Sub-phase 3: first adoption, chaotic environment, bifurcation,
uncertain outcome

Sub-phase 4: macroscopic adoption of 'seed', selective
environment, path dependence

III Retention

Sub-phase 5: retention of adopted 'seed', meta-stability of
actualization process

Sub-phase 6: existing regime as breeding ground for novel
potential(s), link to phase I.

Schumpeter's key contribution lies in the analysis of the (sub-) phases 2, as well as 3 and 4. The *locus classicus* of his analysis is phase II. In phase 3 (first phase of

adoption), the entrepreneur carries out a new combination, changing the environment by initiating a new meso trajectory that eventually gains momentum in phase 4 (second phase of adoption). The latter is generally a population process which can be specified theoretically in various ways. Schumpeter focused on the dynamics of capitalist market forms, such as monopoly, oligopoly, and competition and discussed their welfare and societal consequences. Neo-Schumpeterian economics has an explicit population core from which diffusion, selection, path dependence and related models can be developed and the original market dynamic integrated. A further link is from Schumpeter's adoption phase II to phase 2 (second phase of origination), which displays the entrepreneurial activities with regard to search and discovery of new ways of doing things.

The lacunae in Schumpeter's work are phases 1 as well as 5 and 6. In all his work, Schumpeter has emphasized that it is not the creation, but the carrying out of new ideas that is relevant for coping with the phenomenon of economic development. "There are always changes in an economy, and we are not closer to the exhaustion of possibilities today than we were in the stone age" (1912, p. 161). While this is a reasonable conjecture, it does not provide us with an appropriate micro foundation for a theory of a knowledge-based economy in which the creation of knowledge is a pivotal factor and requires theoretic recognition. The lack of explicating phase 1 is a major theoretical deficit in Schumpeter's work, as Witt aptly remarks. (Witt 2002).

The second lacuna refers to phase III, which essentially deals with institutional factors. Schumpeter refers to institutions and related factors occasionally, for instance when arguing that habits, once "hammered in", become "as firmly rooted in ourselves as a railway embankment in the earth" (Loasby 1999), but he fails to deal with phase III systematically. Significantly, meso builds on the notion of circularity between individual and population. The trajectory dynamic unfolds not as a diffusion of a single valued variable, but rather as a process in which individuals interact with an emergent population in a self-reinforcing way. Veblen analyzed this process on the basis of his concept of circular and cumulative causation. Schumpeter criticized Veblen's work on the grounds that it was non-theoretical, sociological and populationist, and one can conjecture that, for this reason, he rejected it. But there is a deeper reason for this rooted in his view of causality. Unlike Veblen, he outlines a linear causality principle:

"We speak of cause and effect only in the case of an irreversible causal relationship. ... In contrast, we do not speak of cause and effect in those instances where we have a reciprocal relationship between two facts,

We consider as a cause of an economic phenomenon only its explanatory principle (Erklärungsprinzip), that is to say, that aspect that allows us to comprehend the nature (Wesen) of the cause." (Schumpeter, 1912).

This causality principle is straightforward in that, for instance, the creation of novelty comes before its carrying out, or mass adoption follows innovation, endorsing generally the logic that underlies the trajectory dynamic. Various types of models, particularly wave or cycle models, can be built on this basis. In a Kondratieff model, innovations may be viewed as the causal inception of an emergent dynamic whose pattern can be described as a logistic curve. The problem arises when this causality principle is applied to a many particle problem. Here, linear causality does not wash. A population is not only an aggregate of individual behaviors, but it (frequently) becomes also an order parameter that feeds back to individual behavior. The application of the linear causality principle excludes a broad range of models subsumed under the term path dependence, and following this principle would narrow down the scope of a Neo-Schumpeterian program drastically. (7).

12. Macro: The Seventh Chapter

The message economists have to deliver, however, is not mainly measured by degree of sophistication of the analysis of meso, or any other elementary unit, but rather by the content, originality and validity of the statements about the economy as a whole. Schumpeter addresses the issue explicitly in Chapter 7, entitled "The Economy as a Whole", of the first edition of his "Development Theory". Schumpeter gave rise to high expectations, since he is rightly considered to be a man who has a vision of the 'whole' and an extraordinary talent for 'unification'. He was a scholar of rare intellectual stature, a highly cultured person, widely read, a polymath, with interest in and knowledge of almost everything, an economist who made seminal contributions to all major domains of the discipline, encompassing the history of economic thought as well as theoretical, methodological, historical and statistical analyses. Recognizing his broad vision, he has been heralded by some as the *spiritus rector* of a "unified social science". (Shionoya 1997).

However, Schumpeter's extraordinary abilities to unify, integrate and expound connecting principles show up nowhere in his economic theory. Neither in chapter 7 nor in his other work does he leave any traces of his genius that would demonstrate how the theoretical elements combine into a whole. Schumpeter superscribes chapter 7 with *Das Gesamtbild der Volkswirtschaft*, which means literally, 'The *total* picture of the economy'.

This has been translated as ‘The Economy as a *Whole*’, which is nice English prose. (8). However, a note of semantic clarification seems appropriate. Significantly, ‘totality’ (Schumpeter’s Gesamt-) and the ‘whole’ (translator’s Ganzes) are not identical. While the term ‘totality’ refers to the sum total of factors relevant for the analysis of a phenomenon, the term ‘whole’ makes an additional statement about how these combine. Schumpeter made in chapter 7 only two brief remarks about the economy as a whole. He noted, on the one hand, that there are complex interrelationships between the economy and the cultural system, and, on the other hand, that the classical economists were wrong in treating the economy as a whole on the basis of aggregates. As for the remaining part, two thirds are devoted to a précis of the essentials of his theory of economic development, and one third to the role of the entrepreneur in the areas of politics and the arts and science. He remarked in the foreword to the second German edition (Schumpeter 1926) that his “cultural sociology” had “distracted the reader from the problems of dry economic theory”, and it is only a natural consequence that eventually he eliminated this chapter in later editions altogether. (9).

The core of Schumpeter’s theoretic work is on economic development which, by definition, refers to the economy as a whole. He built his theory of economic development on the concept of the circular flow - elaborated in chapter 1 of his “Economic Development”. The starting point is a stationary state in which the agents follow the "old familiar ways of doing things" and the circular commodity flow repeats its course. Development occurs when energetic entrepreneurs destroy the stationary structure by carrying out new combinations. The entrepreneur "incessantly revolutionizes the economic structure *from within*, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction", Schumpeter argues, "is the essential fact about capitalism." (Schumpeter 1942, p. 83, *emph. as in orig.*). This process runs through all levels of micro-meso-macro. It starts with an entrepreneur who carries out an innovation (micro), develops into a population of agents who imitate it (meso), and consequentially destroys the existing structure of the economy (macro).

How, then, does the incessantly changing structure look? This question relates, first of all, to the structure of the circular flow. The concept of circular flow is consistent with any statement about structure; it is neutral in that it can be defined with or without structure, and different structures can be read into it *ad libitum* -- the Physiocrats, in the guise of Francois Quesnay in his *tableau économique*, introduced structure on the basis of a matrix of social classes, and Keynes did so by distinguishing between sub-aggregates that are linked to respective behavioral propensities. In the first chapter,

Schumpeter made eclectic references to the classical and pre-classical writers, but did not come up with a comparable coherent framework that would explain the structure of the circular flow.

However, Schumpeter referred frequently to the destruction of equilibrium, and emphasized that the economy actually never is and never can be in equilibrium. The reference here is to Leon Walras. Schumpeter held the view that Walras's general equilibrium theory could be implanted straightforwardly into the circular flow. The limitations of this view become immediately apparent if we consider that the circular flow describes repeating occurrences at both the operant and the generic level. It refers to a physical flow of commodities *cum* money, and a causal circularity in terms of self-reinforcing generic variables. It is the upshot of traditional equilibrium theory that it provides a solution to the coordination problem by keeping the latter constant. What, in Schumpeter's view, is the *magna carta* of economics provides a solution to the coordination problem only at the operant level. It does not furnish us with any generic explanation, since the variables that are expected to do the job are treated exogenously. A *ceteris paribus* clause is not a theory. To assume that general equilibrium theory solves the generic coordination problem is to assert exactly this.

Schumpeter did not ignore structure, but he wrongly assumed that Walras's equilibrium model could solve the generic coordination problem. He accordingly built his theory of development on this premise, and assumed that this would explain the dynamic of structural change. Keynes had a similar belief when he argued that (neo-) classical theory had solved the relative allocation problem, and all that was left to be done was to introduce aggregates and to link them to new behavioral propensities. (Kregel 1973). While Schumpeter thought that the theoretical program of economics could be completed by adding a dynamic chapter, Keynes thought that this task could be accomplished by adding macro economics. They both assumed wrongly that this could be done with general equilibrium theory as the departure point.

13. Hayekian rescue

Hayek recognized that we can cope appropriately with coordination and change in an economy only if we deal with generic knowledge. By exploring the “market as a discovery process”, he contributed to the Austrian standard model, and demonstrated how rent-seeking agents and arbitrageurs operate, but he also pioneered a progressive variant of Austrian economics bringing into theoretic focus the grand theme of generic knowledge growth. Hayek recognized that there was not only an invisible hand at the operant level,

which coordinated the activities of the butcher and brewer who exchanged commodities and money, but also at the generic level where knowledge was divided and needed to be re-coordinated. His departure point was the two first chapters of Smith's "Wealth of Nations". Hayek recognized the significance of the distinction between operant and generic, and dealing with the latter went beyond Smith's concept of division of labor, as the following passage reveals:

"..... (P)rice expectations and even the knowledge of current prices are only a very small section of the problem of knowledge The wider aspect of the problem of knowledge is the knowledge of the basic fact of how the different commodities can be obtained and usedand under what conditions they are actually obtained and used, that is, the general question of why the subjective data to the different persons correspond to the objective facts. Clearly there is here a problem of the division of knowledge, which is quite analogous to, and at least as important as, the problem of the division of labour. But while the latter has been one of the main subjects of investigation, ever since the beginning of our science, the former has been completely neglected, although it seems to me to be the really central problem of economics as a social science." (Hayek 1937, 47).

In his later work, Hayek developed this proposition into a general theory of generic knowledge based upon which he explained was the spontaneous emergence of order, self-organization and the evolutionary dynamic of the economic system. The key to all this is the knowledge processing individual. Given this premise, recourse to the commodity space of general equilibrium theory was an anathema. In Hayek's approach, the individual is not only an endogenous destroyer in the commodity space, but above all a creator, adopter and user of generic knowledge. He could never end up with a model where the commodities "have spoken", or, as Mill said, "the factors of production are the commodities themselves". (Kurz 2006). This exactly is, Hayek argues, what Schumpeter failed to acknowledge, and, in a devastating critique, he referred to the difference between his work and that of Schumpeter:

"A recent Statement by Professor Joseph Schumpeter in his *Capitalism, Socialism and Democracy* provides a clear illustration of one of the methodological differences which I have in mind. Its author is pre-eminent among those economists who approach economic phenomena in the light of a certain branch of positivism. To him these

phenomena accordingly appear as objectively given quantities of commodities impinging directly upon each other, almost, it would seem, without any intervention of human minds." (Hayek 1945, p. 529).

It is certainly an irony that Schumpeter, who persistently criticized the classical economists for this fallacy, must now swallow the same blame for his own work. (10).

14. Schumpeter as knowledge agnostic

Where there is smoke, there must be fire. Schumpeter indeed has little to say about knowledge, and the reason for this lies in his particular interpretation of the human individual. He was a pioneer in that he criticized the aggregate view of the classicals and introduced the concept of methodological individualism, and he overcame the narrow confines of neoclassical economics by adding to *homo oeconomicus* an energetic component that brought about change "from within" at the generic level. The limitations of Schumpeter's methodological individualism lay not in its scope, but in its content. He viewed the individual one-sidedly only as an *energetic* personality, not as a knowledge and information processing agent. Though active, the agent he described is not involved in any systematic way in knowledge creation, knowledge adoption or knowledge communication. The energetic personality type relies on a particular social-psychology the origins of which he nowhere describes (as with Karl Popper, he rejected psychology as a scientific discipline). Essentially, he rejected the view that ideas, which are the content of knowledge, should play any role in economic theory. He considered as particularly flawed the notion that development could be explained as the evolution of ideas, and suggested instead that the energetic individual should be put at centre stage.

Schumpeter's proposition gains a distinct profile when we apply it to those fields of human culture that we generally associate with the cosmos of ideas, namely the arts and sciences. In the mentioned chapter 7, Schumpeter contended that the developments in the arts and sciences depend less on the creation of new ideas as on the ability of energetic personalities to bring them into the public. "The history of science", Schumpeter argued, "shows this dramatically. It is generally so that a new idea is adopted by a powerful personality and then made to become influential. This personality is not required to be the creator of this idea, just as the entrepreneur who adopts the first time a new production method has not to be necessarily its inventor. What characterizes the leader (Führer) is here, as everywhere, the energy for the deed

not that for thoughts. And this function is essential for the development in all fields. A new idea, defenceless as it were, would never get attraction by itself.” Schumpeter 1912, 543-544). (11).

He considered his construal not only theoretically sound, but also instrumentally adequate. “It is an advantage of our view that it refers to sizable facts and not to any intangibles such as the ‘power of ideas’ or any other entities that in their effects cannot be proven.” (Schumpeter 1912, 545).

An innovation involves a cognitive process with regard to the creation of a new idea (invention) and an energetic process with regard to its physical actualization. As Schumpeter aptly remarked, an entrepreneur carrying out an innovation brings about a “creative destruction” of the structure of an economy. The well-known metaphoric heuristic acknowledges that both cognition and knowledge (creative) and its physical actualization that changes the structure (destruction) are essential for describing economic development. The peculiarity of Schumpeter’s interpretation lies in its treating the creative occurrence in terms of destruction only. Destruction, undoubtedly, is important. And it is, methodologically, most helpful because it does not call for any assumptions about cognition, creativity or ideas. A dog can throw down a vase, and the Taliban could destroy the Buddha statues. Both rely on ignorance. It does not require much knowledge to destroy. However, it does require knowledge to build up. Economic development relies not only on creative *de*-struction, but also on creative *con*-struction. To cope with the category of construction requires that knowledge be a constituent factor of the theory.

The playing down of knowledge has as a consequence that the meso unit cannot serve adequately as an elementary unit for dealing with structure and with change at the generic level of the economy. To be a structural component, meso requires that it can cope with quality, which it can do only when employing categories such as ideas and knowledge.

However, the deficit shows up also with regard to the treatment of the actualisation process. The category of innovation requires that we make statements about new ideas (invention) and about their physical actualization. If we talk only about new ideas, it is invention, and if we do not talk about new ideas, it is neither invention nor innovation. Now, if we turn to Schumpeter’s celebrated list of the five important cases where innovation in a capitalist economy occurs, we see that he talks about innovation without new ideas. He treats an extension of the actualization space

or an increase in adoption frequency in the same way as an innovation in the sense proper. Let us look at the list. Innovations are said to occur by introducing

- (1) a new consumer good,
- (2) a new method of production, including a new way of handling a commodity commercially,
- (3) the opening of a new market,
- (4) the conquest of a new source of supply of raw materials or half-manufactured goods, and
- (5) the carrying out of the new organization of an industry. (Schumpeter 1934, 66).

The items (1), (2), and (5) are congruent with the term innovation. The items (3) and (4), however, are horses with different colours. We do not have in the same way a novel idea or rule as previously, for instance, a new consumer good or a new method of production. What we have is a different context in which a new (or old) idea or rule is actualized. A firm becomes an ‘innovator’ by extending the scope of its market in order to increase its sales or to secure its supply sources. Basically, what changes here is not the idea or rule, but the relative frequency of its adoption. We can talk of an innovation if, and only if, the new context owes properties that call for “new ways of doing things”, say employing a new form of strategy. Clearly, to avoid double counting, the additional criteria must not be included in any of the other items, for instance, in item 2 (a “new way of handling a commodity commercially”). Generally, Schumpeter's enumeration is useful as a shopping list for business people or for teaching purposes, but it is not particularly helpful as a tool for systematically (re)constructing economic theory or as a reliable taxonomic device for empirical analysis.

15. Generic Architecture of Economy

Justified as the preceding critique may be, there remains the fact that Schumpeter’s work is a major source of inspiration for reconstructing economics. The cornerstone of his contribution is meso. It leads, on the one hand, to the construction of a micro-meso-macro framework challenging the wisdom of the received micro-macro dichotomy, and, on the other hand, to a bimodal principle on grounds of ontological considerations.

Macro emerges as a two-level construct that is composed of a “deep” level of ideas or generic rules, and of a “surface” level composed of their physical actualizations.

Concluding from the previous discussion, Schumpeter’s theoretical contribution concerns the surface, rather than the deep level of the economy. The energetic entrepreneur adopts a new rule (micro), initiates a new population of rule adopters (meso), and destroys an existing structure (macro). Hayek’s contribution, in turn, relates to the knowledge base of the economy, that is, the neural-cognitive disposition of the individual (micro), the process of knowledge diffusion and adoption (meso), and the engendered change of the economy’s division and coordination of knowledge (macro). Clearly, both Schumpeter and Hayek have an important story to tell. Given their complementarity, their works combine into a *unified Schumpeter-Hayek program* that is complete as a platform for generic economic analysis.

In Schumpeter's economics, two terms describing the phenomena of the economy as a whole play a particular role: *structure* and *equilibrium*. How do they fit into the generic architecture outlined? This is a big question, plagued with semantic and basic conceptual issues. We employ in the following brief account only the theoretical categories introduced and supplement them with evolutionary terms used in the literature (with no further explanation).

Dealing with the deep level, we have a *deep structure* of interrelated ideas. There is a mechanism coordinating the parts into a whole; we associate this with (self-) organization. Analogously, on the *surface level*, we have a surface structure of interrelated physical components stated in terms of actualization processes. The universal measure for macro with a view to the appropriateness of meso components is *generic correspondence*.

Ideas relate to structure; to play their role, they must fit, or must be adapted. For instance, an invention that comes too early is an unadapted one. The individual performance criterion is adaptiveness, its micro measure *effectiveness* (not efficiency). The generic correspondence measure for the deep macro structure is *order*.

Schumpeter's circular flow is not deeply structured. There is no mechanism, no self-organization, that would coordinate the generic activities of the individuals. There is consequently no measure of generic order.

Physical or matter-energy entities relate to process. To be instrumentally adequate, they must be *efficient*. For instance, a firm producing with minimal cost in an industry is efficient. In meso, micro efficiency is always relative to others, since the individual is a member of a population. (12). The generic correspondence measure for the surface macro structure is *equilibrium*.

The theoretical concept of generic equilibrium can be stated as follows. At any given order, there is a set of potential (p) and of consumed (c) actualizations. There is generic equilibrium if the condition $p - c = 0$ is met. The generic equilibrium conditions apply to all levels: micro, meso, macro. There is general generic equilibrium of the whole economic system if all generic equilibrium conditions of all levels are met. There is generic micro equilibrium if an improvement of a retained generic rule is impossible, for instance, if a firm has perfect Nelson-Winter routines. In a decision theoretic format, marginal learning costs equal marginal benefits from perfecting a routine. There is meso equilibrium if all agents that could and wanted to actually adopted an idea. The logistic curve of mesoscopic adoptions will have reached its maximum. Finally, there is macro equilibrium, if, at a given constellation of micro and meso equilibria, the relative adoption frequencies of all component parts of the system correspond. There is generic Pareto optimality of the system if all components of all levels are in equilibrium.

The exposition of multi-level equilibria may be supplemented with a set of specific theoretical propositions. At the micro level, equilibria can be expected to be established frequently. The likelihood of reaching equilibrium can be assumed to be decreasing as we go to meso, and from there to macro, with the likelihood of being lowest at macro due to the multitude of parallel processes. (13). Employing this theoretical exposition and set of differential propositions, we may give a more precise meaning of what Schumpeter may have meant when he said that the capitalist economy can never be and never is in equilibrium. There is no way of reaching this conclusion on the basis of Walrasian general equilibrium theory, since it deals with the operant, not generic, level of the economy.

Developmental change occurs (1) at a deep level as transition from one generic rule to another inducing a change of order, and (2) at a surface level as the new generic rule is adopted destroying an old equilibrium and establishing a new one.

16. Program in progress

In the following, a brief *tour d'horizon* of the literature dealing with the various strands of the emergent theoretical program shall be provided. We have seen that Schumpeter pioneered meso, and has inspired to the construction of a micro-meso-macro framework, but that his theoretical construct has deficiencies. These, however, can be overcome by acknowledging the theoretical ideas of Hayek and of Veblen. Depending on the observer's view, they can be combined into a Schumpeter-Hayek or a Schumpeter-Veblen program, or - acknowledging the relevance of the theoretical ideas of all - into a unified

generic economics program. It is important to recognize that currently much work is done under the umbrella of Neo-Schumpeterian economics that relates to fields that constitute exactly such a unified program.

Various taxonomies are conceivable with a view to designate the various fields of the program. The skeleton common to all variants is composed of bimodality and micro-meso-macro. The proponents of such a Neo-Schumpeterian program are well aware that the various fields interconnect and that theoretically interesting answers come forth by detecting these connections. Any taxonomy here is a bold attempt to be systematic, but being so may be counterproductive for the cause for which the taxonomy is constructed.

The hallmark of the program is that its proponents adopt generally a process view. Differences in the works show up in that they either deal explicitly with coordination, structure and order or focus only on aspects of the process employing a *ceteris paribus* clause with regard to the former. We may, in this way, distinguish between *systemic* and *non-systemic* process approaches. The former includes works by Metcalfe, Foster and Ramlogan (2006) which link self-organization and self-transformation and explain the macro dynamic as emergent property of micro diversity and of meso change. The models are developed in a Smith-Young-Fabricant-Salter-Kaldor-Dahmén perspective and are reminiscent in their analytic approach of classical economics, inviting connection with the works of, for instance Pasinetti (1993) and Nell (1998). Parallel to production focused approaches, the generic demand side differs from both classical and neoclassical economics in contributions by Witt (2001), Earl and Potts (2004), Bianchi (1998), and, in a similar vein, Post-Keynesians have been linked to knowledge approaches in Foster (1987, 1994) and Verspagen (2002). The systemic process approaches include the broad class of endogenous, evolutionary and Neo-Schumpeterian growth models. In these, self-organization and structure show up perhaps less explicitly, but, unlike in neoclassical endogenous growth models, they are always present as a hidden agenda. Contributions include works by Fagerberg (2002, 2003), Silverberg and Verspagen (2005), Llerena and Lorentz (2004), Dinopoulos and Thompson (1999), Peneder (2004), and Alcouffe and Kuhn (2004).

Another strand of works puts at centre stage the coordination aspects of macro analysis. Macro structure is, on the one hand, structure of meso components, and, on the other hand, the coordinated activities of individuals constituting these. The two are different sides of the same coin, but for practical reasons they are usually treated as two building blocks of a macro theory. The first refers to the division of knowledge and

labor, and, building on the legacy of Smith, Petty, Babbage and Storch, recent contributions include works by Leijonhufvud (1995), Loasby (1999), Metcalfe (2002), Corsi, (1991), Helmstädter (2003), Antonelli (2003), Amendola and Gaffard (2003), and Foray (2004). In his "History of Economic Analysis" (Schumpeter 1954), Schumpeter refers to the classical precursors, but in his own theory the works of these authors do not play any role (for reasons mentioned in sec. 7).

The second refers to the self-organization of the activities of many autonomous individuals. The claim of neoclassical economics has been that it can provide a solution to the problem of the "invisible hand". The fact is, the Walrasian simultaneous equation system provides an account of the equilibrated post-transaction state of all commodities, but it does not provide any mechanism of coordination. The auctioneer (as later generations called it) is an exogenous central agency that can represent the invisible hand of the market as it can represent a Soviet central planning agency. In a centrally planned economy, the coordination is top down, but in a market economy, it is bottom up, and any theory that fails to recognize this fundamental systemic-empirical difference is bound to be seriously flawed. Contributions that deal with the problem of decentralised coordination include the works on self-organization by Witt (1985), on coordination as network processes by Potts (2000), Hutter (2001), and Herrmann-Pillath (2002), on complex systems analysis by Allen (2001), on the autocatalytic character of productive knowledge growth by Brenner and Cordes (2004), on the experimentally organized economy by Eliasson (1978, 1991), and on cellular automata as markets by Mirowski (2002) and (as a critique based on a rule approach) by Potts and Morrison (2006). These works are paralleled by developments in agent-based computational economics, where agents are taken to be a bundle of data and behavioral methods, and the objective is to generate particular classes of macro regularities from particular classes of repeated interactions of agents. Contributions to this field include works by Pyka and Fagiolo (2005), Tesfatsion (2002), and Bandini, Manzoni, Vizzari (2004).

Further works that deal with the economy as a whole refer to order. Order is a theoretical term, defined, for instance, in terms of (deep) structure-efficacy and (surface) process-efficiency, but it is also a political term in that it can be associated with desiderata and conditions conducive to reach them. Methodological individualism implies that actual individualism is possible politically, but the latter does not produce a priori the political conditions which make it possible. The early proponents of German ORDO-liberalism thus thought that the spontaneous conditions of order occurred only in Manchester, while in the rest of the world it is required that these are ensured by political authorities.

This aspect of order is prevalent in the works of Eucken, Röpke, Böhm, Müller-Armack as well as in that of Hayek and of Loewe. (Blümle and Goldschmidt 2002). Building on these, contributions to an evolutionary economic policy - to wit, premised on individualism and spontaneous order - have come forth by Wegner (2005), Koch (2005), Okruch (2003), Kerber (2005), Vosskamp (2001), Schnellenbach (2002), and along the lines of industrial policy alternatives by Elsner and Groenewegen (2000). Schumpeter was a finance minister and banker in Austria (both with mixed success), and his policy concerns revolved around budgetary questions, as the "*Rechenpfennig*", and not around order. When he detected tendencies of concentration and petrification of capitalism in the 1930s and 1940s, he did not turn to the *ORDO-Lehre*, but provided instead a predictive account of the future of capitalism on the basis of his own theory. (Schumpeter 1942).

The strength of Schumpeter's work lies in non-systemic process analysis. Much of his work was devoted to the taxonomic, statistical and historical analysis of cycles or waves of all time scales. The popularity of Schumpeter's work since the 1980s can be largely attributed to the fact that, from that time on, the diffusion of an increasing number of important and often clustered innovations could be observed and that Schumpeter's hypothesis of a Kondratieff cycle provided a neat explanation for this. Contributions to the analysis of various cycles, including that inspired by Kondratieff, include those by Freeman and Louça (2001), Andersen (2002, 1994), and Metz (2002).

Schumpeter pioneered meso, and the core of the Neo-Schumpeterian program is meso. The contributions to this large and growing research area include works on life cycles by Klepper (1997), on modelling industrial evolution by Winter, Kaniovski and Dosi (2003) and Dosi (2000), on Schumpeterian competition by Winter (1984), on selective adoption and self-organization by Gowdy (1992), Foster (2000), and Knudsen (2002), on the historicity of industrial evolution by Malerba, Nelson, Orsinego, Winter (1999), on path dependence by David (2005), and Arthur (1989), on industrial organisation and innovation dynamics by Werker and Athreye (2004), Malerba (2006), Audretsch (1995), and Cordes (2005), on technical systems by Carlsson and Stankiewicz (1991), on heterogeneity, networks and industrial innovations by Cantner and Krüger (2004a, 2004b), Pyka (2000), Saviotti and Pyka (2004), and Saviotti (1996), to mention but a few from a rich set of important contributions.

The first phase of a meso trajectory deals with novelty that always originates in micro, and, from an economics point of view, micro is therefore particularly relevant. The micro adoption and retention determine the speed, relative adoption frequency and

structure of the meso diffusion curve, but innovations describe the global growth dynamic and qualitative course of economic development. Works on micro (quite a few of them conducted in the management sciences) are legion, and include works on an evolutionary, knowledge-based theory of the firm by Augier and Teece (2006), Foss and Klein (2005), Dietrich (2006), with emphasis on novelty and development Witt (1998) and Rathe and Witt (2001), Beckenbach and Daskalakis (2003), Encinar and Munoz (2006), and as a neo-Schumpeterian theory of the firm by Winter (2006), Levinthal (2006), Langlois (2005), Grebel, Pyka, and Hanusch (2003), Ebner (2001).

Schumpeter emphasized consistently that economic growth is different from economic development, the former dealing with quantity and the latter with quality. He contended that, in this way, population growth or an expansion of the capital stock could lead to economic growth, but never to economic development that necessarily involved qualitative change brought about by innovations. A theoretical account of the phenomenon of quality is thus essential, but Schumpeter had surprisingly little to say about it. In fact, a number of his statements are quite misleading, for instance, when he says that economic development represents an outward shifting of production functions or production possibility curves. Mathematically, this can be treated as a step function, but theoretically the construct is meaningless since it is exactly the 'in between' of the two functions that is theoretically interesting. Even if one attempts to fill the gap, it still would be difficult to see how the factorial quantities of the function could ever serve as a base for an explanation of the phenomenon of a qualitative transition. It is a major challenge for a generic theory of economic change to deal with quality, and the question is how to meet it.

In their "An Evolutionary Theory of Economic Change", Nelson and Winter made a seminal contribution to economics by introducing Schumpeter's concept of innovation and by developing it along Darwinian lines. However, unlike Schumpeter, they unpacked the intricate notion of innovation by suggesting the concept of routines. Their work gave rise to an enormous and still growing literature in the fields, on the one hand, of evolutionary growth theory as mentioned above, and, on the other hand, of routines. The latter developed into a multi-faceted venture with contributions by Hodgson (2000), Hodgson and Knudsen (2005), Lazaric and Raybaut (2005), Vromen (2004), Cohendet and Llerena (2003), and, rediscovering Veblen along micro-meso-macro, by Brette and Mehier (2005).

The problem is to cope with quality in an economy, and this poses the question of how to formulate a concept with sufficient degrees of generality and of how to define

the scope of its application. We have introduced the canonical approach of rule, where rule has been defined as any idea with a deductive format for economic operations. The question then is: how can we conceive the economy as an evolving structured composite of rules, or simply, where are rules in an economy? Broadly speaking, rules are actualized in subjects and objects. (Dopfer (2004, 2005), and Dopfer and Potts (2006)). As for subjects, or human individuals, they are carriers of cognitive rules that allow them to perform operations in the 'internal environment' of the brain, and behavioral rules that allow them to perform operations in the 'external environment' of social contexts. There have been early contributions to both by Hayek, and works that have been developing his and further ideas on cognitive rules, 'rules of conduct', and 'interactive rules' include that of Vanberg (2005), Ostrom (2004), Rizzello (1999), and Budzinski (2001).

Object rules refer to any possible rule carrier that is not a subject. Object rules are associated with organization. The distinction here is between social organizational rules and technical organizational rules.

These analytical units suffice to locate unambiguously the place of Nelson-Winter routines within the canonical rule framework proposed. A routine, or "organizational gene", is a rule whose carriers are subjects in a context that is organized by social and technical rules. A particularity of the term routine is that it refers, at least literally, to a completed process of routinization. Inspired by Veblen, Day called it habituation. (Day 1975, 2001). In a narrower meaning, routines are therefore subject rules that are in the third phase of adoption organized in a context whose rules are equally in the third phase of adoption. (14).

Technical rules refer to both single objects, such as machines, instruments and buildings, as well as composites of interconnected objects, such as the technical organization of a firm or the technical organization underlying the division of labour of an economy.

From an economist's point of view, the canonical rule approach has the advantages that

- (i) it comprises the total set of rules relevant for an economy,
- (ii) explicates both the status of idea and actualisation, and
- (iii) embraces all phases of the process dynamic of rule, namely creation, adoption and retention of rule, which in the last phase is - if it is a subject rule actualized in an organised context - a routine.

Quality refers to ideas, and unless we define the nature of these, a rule or routine approach is bound to remain incomplete. Ideas come in the literature in various guises, as mental models, cognitive programs, algorithms, heuristics, theories, receipts, mental conjectures, scripts, paradigms, modules or mental schemas. The literature abounds also here, and, continuing what we honestly feel may be only a random walk in the choice space of important works, we include contributions by Vromen (2004), Nooteboom (2004), Denzau and North (1994), and Fields (1984).

These works provide a broad range of theoretical specifications, but from an economics, as well as interdisciplinary, point of view, the question arises how these can be generalized into a concept that can explain major questions related to the economy or society. Employing a rule approach, the nature of ideas can be discussed in the framework of a rule trajectory. The question is, how the content - or *noetic core* - of a rule influences the behavior of agents, for instance the decision to adopt the rule, the propensity to learn it or the willingness to accept its guidance in habit following. (15). The question is not what the nature of the agents is, but what the nature of the rule (created by an agent) is with regard to its ability to influence - in its message content - an agent or plurality of them. Theoretical answers refer to issues such as social organization (e.g. motivation) in the firm (micro), seemingly irrational behaviour in financial markets (meso), the persistence of institutions in a Schumpeterian stationary state (macro), and, last but not least, the lock-in power of self-confirming scientific theories (meta). (16).

17. Conclusion: You will get a railway

The approach that emerges from Schumpeter's work differs from mainstream economics in that it builds from a set of generic variables, while the latter analyzes operations in a commodity space, keeping the set of former variables constant. In mainstream economics, the micro-macro framework serves well the purpose. Aggregation and disaggregation are mirror procedures, or, as Samuelson in his textbook says, you can start either with micro or with macro as you like it. In the generic program meso is central. Meso serves as both structure component and process component explaining generic structure and generic change. To rely in this program only on micro and macro is like Hamlet without the prince. Schumpeter made the cast complete by laying the foundations and by contributing theoretically to meso.

While Schumpeter taught us a lesson whose full significance for economic theory we only gradually come to grasp, his work also has considerable deficits. However,

we think that these can be overcome by turning to the works of economists of other strands of the generic program, in particular to those of Hayek and of Veblen.

The core of the emerging unified program is a coherent and consistent treatment of knowledge. Schumpeter had a dynamic perspective, and, accordingly, the specific core of his program is new knowledge or innovation. Schumpeter highlighted the essential nature of the phenomenon of economic development by contrasting it to operations in stationary states. As he noted, you may add as many mail coaches as you like, you will never get a railway. The basic nature of his theory can be highlighted by employing analogously this exemplar: add as many operant theories as you please, you'll never get a generic theory thereby. Let neo-Schumpeterians head for the railway.

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Notes

- (1) The concept of *meso* takes on an intermediate position in the distinction between *micro* and *macro*, and hence presumes that distinction. The micro-macro distinction became popular after the publication of Keynes's "General Theory" where he demonstrated that the aggregates of individual decisions (micro) of a Walrasian or similar (neo-) 'classical' equilibrium was consistent with various states of the system when defined in terms of aggregates of other (macro) variables, in particular employment, income and money volume. The present-day proponents of the so called "new" classical macro economics

view the problem differently, but the important point here is that the established distinction between micro economics as dealing with Walras-type decision variables and macro economics as dealing with the mentioned aggregate variables has survived and is serving as a powerful taxonomic device and classifier for textbooks and teaching curricula in the discipline. This dichotomy did not exist at a time when Keynes was alive and when Schumpeter wrote his essay on Keynes. Schumpeter suggested to call “monetary analysis” or “income analysis” for what today is called macro economics arguing that “(s)ince the aggregates chosen for variables are, with the exception of employment, monetary quantities or expressions, we may also speak of monetary analysis, and, since national income is the central variable, of income analysis.” (Schumpeter 1952, 1997, p. 282). It is evident that the usage of the terms micro and macro economics is a mere convention and that we could employ with equal vindication Schumpeter’s terminology, or a similar one, to denote appropriately the distinction between the two sets of variables. Evolutionary economists see no necessity to follow the conventional terminology and usually refer, when talking about *micro* economic analysis, to firms, households or behavioural routines, and when talking about *macro* economic analysis to the division of labour and knowledge or static and dynamic relationships between aggregate magnitudes. The term ‘*meso*’ emerges as constituent concept, as we shall see, from an evolutionary perspective that defines micro and macro in this way. (For further discussion sections 10 on ‘Meso economics’ and 12 on ‘Macro: The seventh chapter’).

(2) The concept of “*object*” allows us to include both non-economic and economic entities, and thus to refer to broad differences when investigating into the nature of objects. More specifically, we can relate the concept of object to that of *goods* (including services), and define the latter as any object that is a tradable; for instance, wheat is an object in a metabolic process, but becomes a good when it is a tradable in the wheat market. A *commodity*, then, is not a specification of an object but of a good. Following Gerard Debreu, a commodity is a good “defined by a specification of all its physical characteristics, of its availability date, and of its availability location. As soon as one of these three factors changes, a *different* commodity results.” (Debreu 1959, 30, *emph. as in orig.*). Debreu emphasises “the full generality of the concept of commodity.” (Debreu 1959, 32). In the next section, we shall argue that this generality is relative in that it includes only the operant, but not the generic level of an economy. Debreu provides a good example of what can be called the “Commodity Approach”. He claims generality of his variant of a commodity approach as follows: “By focusing attention on changes of dates one obtains, *as a particular case* of the general theory of commodities, a theory of saving, investment, capital, and interest. Similarly by focusing attention on changes of locations one obtains, *as another particular case* of the same general theory, a theory of location, transportation, international trade and exchange.” (Debreu, *op. cit.*, *emph. as in orig.*). (See also discussion on the Mill-Sraffa view that “production factors are the commodities”, section 13). The Debreu, or respectively, Arrow-Debreu-Hahn model, can be viewed as one of several possible models for the analysis of the ongoing operations and resulting (equilibrium) states of an economy at the operant level. The term ‘commodity’ is appropriate for the analysis of this level, and we shall adopt it in this way in our analysis. However, we shall not follow the universal claim that the ‘Commodity Approach’ represents the master model of the discipline upon which further theorizing about coordination and change can and must be based. As we shall see, Schumpeter fell into the trap of this fallacy when taking Walras’ equilibrium model (and implicitly its Arrow-Debreu-Hahn offspring) as a solution to the coordination problem of the economy. See section 12.

(3) As in the case of micro and macro (footnote 1), we encounter again a language deficit. Generally, we shall make a distinction between the operant and the generic level. In

footnote 2, the term operant has been associated with a 'Commodity Approach'. The term 'generic', in turn, shall denote the set of slow changing or 'classical' variables; these are typically kept constant in neoclassical economics.

We are of course free to choose any term, but we think that the use of the stem 'gen-' has the advantage of embracing various meanings that are relevant for our analysis. The term 'genetic' is used in biology in reference to biological information, but we are interested only in the general aspect of information (gen), not in its biological specification (-etics, or gen-e). The 'gen'-related biological language is of quite recent origin; in the days of Weismann the term 'germ plasm' was still used instead of 'gene'. The stem 'gen' can be also associated with the term 'genesis' or 'generation'. The use of this meaning of the word stem is relevant for our analysis when dealing with change, for instance, when discussing the generation of novelty. While it would be sufficient to call this level simply X-level, we think that the term 'generic' can additionally provide also a substantive meaning in that it can be associated in its stem generally with information, but does also allow us to distinguish biological information (gene, genetic) from social and economic information (generic rule, generic analysis), and because the generality of the word stem allows us to include other relevant meanings, such as (rule) generation. For further discussion see (Dopfer 2005); also footnote (6).

(4) The entropy law applied in its wider sense states that all physical phenomena follow an irreversible course from order to chaos; chaos denoting here non-order, without the predictive connotation of the chaos models.

(5) For an exposition of an evolutionary ontology composed of three "empirical axioms" (bimodality, association, process) see Dopfer (1990, 2001). A comparison of these with the "empirical axioms" of a mechanistic ontology may be found in Dopfer (2005). For a discussion along the lines of "evolutionary realism", see Dopfer and Potts (2004).

(6) For a rule approach, see Holland, Holyoak, Nisbett, Thagard (1986). Our unified rule approach resembles in many ways that of Holland, et. al. However, it differs in that it places at center stage not environmental rules, but distinguishes between subject rules (cognitive, behavioral) and object rules (social and technical organizational). It, further, introduces a multi-level (micro-meso-macro) co-evolutionary dynamic between the two with a view to explain the static and dynamic of the economy as a whole. *Rules* and (rule) *carriers* are the primary analytical units of the *generic* level of the economic system. See footnote (3).

(7) Heertje has remarked with regard to Schumpeter's work that "technical change in the strict sense of the development of new knowledge and possibilities, and the diffusion of knowledge are almost wholly absent from his exposition." (Heertje 1988). This is well taken, and is a direct consequence of Schumpeter's failure to cope with circularity. The list includes, besides path dependence, a number of further approaches that were developed particularly between the mid 1980s and the mid 1990s, such as network externalities, synergetic parameters, increasing returns, indivisibilities, bifurcations, sensitivity to initial conditions, and predictive chaos. See also sect. 14 on "*Schumpeter as a Knowledge Agnostic*".

(8) See note (11).

(9) The editor of a special issue in which the seventh chapter was published and discussed poses in his introduction the question: "Why then did Schumpeter drop this innovative chapter from the second edition, and never refer to it again in his own published work? There is no clear or easy answer to this question." (Mathews 2002, p. 2). As we have

argued, the chapter is simply superfluous in view of the fact that it does not provide the reader with any additional theoretical cues as to the problems of the "economy as a whole". We agree with Mathews's further conjecture that it is unlikely that Schumpeter had disagreed later with what was written in this chapter.

(10) To wit, positivism rejects the notion that (unobservable) ideas could play any role as variables (or as terms of the protocol language) of a scientific theory. Theories had to be stated in terms of observable and measurable matter-energy actualisations. There is arguably objective knowledge in any physical actualisation - an idea or rule carried by an entity -, but since that idea or rule had been assumed to represent a "law" and thus was constant, it made no difference whether or not ideas were part of a theory, and, employing Occam's razor, one could do without them. As shown in section 14 on "*Schumpeter as a Knowledge Agnostic*", Schumpeter explicitly rejected the view that an economic development (or cultural) theory could be built on the notion of idea or knowledge. This is a disturbing fact, since he talks about innovations, novelty or qualitative change all the time, and these arguably refer to ideas or knowledge - to what else? To be clear, the issue here is not to substitute quantitative analysis of physical actualisations with qualitative analysis of ideas or knowledge, but rather to reject the view that the latter are empirically without genuine (ontological) weight and that the analysis of economic phenomena can be conducted in terms of quantifiable observables only.

(11) Translations of Schumpeter's original works in German are generally by this author. This includes the quoted passages of chapter 7 of Schumpeter's "Theory of Economic Development" (1912). There is a good translation of chapter 7 by Ursula Backhaus in *Industry and Innovation*, Volume 9/1 and 2, April/August 2002. There are some differences in her and my translation, but having used my translation already in my earlier work and for the sake of coherence, I stick to my own. In no way does this question the validity of her translation.

(12) The generic architecture proposed gives the notion of relative frequency a dual meaning. First, referring to *process*, it can be conceived as relative *meso frequency*, second, referring to *structure*, as relative *macro frequency*. The issue of relative frequency and its significance for economics has been thoroughly analysed by J. Stanley Metcalfe (1998, 2005), Metcalfe et. al. (2006).

(13) The idea to state the theoretical propositions in terms of differential probabilities has been suggested to me by my former student Georg D. Blind. I gratefully acknowledge his contribution.

(14) Subject and object rules have the same characteristics with regard to meso. There is an origination and mesoscopic diffusion of the rule. The difference is that subject rules have (unlike object rules) an "internal" trajectory, for instance, subject rules are learned.

(15) This itself refers to the actualisation of a "deeper" rule. Our approach is premised on the idea that rules (used for operations) are originated, adopted and retained by humans (HSO). For this, humans require a mechanism that itself is composed of rules. While the genetic endowment - that itself can be viewed as composite of biological rules (genom) - plays a major role in that process, it is assumed that human agents (during their life time) originate, adopt and retain (cultural, not biological) rules that refer to the mechanism itself and not only to rules that enable to perform operations. We call the latter 1st-order or operational and the former 2nd-order or mechanism rules. For further discussion of the various orders of rules see Dopfer and Potts (2007).

It is immediately clear that the two interrelate in complex ways and that they both belong to different orders of complexity. In fact, the 2nd-order (rather than 1st-order) rules distinguish in an essential way the higher primates from humans. While chimpanzees, etc. can learn operations, that is, adopt observed behaviour, they cannot invent or learn the 'learning rules' themselves. Most of the cultural advance of the human species depends on exactly this capability. The two types of rules involve different orders of complexity, that is 2nd-order rules are more complex than 1st-order rules. The upshot of this distinction is this: solutions to problems of 2nd-order complexity require imagination. Chimpanzees can learn operations, but humans excel in their imagination - to originate, adopt and retain 2nd-order rules. (Dopfer 2004).

(16) Any rule has a deductive format, but - among and within rule types - the specific construction of that format may differ widely and decide over the adoption probability and survival of a rule. Generally, a rule can be seen as being powerful to the extent it can attract and 'lock in' cognitively an individual. On the role of so called cognitive 'closure judgments' that lead any 'inquiry' always back to an already adopted rule, thus - self-referentially - confirming its worth and establishing a selective advantage over others see Dopfer (1991) and Hayden (2006).