Agent Behaviour, Financial Market and Welfare Theory

Dr Bernard Paranque, Dr Walter Baets, and Dr Henry Pruden, Euromed-Marseille Ecole de Management, Marseille, France

ABSTRACT

An important literature has pointed out the coordination problems faced by the agents, in particular the financial one when they have to manage risk and their portfolio. If we follow Kaldor and its definition of speculation, then we could point out that in this case agents are short term oriented because they have to face to an uncertain reality: uncertainty about the behaviour of their competitors at present time and in the future, and uncertainty about the future reality which will be built by their own decision and action. Then each agent tries to anticipate the behaviour of the others, on one hand to do the same (then in average it is a way to avoid lost), on another hand to try to find an opportunity which has not been seen by the other (the way to earn money, doing what the other can't or may not do), that means mimetic versus opportunism (or free rider behaviour). In both case, we have a kind of reproduction of habits without any collective perspective. The latent hypothesis is that individual decision produces the people satisfaction, the social welfare. We thinks there are three reasons to disagree with this hypothesis (cancelling that it does not work in reality): a lack of specific tool allowing us to anticipate change and communicate about it; a lack of understanding "what is the common reality"; a lack of an agreement on "what and how can we do together". That means that we need to understand that rules are not a constraint like they could be in the contract theory but more a through out line to help us to coordinate a collective action

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INTRODUCTION

In previous papers (Pruden, Paranque, Baets, 2004; Baets, Paranque, Pruden, 2004) we have shown another interpretation of the irrationality of financial market agents. We organized the analyses around a "positivist theory" of behavioural finance and the "nominal theory" of technical market analysis rules. The behavioural finance model for structuring the data of the experiment was the Cusp Catastrophe Model of non-linear behaviour. The nominal model, based upon the data exposed by the positivist model, was a group of four technical market analysis principles and one mental discipline/trading strategy discipline. We have also tried to extend the interpretations of the findings.

The previous paper presented a methodology to anticipate the break down of financial markets. The question could therefore be, not only how to anticipate the consequences of financial agents' behaviors, but also how to give these agents a way to modify their own behavior. That means, above all, to have a common vision of our world. Our present contribution tries to give an answer.

THE CAL TECH EXPERIMENT

The focus of attention of the Cal Tech experiment was upon the "Irrational Exuberance" displayed by student traders who swarmed together to carry the price of shares in a fictitious oil well to an extreme level that far exceeded the oil well's underlying economic value. The belief system of these student traders who engaged in the buying and selling of shares so as to collect and dividend and then by win the game was essentially "the greater fool theory". Indeed so long as there was someone else willing to buy at an even higher price, each individual agent or trader involved would seemingly be acting rationally even. Though their collective behaviour created a speculative bubble that led to a subsequent crash in the price of the stock. This experiment at Cal Tech took place in the year 1997; this experiment that revealed boom and bust that soon followed in the world's stock marketer.

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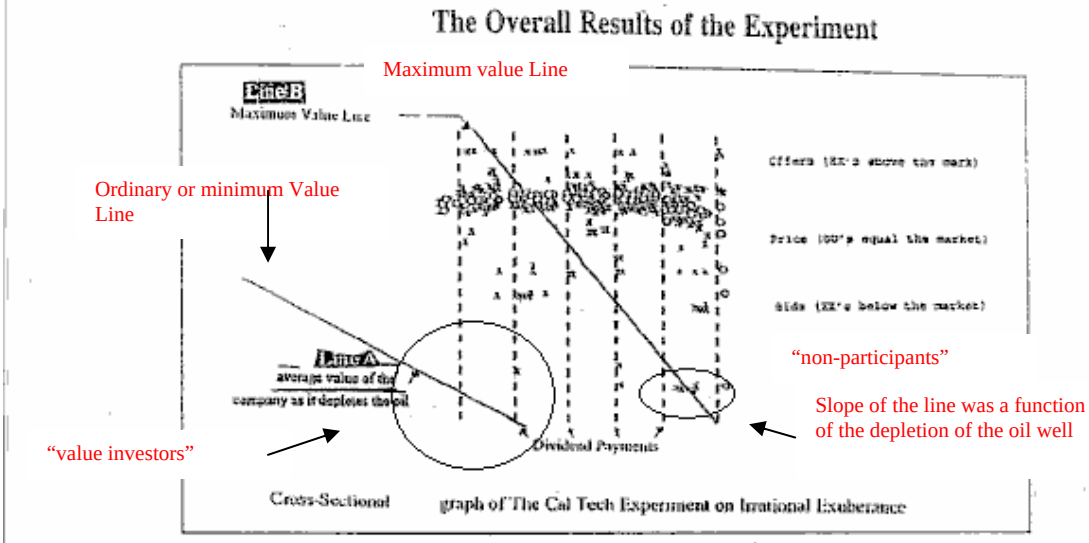
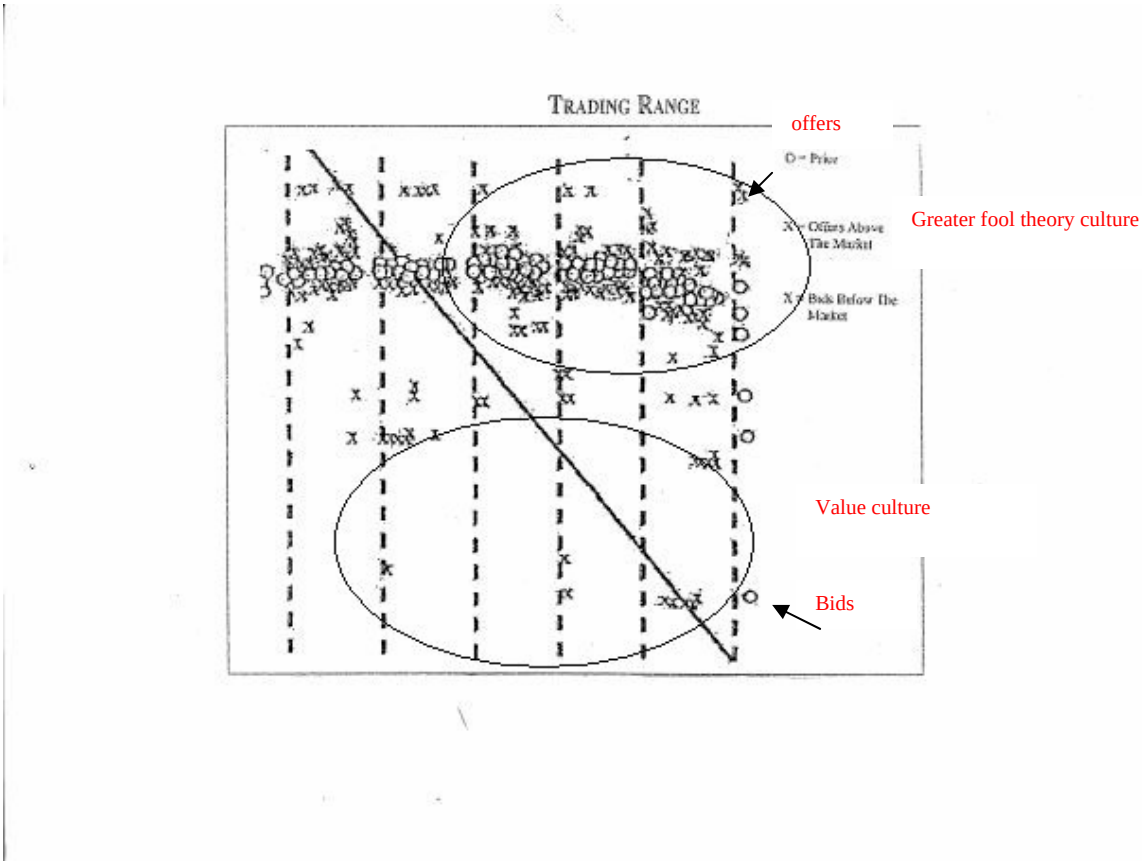


Could the result have been any different? Were there available alternative belief system that could have brought about a different constellation of results? If so at what price and under what circumstances?



In this paper the authors wish to look beyond the obvious, dramatic data of the experiment in an effort to examine either the presence on the possibility of alternative belief systems and different structures of interaction and exchange. Then the co authors consider being a challenging and uncertain undertaking. The author's appreciate that the structure and the motivation of human actors being acting as individual agents in a competitive exchange environment may inevitably induce the conditions of rampant speculation according to the greater fool theory. But the negative consequences to the majority of the participants in such a savage game bring up issues of social ethics and social welfare?

However another than simply dream about an utopian ideal, the possibilities of substantially different outcomes will be considered rend to the extent possible related been to the data generated by the experiment involving human actors ; to the premises or rules of the game that may have pre-destined the behavior of boom and bust.

The Value Investor

One can observe that a cadre of student participants declined to play the game according to the premises of the greater fool theory. Presumably the belief, the value system of these non-participants was akin to a well known Wall Street type, the "value investor" hat us posit an assumption the value system, the belief system, held by the non-participants was that of the rational economic man, the rational investors. The pattern of bids offered at prices consistently at or below the diagonal vectors showed a strong conviction in their beliefs t o value pricing as opposed to the price levels generated by the actors who were playing the greater fool game.

Elsewhere in this paper the Professor Baets will offer possible explanatory models to account for the phenomenon of the non-participants, be they motivated by repulsion or revulsion of the speculative crowd. They absented or were they indeed steadfastly adhering to the economics of the value investors. It should be noted that in the real financial market of the late 1990's, the value investor was left sitting on the sidelines because they refused to risk money in the inflated values of the late 1990's, even at the cost of under performing the market averages and losing customer. Like a religious cult that sensed that the end-of-the-world was nearing, they may have become ever more stead fast in their belief as the collective madness of the crowd vaulted the spare price of the oil well in the experiment even farther from underlying economic value. Ultimately other agents in the game gathered around their banner as can be observed in the rising chorus of lower and lower priced (see figure, the rise in fear greed bids). This migration toward the value pole and ever lower bids reflects the contrasts and implicit conflict between the two cultures of value investing versus the greater fool theory.

A question of social welfare?

The "rules of the game" set out by Professor Plott and his colleagues to guide the participants of the game are the following one. Given the "dog -eat-dog" and the" winner(s) take the cash-prize environment" set forth for students in the game (and in our security markets), it was no surprise that a speculative bubble would emerge not that the resultant structure of collective behaviour could be explained with agent behaviour and swarm theory.

These "rules of the road" were set outside of the experiment but never the less they were potentially determining, perhaps those rules set in motion a "self fulfilling prophecy". Implicit in those rules were a set of rules, a belief system about now a market should be structured and hare the payer ought to might be encouraged a behave.

In the third section an alternative "set of rules of the game" is offered based upon the belief system of "social welfare". Some conjectures will be present as to how the collective behaviour of the experiment may have played out. A different assemblage of price data, bids and offers could be seen to have resulted. The consequences to all but especially the victims of the crash can be seen. Finally the last section of the paper will conclude with some preliminary hypotheses and operational definitions which could be employed in a future experiment to test the social welfare model.

AGENT BEHAVIOUR AND SWARM-LIKE THEORY

In the part A article, we have observed a clustered, rather linear and persistent behaviour of actors/agents. In fact, an interesting observation is that the model visualizes the emergence of certain kinds of local stabilities (probably comparable to what is known as attractors in complexity theory), before something like a (belief ?) shift takes place moving the agents and the system into what could be called discontinuous behaviour. The model indeed visualizes emergence of interacting agents, but as it is defined, of course, it does not allow us to gain insight into the mechanism of the construction of the phenomenon it describes. If we would like to take this argument further than what the paper suggests, and get a deeper understanding of both the market behaviour and, specifically, the role of the interacting agents, we should go deeper into theories that are emergent in nature, and simulate agent based behaviour.

Commonly known are SWARM-like theories.

Behavioural Finance and Technical Analysis point out the co-ordination problem of the agent's action. This is commonly accepted, but, until now, it has been studied under a certain (widely accepted) ontological and epistemological assumption, i.e. that reality is based on a causal interaction between variables, independent of e.g. the emotional aspects of human agents. It is based on the assumption of a majority of cognitive psychologists who still consider the mind as a processor (a computer) of information that is outside the person. It denies that the observer creates his own reality while observing, and it denies the fact that market behaviour is made up of a momentaneous interaction of agents (and their respective behaviours). A consequence of this ontology is that only what can be measured could be managed, and more broadly, only what can be observed exists. It is this rational, reductionist view of human behaviour that we often find in technical analysis. Within this ontological and epistemological choice, causality makes sense, and (knowledge) engineering approaches should be able to give answers to issues of market behaviour. Knowledge engineering techniques have been extensively used in order to construct market analysis tools.

Keep in mind that we classically talk about emotions and psychology, but always and only within the above described ontology. That seriously limits our view and hence what we will eventually observe. In order to observe differently, we have to first investigate the ontology behind our thinking. An ontology that increasingly gains attention is the one based on what neurobiologists (Maturana and Varela) call an enacted and embodied view of cognition. This ontology is one that is based on the acceptance that the observer himself creates the reality which he observes.

There is no reality, but it is created as you observe.

This concept would indeed allow us to explain what we could call non-rational behaviour of traders for instance. Traders are not irrational, but they can only observe the reality which their experience (and their learning) allows them to observe. This ontology empowers the agents to interact in a network, and then to create together (in a dynamic process) a reality. In fact this ontology is an emergent one, in which knowledge and behaviour are continuously created via interaction, and hence cannot be anticipated using top-down (causal) models.

Indeed, this ontology is not based on causal relationship, but rather on synchronicity (being-together-in-time). We will get back to that later. For the time being, and in order to understand the essence of agents' behaviour, we make the choice that reality is created via the interaction of individual agents who create emergent behaviour. In the words of the famous Spanish poet Machado: there is no path; you lay down the path in walking.

What do we understand by enacted and embodied cognition, within an autopoetic system? An autopoetic system is a neurobiological concept that describes the behaviour of any neurobiological colony, including, therefore, human behaviour. An autopoetic system is one that organises and reproduces itself in such a way that is ideal for survival. The human body is an excellent example of an autopoetic system. Cells in the body continuously reproduce in order to help the body to survive. Furthermore, the body is completely self-organised.

Within such a system we can identify a mind (say an individual's mind) that is embodied, which means that it is not just embrained (the computer metaphor) but literally distributed through the body and via the sensors (the human senses) in continuous contact with its environment. The environment co-creates the mind. Cognition, which will eventually lead to behaviour, is then enacted. Enaction has two dimensions: action and shaping. Therefore cognitive action always contains these two components: action and creation. All the rest is information. We hit a common misunderstanding between knowledge and information. Information is static (and linear) and therefore can be copied and repeated, whereas knowledge is dynamic (and non-linear) and therefore needs to be created over and over again each time. Complexity theory (Nicolis and Prigogine) has proven that to us over the last 30 years. The enacted view on knowledge (and behaviour) allows us to explore models that have creative force and show emergent behaviour.

An often-made assumption, that we presume is too limited, is that rational (human) behaviour could only be causal (based on the hidden ontological assumption described above). If it is causal one can write it down in equations that in turn would drive reality. If we really believe in behavioural theories, then let us take this to its finality: agent theory.

For the sake of clarity, we have already touched upon a few concepts of complexity theory (dynamic non-linear systems behaviour) that shed a completely different light on market behaviour (Baets, 1998a and b). Systems are auto-organisational, based on an embodied mind and on enacted cognition. Systems and

knowledge are created over and over again (which is, by the way, what our brain does, since it is the most efficient way of organisation).

Reality is not Newtonian (fixed time-space concept) but emergent (co-created in interaction). In my habilitation thesis I have called that "The quantum structure of business" (Baets, 2004). Complexity theory goes much further, but for the purpose of our argument, we can leave it here.

An interesting development, based on this complexity theory is what we know as artificial life research (Langton) and one of its further developments, i.e. agent based simulations (Holland). Agent based simulations is a development in artificial intelligence, that, in contrast to what AI is unfortunately still known for, i.e. expert systems, exposes learning behaviour. Indeed agent simulations are based on the interaction of individual agents, that have individual qualities and purposes, and that agree on a minimum set of interaction rules.

Behaviour is clearly dynamic and produced in the continuous interaction of agents that exchange information with each other. The least one can say is that this is very similar to human behaviour, particularly on financial markets. Where catastrophe theory implies a time dimension, agent based simulation gives due importance to what Prigogine calls the "constructive role of time". Each time we bring in the arrow of time, let us say the constructive role of interaction, behaviour gets created; it literally emerges.

This view supposes a number of "interacting" agents, within a specific field (of action) each having their own personal qualities and goals and following a minimum set of interaction and exchange rules. The question then becomes how such a complex system could come to a coherent state. Most suggestions go in the same direction. Varela suggests resonance as the mechanism; Sheldrake suggests morphogenetic fields: sense is made out of interaction in a non causal way. This mechanism of resonance is what occurs in "SWARM"-like societies (Epstein and Axtell, 1996). In fact we are talking here of agent theories. In agent theory, as already suggested, we only have to identify the playing field (let us say a particular financial market) and a number of agents. Each agent is autonomous in achieving his goal(s) and is, of course, gifted with qualities (like experience, information, human characteristics). Those agents interact with each other based on a minimum number of interaction rules. Those rules govern the behaviour in the simulation, but they also define the learning of the different agents. Then agents, translating learning into (new) action, co-create in interaction with each other, continuously new (and adapted behaviour). Indeed, in such a market, the "path is laid down in walking", just as reality is in financial markets.

The argument hence becomes to take Catastrophe theory one step further to its intrinsic ultimate claim, i.e. that time plays a constructive role in (market) behaviour. In our own research (Baets 2004 and 2005) a number of projects are undertaken using agent theories, but not yet in the financial markets. They have been successfully used in order to visualise the emergence of innovation in a large consumer goods company; to visualize emergent market behaviour, allowing identification of an adapted market introduction strategy; to study emergent states in conflict handling.

The basic question leads us back to the ontological choices we discussed earlier. Once we accept complexity theory as a promising paradigm, we cannot avoid the question of causality. Quantum mechanics has given the world a tremendous dilemma. How is it possible that two photons moving in different directions still keep in instantaneous contact? As Pauli (Van Meijgaard), amongst others, suggests, there should indeed be interaction in a non-local field. Things seem to occur "at the same time" without having any causal relationship. It is this quantum structure of (financial markets) that deserves our attention in order to improve our understanding of market behaviour (Baets, 2004).

THE NEED OF AN AGREEMENT TO ACT TOGETHER

« Behavioral Finance and Technical Analysis » point out the coordination problem of the agent's actions. More precisely, the question is the effect of the action of certain kinds of agents on the collective welfare and, by consequence, how to anticipate negative consequences. There are three main answers: the first is the laws and other professional rules such as SEC, Basle and so on; the second is the availability of tools allowing actors to avoid problems like the one proposed in the article quoted above; the last is at the level of the individual and it's own capacity to take into account the collective interest of so-called social welfare. The neoclassical theory says that, under specific hypotheses, markets, and particularly financial markets, are the best way to ensure the right allocation of resources. But, since the hypotheses are never verified, we need other tools to manage the market. We need to have tools to help us. We will not speak about laws and regulations as prepared by Basle2

We will focus on the behavior of the individual. There is a lot of criticism pointing out the myopia of the agents, the mimicking of their decisions. Even these attitudes are the cause of the breakdown, when one loses his confidence in the others or, more relevant, one decides to change because he is able to influence the

market (in fact it is the only way to win: a winner needs a lot of losers; that means a lot of followers). But because of that, it could be possible to anticipate the breakdown if we are able to identify the main proxy of these strategies as it was demonstrated in the paper.

The main point is the social responsibility of each of us.

This responsibility cannot be assumed without clear rules of action. I would like to take an example.

In an article published in October 2001, Jensen highlights the operational limitations of the prevailing interpretation/use made of value maximization and the stakeholder theory.

He then engaged in a criticism of the central model of entrepreneurship with the polar figure of the manager and the shareholder in which he wants to introduce other stakeholders of the firm.

Without it being explicitly stated, it seems that the different financial scandals may have a bearing on the desire to explain the operating conditions proposed by these two theories, which are, in some ways, competing, and in others, complementary.

On the one hand, it is argued that value maximization for the shareholder, with all the problems in terms of monitoring this entails, is the best way to attain social welfare in a market economy; on the other hand, stakeholder theory stresses the need to take into account the interests of all of the stakeholders in a firm, including the customers, all of the suppliers, and the employees. According to Jensen, the complementarities of the two theories stem from the need to understand value maximization from a collective point of view: social welfare is only achieved when, on the one hand, "all of the value" contributed by each of the stakeholders is maximized, and on the other, this maximization of value occurs over the long term. The firm is therefore recognized as a historical and complex organization.

However, an operational problem arises if managers are expected to maximize value thus defined, in that there is no reason why the objectives of the various stakeholders should coincide. This criticism is valid both from the point of view of value maximization (how can several objectives be managed simultaneously?) and that of stakeholder theory (how is a common objective to be defined?).

In fact, if Jensen recognizes the relevance of the stakeholder theory, he underlines a problem. This theory is not able to answer the question of how to manage several aims which could diverge. He says, before managing the firm and maximizing its value taking into account the wishes of the stakeholders, there is the need to obtain an agreement, on the one hand about the hierarchies of the aims, on the other hand about the modalities of their accomplishment and the monitoring of the performances of the firms[2]. Thus, the agreement is the core of the deal and of the future performance because it determines the manager's value maximization strategy, in particular in the field of the organization of the firm. For the supporters of the stakeholder theory there is a tool, the « balanced scorecard », but, in accordance with Jensen, they say nothing about the initial necessity to obtain agreement on the objectives from every participant involved in the firm and then, on the way to build the common game rules.

The need of an agreement to act together

This concern, that of « social welfare », implies dealing with « des problèmes d'informations, d'anticipation et d'évaluation » (Salais and alii, 1986, p 193). In fact, at a collective level but also at an individual level, we need to agree on a common « reality », not only to build it but also to agree to act together in this perspective: « L'enjeu de ces négociations est le modèle d'interprétation à retenir pour « construire la réalité » qui se présente à eux [les agents] comme problème à résoudre »[3] (id, p 197-198). In other words, this necessary negotiation expresses a convention through which « l'accord des agents sur leur description du monde et leur [permettant] ainsi de coordonner leurs projets »[4] (id, p236) is approved. That kind of agreement « repose sur des processus sociaux d'élaboration de modèles de représentation de la réalité »[5] (id, p239).

The next question is how to manage this agreement at a collective level and an individual level. For that, we need to identify specific co-ordination principles on which we can obtain an agreement from the stakeholder and the availability of specific tools given the opportunity to manage collective behavior by anticipating the risk of breakdown - that is, the behavior of the one who does not play with the same aim. But, it

[2] Those interested may read a comment, in French, in Paranque (2004).
[3] The stake of these negotiation is the model of interpretation of the problems they faced and which the agents have to resolve
[4] The agreement of the agents about their view of the world allows them to coordinate their project.
[5] Is based on social process through which the model of representation of reality is created.

is not possible to negotiate this kind of agreement without discussing the relevance of the criteria of management and the sense of performance, and then the different understandings between the stakeholders. For example, from the workers' point of view, the starting point must be the value added and not the EBITDA or the cash flow, because the value added is the condition of their wages, despite the fact that wages have an influence on profit.[6]

In total, « entreprendre avec efficacité suppose de maîtriser l'incertitude relative aux marchés, aux technologies et aux produits futurs, la cohérence de ses propres projets par rapport à ceux des autres agents, partenaires ou concurrents. »[7] (id,p246). Nevertheless, the main point is the co-ordination of the agents' behavior which deals with the uncertainty of management.

"Dans un contexte de relations aux autres dont on ne peut faire abstraction, l'incertitude tenant à la personne doit être comprise comme une incertitude communicationnelle. Cependant, cette désignation est elle-même ambiguë, car elle pourrait laisser penser que l'incertitude se résume à un problème de circulation de l'information, à une imperfection. Or une information ne peut circuler que si elle a été au préalable élaborée dans un langage commun et que si, par conséquent, elle peut s'ajuster de part et d'autre dans un dispositif qui lui soit congruent (par exemple, la présence de codes identiques) »[8] (Salais, Storper 1993, pp 76-78) .

DISCUSSION AND IMPLICATIONS

There has been a lot of important literature pointing out the co-ordination problems faced by agents, in particular financial ones, when they have to manage risk and their portfolio. If we follow the thinking of Kaldor and his definition of speculation, then we could say that agents take a short-term view of things because they have to face an uncertain reality (Aglietta, 2001). Uncertainty about the behaviour of their competitors (the Other) in the present time and in the future, and uncertainty about the future reality arising from their own decisions and actions. Then each agent tries to anticipate the behaviour of the others, on the one hand to do the same thing (anticipating that it is a way to avoid losses), on the other hand to try to find an opportunity which was overlooked by the other (a way to earn money, doing something the other cannot or may not do), in other words mimetic versus opportunism (or free-rider behaviour). In both cases, we have a kind of reproduction of habits without any collective perspective. The latent hypothesis is that individual decision produces people satisfaction, social welfare. We think there are three reasons for disagreeing with this hypothesis (besides the fact that it does not work in reality): a lack of understanding "what is the common reality"; a lack of an agreement on "what can we do together and how"; a lack of specific tools allowing us to anticipate change and communicate about it. That means that we need to understand that rules are not a constraint like they could be in contract theory (Hart, 1995) but more a through-line to help us to co-ordinate a collective action (Moureau, Rivaud-Danset, 2004).

We do not agree with the standard approach based on "methodological individualism" and we are more involved in a global approach focused on the interaction between people rather than co-ordination between individuals.

To this extent we can define this approach as a "Euro-Mediterranean" approach. This approach highlights the complexity, the diversity, the dynamic and the synchronicity (Baets, 2004) of behaviour, in particular behavioural finance, as opposed to rationality, which is in general a way to reduce diversity, static and causality. The interaction between people is not based on causality – a contract cannot be efficient - but on a synchronicity of relationships based on "if you do that and I do that, we can do that together" without any kind of determinism. We call this approach an interpersonal approach (Salais, Storper, 1997); that is an approach where action and behaviour are evaluated in the process of the action itself and in which failure is sanctioned by a certain kind of expulsion from the community of producers, even the social community. So, contracts are not only between individuals but mainly implicitly between communities as we can see with the new ethical mutual funds or social rating. In this way, the deal concerns not only an operation but a process of social welfare.

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[6] "Wages regulation system (la forme salaire in French) maintains the workforce's lack of awareness of the work that has been achieved" (page 255 Salais et alii) to the extent that the accomplished work is revealed through the produced value once the intermediary consumptions have been paid, namely the added value (see page 227 as well as the written work by Paul Boccara on the subject at hand, 1985).

[7] To do something effectively required the mastery of the uncertainty relative to future market, technology and goods, the coherence of its own projects in comparison with those of others agents, partners or competitors.

[8] In a context of relationship with others, which is a common background, uncertainty relative to the person must be understood as a communicational uncertainty. However, this definition is itself ambiguous because it could let you think that uncertainty is only a problem of transfer of information, as an imperfection. But information can only be transferred if it is in a common language and then if consequently there is a good fit between both parties (for example, the existence of the identical codes).

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About the Authors

Henry O. Pruden, Ph.D.

Hank Pruden is a professor in the School of Business at Golden Gate University in San Francisco, California where he has been teaching for 20 years. Hank is more than a theoretician, he has actively traded his own account for the past 20 years. His personal involvement in the market ensures that what he teaches is practical for the trader, and NOT just abstract academic theory.
He is the Executive Director of the Institute of Technical Market Analysis (ITMA). At Golden Gate he developed the accredited courses in technical market analysis in 1976. Since then the curriculum has expanded to include advanced topics in technical analysis and trading. In his courses Hank emphasizes the psychology of trading and as well as the use of technical analysis methods. He has published extensively in both areas.
Hank has mentored individual and institutional traders in the field of technical analysis for many years. He is presently on the Board of Directors of the Technical Securities Analysts Association of San Francisco and is past president of that association. Hank was also on the Board of Directors of the Market Technicians Association (MTA). Hank has served as vice chair, Americas IFTA (International Federation of Technical Analysts): IFTA educates and certifies analysts worldwide. For eleven years Hank was the editor of The Market Technicians Association Journal, the premier publication of technical analysts. From 1982 to 1993 he was a member of the Board of Trustees of Golden Gate University.
Professor Pruden is a visiting professor/visiting scholar at EUROMED-MARSEILLE Ecole de Management, Marseille, France.

Dr. Bernard Paranque

Bernard Paranque is a doctor of economics (University of Lyon Lumière - 1984) and holds the "Habilitation à diriger les recherches" (University of Lyon Lumière 1995). He began his career as an associate economist in an accountancy firm in 1984.
In 1990, he joined the "Banque de France" (French Central Bank) business department. From 1990 to 2000 he produced papers on the financial structure of non-financial companies (see http://www.ssrn.com). He was a representative of the Banque de France in the European Committee of Central Balance Sheet Offices between 1993 and 2002.
In 1999, he was on secondment from the Banque de France to the Secretary of State to SMEs' where he was in charge of the "Business financing" department. He was also a member of the French delegation to the SMEs' working party of the Business and Environment Committee of the OECD.
His research refer to the "économie des conventions" and are focused on the financial behavior of the non-financial organization and the promotion of specific tools and assessment procedures designed to enhance SMEs' access to financing.
He is co-author with Bernard Belletante and Nadine Levratto of "*Diversité économique et mode de financement des PME*" published in 2001. He is also the co-author of "" *Structures of Corporate Finance in Germany and France"* with Hans Friderichs in" Jahrbücher für Nationalökonomie und Statistik", 2001.
He is associate researcher of the CNRS team IDHE-ENS Cachan in Paris and member of the New York Academy of Science.
He joins Euromed Marseille Ecole de Management in September 2004 as Professor of Finance and Head of the "Information and finance" department.

Dr. Walter Baets

Walter R. J. Baets is Director Graduate Programs at Euromed Marseille – Ecole de Management and Distinguished Professor in Information, Innovation and Knowledge at Universiteit Nyenrode, The Netherlands Business School. He is also director of Notion, the Nyenrode Institute for Knowledge Management and Virtual Education. Previously he was Dean of Research at the Euro-Arab Management School in Granada, Spain. He graduated in Econometrics and Operations Research at the University of Antwerp (Belgium) and did

postgraduate studies in Business Administration at Warwick Business School (UK). He was awarded a PhD from the University of Warwick in Industrial and Business Studies.
He pursued a career in strategic planning, decision support and IS consultancy for more than ten years, before joining the academic world, first as managing director of the management development centre of the Louvain Universities (Belgium) and later as Associate Professor at Nijenrode University, The Netherlands Business School. He has been a Visiting Professor at the University of Aix-Marseille (IAE), GRASCE (Complexity Research Centre) Aix-en-Provence, ESC Rouen, KU Leuven, RU Gent, Moscow, St Petersburg, Tyumen and Purdue University. Most of his professional experience was acquired in the telecommunications and banking sector. He has substantial experience in management development activities in Russia and the Arab world.
His research interests include: Innovation and knowledge; Complexity, chaos and change; The impact of (new information) technologies on organisations; Knowledge, learning, artificial intelligence and neural networks; On-line learning and work-place learning.
He is a member of the International Editorial Board of the Journal of Strategic Information Systems, Information & Management, and Systèmes d'Information et Management. He has acted as a reviewer/evaluator for a number of International Conferences (e.g. ECIS an ICIS) and for the EU RACE programme. He has published in several journals including the Journal of Strategic Information Systems, The European Journal of Operations Research, Knowledge and Process Management, Marketing Intelligence and Planning, The Journal of Systems Management, Information & Management, The Learning Organization and Accounting, Management and Information Technologies. He has organised international conferences in the area of IT and organizational change.
Walter Baets is the author of "Organizational Learning and Knowledge Technologies in a Dynamic Environment" published in 1998 by Kluwer Academic Publishers, and co-author with Gert Van der Linden of "The Hybrid Business School: Developing knowledge management through management learning", published by Prentice-Hall in 2000. Along with Bob Galliers he co-edited "Information Technology and Organizational Transformation: Innovation for the 21st Century Organization" also published in 1998 by Wiley. In 1999, he edited "Complexity and Management: A collection of essays", published by World Scientific Publishing. Recently he co-authored "Virtual Corporate Universities", published 2003 by Kluwer Academic.