Future Counterfactual

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ABSTRACT
In contrast to other *methods* large and small, XP explicitly espouses a financial rationale. This is a bold step; many software practitioners prefer their debate in self-referential software technology terms. Further, financial theory (like that of software development) is itself in a state of flux. What if in *options* we are betting on the wrong horse?

Keywords
Complexity, Theory Stretch, Equilibrium, Evolutionary / Behavioural Finance, Sentiment, Speculation

1 FINANCE THEORY

To the idle observer, finance seems to be nothing more than a game of darts. You pin all the companies, instruments, and strategies at your disposal on the wall and the fall of the dart determines your next move, which in turn involves placing inordinate trust in chains of people you have never met.

But no, there are theories behind finance. And actors in the markets are trained in and are said to be acting on these theories.

Traditional Economics is based largely on equilibrium systems, on a balance between supply and demand, price and quantity, risk and reward. This reflects the scientific times during which economic theories first emerged. That of Newtonian Physics in the 1890s. A shock to the system is absorbed and the system returns to equilibrium.

Farmer[3] notes that in Economics it is the markets that are always in equilibrium, which means trading always occurs at a price that meets everyone's expectations of the future. Financial agents are always rational with perfect foresight. Markets are efficient, which means there are no patterns in prices that can be forecast on a given information set. The only possible changes in price are random, driven by unforecastable external information. Profits only occur by chance.

This model, an approximation or simplification of reality, has worked well enough over the last century allowing Economists to assemble all kinds of instruments which generally work as expected. The future rolls out as planned. If the world wasn't the way it is presented in the model world trading would prove very difficult indeed. An agreed model is needed for trade to take place at all.

While Science has moved on from determinate systems to quantum theory where indeterminism is intrinsic, Economics has stood still sticking to the science on which it was originally modelled and in a twist of irony it finds itself defending Einstein's remark at that time "God does not play dice".

Economic theories arose at times when the goods traded were tangible products and the time scales involved were in the order of months. In the modern world information bits not gold or coins or paper or the good itself are traded at the speed of light. In modern markets the volume of daily currency trading is roughly 50 times the daily output of the world. If financial markets really were in equilibrium there would be far less activity as agents would only trade if there was new information or if their desires changed.

Thomas Kuhn [1] suggests 4 steps in the evolution of ideas:

1. Theory laid out	A theory is laid out in order to explain a phenomenon.
2. Theory tested	Scientists test the theory and find facts that counter it
3. Theory stretched	Because of personal investment theory is stretched as long as possible to accommodate new findings
4. New theory	New theory supercedes the old theory

Some economists now feel that the theory stretching (by adding a risk beta here or an increasing amount of parameters there) of classical economics has got beyond a joke. There have been a large number of observations, which the old theories did not predict correctly. Anomalies include higher volatilities, higher transaction volumes, speculative bubbles (share prices divorced from fundamental information), the January effect and the fact that if you "can't beat the market" over time how come some people do? The suspicion is that during such anomalies, when the market does not exhibit text-book behaviour opportunities are lost because text-book reactions are incorrect. Another suspicion is that the market model rules have a limiting effect on market potential. Still another is that in new technologies certain businesses enjoy increasing returns on investment[9].

IT driven transaction-cost reduction and information propagation have spawned new practices such as day-trading which in turn have introduced anomalies, for example that the market now drives the economy rather than being a reflection of it.

The unprecedented 4 Billion dollar crash of LTCM (Long Term Capital Management) Hedge Fund provides a good case in point. LTCM was founded by Merton and Scholes who received a Nobel Prize in 1997 for their theory on the rational valuation of *options*. The Nobel Committee Press Release at that time mentions, "…(the method) has facilitated more efficient risk management in society". Further, "Flexibility can be viewed as an *option*. To choose the best investment, it is therefore essential to value flexibility in a correct way. The Black-Merton-Scholes method has made this feasible in many cases".

During 1997 LTCM started to speculate heavily in the shares of Royal Dutch Petroleum and Shell Transport. These 2 companies are closely related to such an extent that they have an agreement that their total profits will always be shared in the ratio 3:2. Traditional financial market theory teaches that the share price will reflect this relationship. In the course of 1998 however the share prices diverged dramatically from this relationship and LTCM lost 60% of its capital. The rational strategy of LTCM was broken by the irrational behaviour of the markets.

On risk an internal Enron manual stated: "Risk management strategies are therefore aimed at accounting, rather than economic performance."

2 MOVING TO COMPLEX ADAPTIVE SYSTEMS

The title alone of an article, in which Cosma Shalizi[2] paints a picture of work by the physicist J.D. Farmer at the Santa Fee Institute, – "Why the Markets aren't Rational but are Efficient" reveals much of what is now happening with Economics.

Crisp neat theories (idealized, simplistic) are being traded for new theories, which are comparatively messy but much better reflect the behaviour of the market. These new theories based on Complex Adaptive Systems (CAS) still model market efficiency (though even efficiency itself is now under question) but without assuming the market is rational. Farmer[3] notes:

"The Black-Scholes pricing theory has two remarkable features:

- the hedging strategies eliminate risk entirely, and
- the option price does not depend on the average return of the underlying asset.

These very special properties are only true under the assumption of normality (*i.e. rationality*). With a more realistic distribution for the underlying returns, risk in option trading cannot be eliminated and the correct option price depends on the full distribution of the underlying asset". Farmer goes on to model the markets with CAS.

CAS in nature are things like beehives. ant colonies, the tropical rainforest. From Holland[4] the essentials of CAS are:

- *Aggregation*. The emergence of complex, large-scale behaviours from the aggregate actions of many less complex agents.
- *Nonlinearity*. In a linear model the sum is the product of the parts. In CAS the aggregate behaviour is more complex than would be predicted by summing the parts.
- *Feedback loops*. Output of one iteration becomes the input for the next iteration. Feedback loops can dampen of amplify an effect.
- *Adaptive Schema*. Agents within a CAS take information from the environment, combine with their own interaction with the environment and derive schema or decision rules. Schemata compete with one another for survival based on their "fitness".

An example of Feedback-loops is the "Theory of Reflexivity" developed by George Soros[6] whose loops create a fundamental uncertainty about reality, investors' actions may change the company in which they are trying to invest.

An example of the Nonlinearity is the predator/prey model. Too many predators leads to a shortage of prey; too many prey leads to an increase in predators. An evolutionary stable population can only consist of a mix of the two. A non-linear outcome of famines and feasts results. A hot topic in economics is information. Should one spend significant effort gathering reliable information from which to make decisions or can one rely on financial theory which states that all information is already held in the share price.

The Information Paradox[149] results since if all analysts rely on information being in the price, the price will in fact contain no information and it would now be advantageous to get some information externally, and if all analysts relied on external information their behaviour and thus the price would reflect this information and it would be advantageous for analysts not to gather information at great expense.

Evolutionary economics sees the market as a population of heterogeneous agents using differing strategies. The importance of each strategy is measured by the amount of capital invested through it. Investment strategies are competing in other words for capital. Variation in security price development determines which strategy is successful at any given moment. Market selection is a complex process of interacting strategies. Mutation (innovation) provides a supply of new strategies to the Market. This in turn changes the security price landscape

The success of a strategy depends on the population mix (or fitness landscape), success itself however leads to a change in the population mix. If a strategy is successful, the amount of capital invested through it will increase which in turn increases its influence on price development.

In other words a strategy that takes advantage of a particular anomaly (pattern) will cause that anomaly to disappear, but other anomalies will arise in the process.

Evolutionary systems theory has it that the *goal* of the system is stability. This is a population mix of strategies immune to the entry of new mutants.

One consequence of the new Economic theories is that while the markets are more completely modelled, prediction becomes almost impossible. This is a reflection of reality rather than a weakness of the theory. LTCM is not a one off example. Traders do not rationally evaluate all available evidence. They use they use their own information mixes ranging from classical valuations from fundamentals through attempting to find patterns in the movement of prices, numerology and astrology.

Humans are inductive not deductive. Behavioural Finance has become a respected topic. Cognitive indexes are now published on financial pages.

3 SOFTWARE DEVELOPMENT THEORY

The theories of software development are also in a state of flux. Despite its recent arrival, software development was initially cast in Newtonian terms. But these man-made cause-and-effect systems of software manufacture; huge software lifecycles, software waterfalls, big M and all the others have been theory-stretched almost beyond recognition.

Some of the simplifications on which these theories are based include, "we know what we are doing" , "we have a grasp of the technology", the technology is appropriate, the customer knows what s/he wants, there is little change, value systems are clear, shared and unchanging.

DeMarco[10] and Highsmith[8] both suggest old industry leaders, to whom these simplifications apply, who have forgotten the need for change. Their processes are optimised to such an extent that change becomes impossible. On the way to these positions they have been ably served by old models. In short traditional models and methods contribute to company ossification. As in finance these models arguably prevent us from taking full advantage of emerging anomalies.

New models highlight this danger and model ways of avoiding it. In turn this is a time for theory-stretch, even old methods profess a certain agility now.

What is replacing the simplistic cause-and-effect structures (and the rigorous role building that it preserved) are dynamic systems of software production where roles are porous and in a sense everything happens at once, testing, writing, delivery. Highsmith[8] explicitly bases ASD on CAS and Beck[7] mentions Feedback and Emergence.

But the metaphor is a difficult one to apply.

In software it is harder to make out a selection mechanism. Can it be price? There is no global market to observe in the way the financial markets can be observed, no objective view. Our markets range from closed and small to large and open. Reasons for and definitions of success are not transparent. What is success in Open Software? As software people do we mean technological or financial success? Was your project successful because you did something simple, was it reportedly successful for political reasons? Because it helps your career? The fact that your company is doing well on the stock exchange or even selling its products well, is this a reflection of some aspect of your software or has it more to do with something else? Better marketing, locked-in customers…. Is the creativity harnessed accounting creativity? Is there a boundary between the software and the strategy of new-technology companies? Which strategies take me across the boundary? Did the model have anything to do with it?

It is not clear whether XP is a CAS (and in some sense future safe) itself, or whether CAS is a way of observing the XP strategy, battling other strategies such as RUP. Is XP a strategy or are the practices in XP strategies vying for survival? Which strategies suffer when others are doing well? Under which conditions might they re-emerge? Is there no symbiotic relationship, is there no flipside, is it all win -win? Where is the strategy innovation?

Is the company, the team or the individual the strategy holder, is it all three? What survives, you, your manager, the company, or the strategy itself?

All these questions are understandable. CAS is a complex model without recognisable boundaries, with bleeding edges, and conflicting views. Decisions you make in your private or public life, your career development and also the strategies followed by your company and organisations and society around you can all be seen in CAS terms. Some books talk of "hierarchies of adaptive contexts"[11].

But let's try again with XP.

We can see XP as a maverick strategy. It is based on the anomalies in traditional software-teaching and practices and technological advances and responds to this with new teaching and practices of its own. XP seizes on what it sees as inefficiencies in the old ways of doing things and drives for what it considers to be new efficiencies. XP will be embraced by those organisations and individuals sharing this view of efficiency. If they can they use the XP strategy to gain advantage, they will.

But will the individual or company see these anomalies tomorrow? Change might be discontinuous. Our very use of XP may paradoxically lead to stability being treated as a new anomaly.

Consider testing in terms of aggregation and non-linearity. This is the XP practice where most arrows land. The argument is clear. You can make accurate statements about what your software does even after kamikaze refactoring sessions. But testing can be a danger to emergence. Vigorously enforced it can become the ultimate top-down plan and surprise-reduction machine. Many people just do not write their best software this way. How valuable is accuracy?

Look at bugs in terms of predator/prey model. For each kind of application and customer there is an optimal balance of the number of and severity of allowed bugs. Clearly too many bugs of a particular severity will lead to contract termination. But zero bugs might endanger the building of a long-term customer relationship. Once again, how valuable is accuracy?

Consider the Planning game in terms of the Information Paradox. Traditional planning is an exhaustive expression of faith in the future. Some plans are up-front statements of intent only, others are moving-instruments of communication reflecting the daily-changing fortunes of the project much like share prices. The more thorough such planning is the more expensive it becomes. It can get to the stage where the cost of planning can outstrip the costs of the risks one seeks to avoid. Information gathering can use up all of your time. On the other hand a plan containing no information is also a significant risk.

The Planning Game does a lot to expose and propagate differing views of risk and efficiency throughout the organisation *and still get some software writing done*. As software developers we might have the naïve view that software cost is the figure everyone is focussed on. Management might have a different view; is the disruption worth it? Which is the rational view here? How much effort are you as an individual really prepared to apply in a given situation? If views of risk, efficiency and remuneration can not be reconciled do you have an escape strategy? Does your value system stem from an inability to move?

And how accurate is the information you have? Buying shares, placing trust in anonymous chains of information and people has its parallel in software development. To use Highsmith's analogy of software development as mountain climbing. Each member of the team, each supplier in the chain, each component vendor, each new technology, each service provider, each gap between marketing promise and reality is a risk. Professional climbers do not climb with people they do not know. Where do we draw the line in software development?

In technology terms, is OO always appropriate? Does it represent over-engineering? If your taxonomies are unstable why not use a scripting language and avoid the yoyo effect of inheritance coupling. But don't I need objects to be able to unit test? To be able to refactor?

We get a good impression here that the advantages in the application of XP practices in software development are not always clear-cut. Trade-offs seem inevitable. Statistics vary, but say the current figure for software project failure is in the order of 70%. Maybe this number is acceptable.

Going back to the DeMarco/Highsmith observations on optimised companies one wonders if such organisations really exist. When did you last experience one? The paradox is that such companies are given as examples on which to base a theoretical move. However when viewed with the new theory one can see these very same companies in a different light. The optimised/efficient company is simply an inefficient one with a great deal of *slack* after all.

CAS leads to more differentiated views. The selection mechanism in Software Development is a conflicting view of efficiency at a particular time in a particular context based on particular experience and understanding of the individuals and organisations concerned.

4 CONCLUSIONS

With a cue from the financial rationale of XP itself this paper has taken a detour into other traditionally separate fields and shown how interdisciplinary work in these other fields has enriched the understanding of what people there experience.

We have seen in LTCM (Enron, Barings, AIB, Asean Economies) that unregulated "risk management" can be dangerous. These dangers have lead to new financial theories.

Looking at this theory change with reference to our own domain we see that its application is rewarding and challenging. We move from the thoughtlessness and blamelessness of software development as a sanitised process to something richer and less clear. Perhaps any neatness we perceive in the financial theories presented are false-readings resulting from the fact that we are not financial experts.

What about *options*? Like the "optimised" companies of DeMarco/Highsmith the option argument in XP is a paradoxical hook. People today are very stock-market aware. Options spark an interest. Very often the Options argument is the one that encourages the transition to XP.

During this transition however something interesting happens. The options argument is based on predictability, on "pure foresight", on equilibrium and cause-and-effect, it is a classic old-economic-theory instrument. LTCM illustrated danger of relying on prediction, which only works if markets are rational. Prediction is a security we like to think exists, but in fact all the time by practicing XP we are learning to do without this comfort.

At some point one can look back and ask, if prediction is less valuable than I supposed why did I transition to XP? The reason is that at pre-transition time we are more susceptible to cause-and-effect arguments. Options are an XP mechanism to move us away from cause-and-effect, they might be the reason we move to XP but are not the reason we stick to it.

We stick to XP because prediction is replaced by something more valuable. Options move us to negotiation, from corporate monologue to social dialogue. From low to high information flows of good quality - by constantly entertaining, resolving, trading conflicting views of efficiency, information from which to generate customer value is more accurate and more up-to-date than ever before. And so we discover that XP is more CAS based than we may think at first.

The gotcha of self-organisation theories is that the name implies that it happens for free, it is self-organising after all. But we are dealing with value creation rather than cost reduction here. Creating the conditions for self-organisation; securing better information, filtering noise, communicating, securing team autonomy… requires more work, more trust, continued development of new (soft) skills, and role porosity.

Body surfing. Chains of experience and service provision (wave assembly) come together, you know the beach, you see the patterns, you judge the moment. The conditions are perfect. Will you catch the wave or get dumped and towed?

New approaches do not come with a guarantee of success. For success you still need a good measure of luck, which brings us back to the fall of the dart. Whatever you read, this has always been the case.

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