The Money Formula

Author: Paul Wilmott and David Orrell

Adaptive Markets

Author: Andrew Lo

These are both very good books about financial markets and how they do and should work. Although they come from different perspectives: that of the academic economist and the financial market practitioner, they essentially agree on an important matter. This is that context matters. A model is only as good as the context in which it is able to be relevant. A failure to understand this lies at the heart of financial crisis.

Paul Wilmott has written texts on quantitative finance and founded Oxford's Diploma in Quantitative Finance, so he has been at the heart of risk pricing, hedging and derivatives in practice. David Orrell has written on money and is an applied mathematician. Their book gives a clear and racy introduction to financial market pricing models, from Bachelier to Fama, Markowitz, Sharpe and Black Scholes (not forgetting Merton). We end up with a description of the ideal portfolio, using continuous dynamic hedging (delta hedging) to remove market risk, and portfolio diversification to optimise our risk reward trade off. We are shown how to achieve this.

Much like the detailed description of the operation of a perfectly competitive market and how it works, this description is very useful in exposing the assumptions that are necessary to make the achievement possible. For example, removing market risk requires the ability to hedge on a continuous basis to be effective. Not only must trading be continuous but the models require an underlying asset to have an independent price series also based on trading. This is what enables the pricing of the options to be made in relation to the pricing of the asset. Stocks, currencies and commodities are indeed traded independently and so the models have relevant context. Interest rates and credit is not traded – only assets based on them are. The standard models have lost relevance, but the usual models tend to ignore this.

On top of this problem, the models also require that volatility is stable over the relevant holding period and that the market price of risk is also stable. Wilmott and Orrell show that this is not true. And they are angry. They are clearly enraged at their fellow mathematicians who were carried away by the salaries and playing with equations and forgot they were playing with other people's money. Especially when out of this came the proliferation of debt instruments that no one understood and which eventually blew up.

Andrew Lo has trodden a similar intellectual path, but perhaps more circumspectly. He starts from the discovery, to his surprise as a well-educated financial economist, that stock prices did not follow a true random walk. If the efficient markets hypothesis is correct, and all information is both available and incorporated into prices, then this should not be true. This is the same proposition as when Willmott and Orrell show that volatility is not stable. Lo

showed that volatility was higher over a longer period than over a shorter one. From then on, he was set on a difficult path to try and explain why and what is going on.

His intellectual journey is described engagingly and over a wide range of literatures and topics from Herbert Simon and Armen Alchian to Stephen Jay Gould and E O Wilson. Lo's core proposition is reached half way through the book, after describing in rather more academic language and more completely than our other authors the route from Bachelier to Black Sholes and delving deeply into neuroscience, psychology and experimental economics. He argues that the existence of observable market inefficiencies is not evidence of bugs in our rationality that better models and data collection will eventually iron out. Instead he argues that human systems work not on an optimisation algorithm but on a survival one that is hard wired. Only in some contexts will such systems produce results which look like 'economic' rationality. These contexts require stability in which agents are able to learn the relevant context and move over time to discover this solution.

In other contexts there will be evolution – and the evolution of ideas happens at the speed of thought not the speed of reproduction. As he puts it, in the end 'survival is the ultimate force driving competition, innovation and adaptation'. Once again, we are treated to a clear description of the assumptions lying behind 'rational' markets and the unchanging environment that is necessary to allow rational and optimal results to develop.

While Wilmott and Orrell describe the outcomes and the mathematical models that have tried to exploit arbitrage that turned out, surprisingly, to exist, Lo is trying to develop the theory behind that fact and the human behaviours that have evolved in our reproductive past to drive the evolution that now happens in our systems present. His position is that it takes a theory to beat a theory, and this is an ambitious aim.

All of our authors would agree, I think, on the following themes:

•   Models are only as good as the relevant context

•   Evolutionary models have a wider area of relevance than our current set

•   Looking to biological models is more powerful for economics and finance than physics envy

•   It makes no sense to define optimality only for a narrow range of stable contexts

•   The world generally changes faster than we can learn about it

Andrew Lo's adaptive markets are an approach to building a theoretical framework to develop these themes. Wilmott and Orrell conclude with an ethical framework for quants which would support these themes.

It seems to me that the time has come to accept that the standard model is not something to be tweaked and extended to try and incorporate messy reality. This is the equivalent of Ptolemaic epicycles getting more and more complicated as they tried to incorporate observed data in an earth centric model. It's time to get heliocentric and to think about a base model of markets which starts from what we know about behaviour.

The development of new data sources, and much larger computing power makes it possible to build models which have different behaviours, feedbacks and evolution. These opportunities should be grasped by researchers and understood by practitioners. In particular, practitioners such as members of the SBE need to be much more aware of the need to take a wider perspective on their policies and recommendations. Or if this is not possible, to be carefully aware of the limits to the contexts in which the models are valid.

Date: June 2017