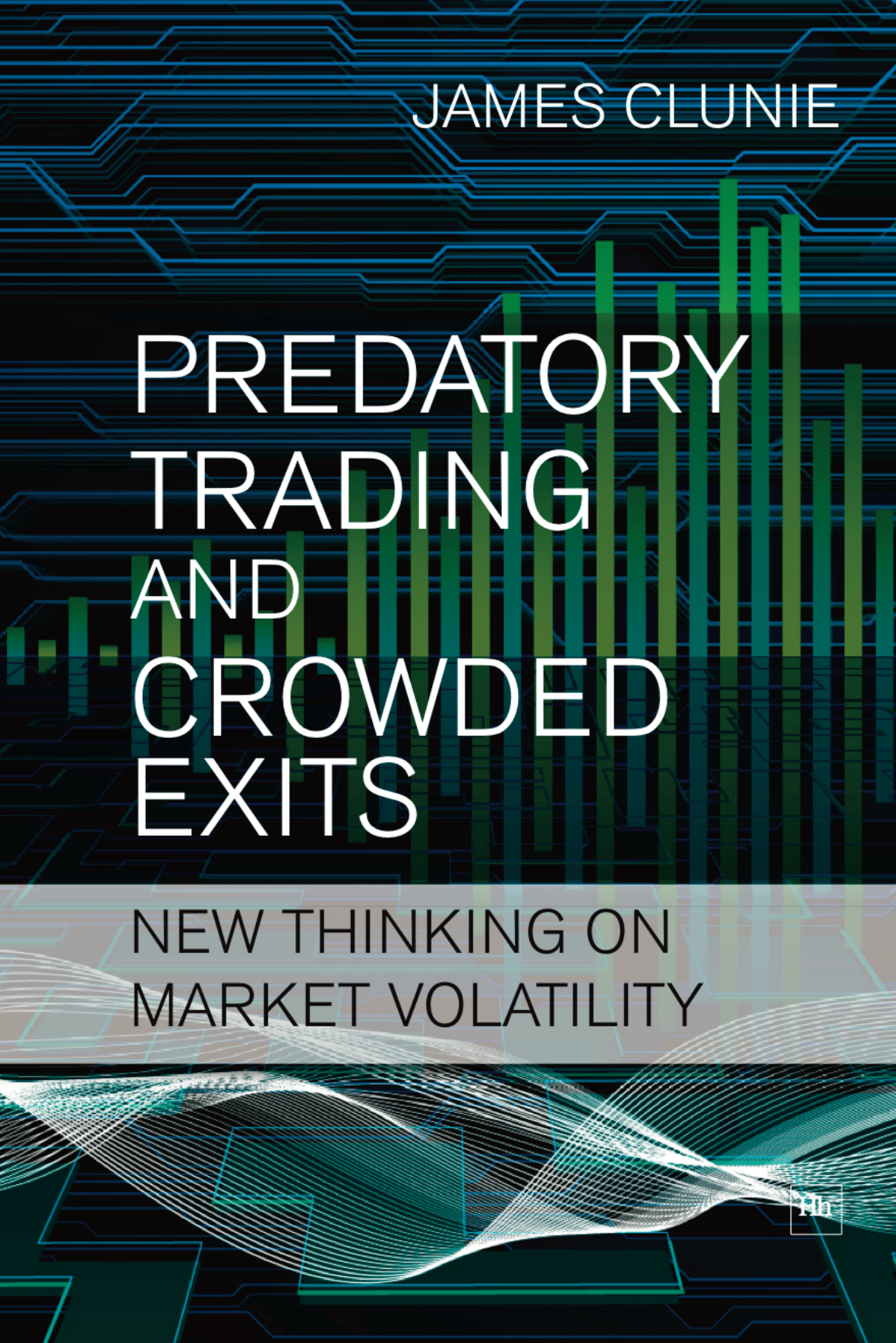
JAMES CLUNIE
PREDATORY TRADING AND CROWDED EXITS
NEW THINKING ON MARKET VOLATILITY

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PREDATORY TRADING AND CROWDED EXITS

NEW THINKING ON MARKET VOLATILITY

BY JAMES CLUNIE

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Contents

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Preface

What this book is about

In this book I look at a series of phenomena that can drive security prices temporarily away from their equilibrium levels, creating opportunities for traders to profit from. At the same time, these phenomena create the risk of losses for the unaware.

The phenomena I examine have only recently begun to be better understood. They include two important liquidity problems faced by traders: predatory trading and crowded exits. I examine these on three levels. Firstly, I describe the basic principles and theory behind the phenomena, to build a solid framework for the way we think about these situations. Secondly, I examine the accumulated empirical evidence on these events. This reveals what has generally happened in these situations, and what the profit opportunity and risks might be like. Finally, I consider a number of individual cases to illustrate what can happen to traders in practice. In the main, these will be extreme events or special situations from which we can learn.

By understanding these phenomena in this way a trader could gain an edge over others in the market. In the first instance, this is achieved by avoiding becoming the victim of the phenomena I describe. Beyond this, it might be possible to use detailed knowledge of some of these situations to (legally and ethically) profit from the events.

Who this book is for

This book should be of interest to traders seeking to gain a superior understanding of how markets work, both in theory and in practice. It should also be of interest to longer-horizon investors who are seeking

to avoid timing errors, and to risk managers seeking to understand better the subtleties of risk beyond traditional risk statistics. Finally, I expect that a number of academics and students of markets will find this work stimulating and thought-provoking.

How the book is structured

The book starts with an introduction to the notion of the 'fair value' of a security. Then, by thinking of markets as an eco-system of different types of players, I describe ways in which securities prices can move away from equilibrium and stay mis-priced for some time. I examine specific examples of these phenomena, include predatory trading, the use of stop losses, crowded exits and manipulation. I end with some thoughts on how traders should make use of their knowledge of these phenomena.

Introduction

Imagine the following situation. You are a trader who understands the relationship between two similar assets. That relationship appears out of line with its historical pattern and little has changed in the way of fundamentals over the past few months. You place the trade, hedging one asset against the other. Now, you only need to wait for convergence…

But it doesn't happen.

The trade moves the other way and you are now nursing a painful loss. No matter, you think, the fundamentals remain unchanged and the trade now looks more attractive than ever. You even try to encourage convergence by advertising the attractiveness of this position to other traders.

But then your position falls to an even greater loss. You are reminded of your head trader's favourite piece of advice:

The market will move to the point that causes the maximum pain

It's beginning to feel that way. If the trade diverges any further you will be stopped out by your own risk controls.

The trade continues to diverge, the pain builds and you are indeed stopped out.

A few days later you see that the two assets have moved sharply back towards their historical relationship. You were correct in your original analysis. But somehow the market had conspired to impose swingeing losses on you.

How did this happen?

Every trader should have a thorough understanding of phenomena such as predatory trading and manipulation; and of liquidity problems that can arise when traders position themselves in a similar fashion to one another. These problems are often understood intuitively, but there is a benefit from understanding the theory behind them and from seeing the evidence of how they work.

In this book, after setting the scene in the first chapter, I look at predatory trading, crowded exits, stop losses and manipulation. In each case, I consider the risks and opportunities that arise for traders.

CHAPTER 1

THE ECOLOGY OF MARKETS

Fair value

What is the right price for an asset?

A common way of thinking about this problem for a security, such as a stock or a bond, is in terms of its fair value. This is the notion that there is a single value that the security is intrinsically worth at any given time.

A rigorous way in which to think about the intrinsic value of a security is to consider the future cash flows that the security will generate for the owner, and then discount those cash flows back to today's money. This concept relies on the idea that an expected cash flow at some future date is less valuable than money in hand today, because of the opportunity cost of not having access to the cash today, and the risks associated with future events. Where an investor or trader knows the future cash flows from a security for certain, and knows the rate at which to discount them, calculating the fair value of that security is simple – a few lines of work on a spreadsheet.

But, in practice, things are not so easy.

Consider, for example, a bond issued by a highly credit-worthy government. The cash flows are documented in the bond's prospectus and are known almost with certainty: each regular coupon payment and the return of principal at maturity of the bond are highly likely to transpire. So far, so simple.

But what is the correct discount rate?

Ambiguity over the appropriate discount rate makes it difficult in practice to estimate the fair value of a security. Analysts develop techniques for coping with this problem – one of the most popular of

which is taking the implied discount rate from similar securities, and using this to discount the cash flows from the security in question.

Now consider a riskier security, such as a corporate bond. In this case, the cash flows to the bond's owner are less certain, as default risk is now higher. Consequently, the intrinsic value of a corporate bond is thus (generally) more difficult to evaluate than for a government bond.

And difficulties do not end with corporate bonds.

Equities offer greater problems – think about the unreliability of cash flows and dividends attributable to shareholders. An extreme example would be, say, a biotechnology company, where cash flows might be zero for the foreseeable future and in the long-run might depend upon success in developing new drugs. Long-term cash flows could be huge…or non-existent!

Uncertainty over both cash flows and the appropriate discount rates leads to great uncertainty over the fair value of a security. Two analysts, each using the same theoretical discounted cash-flow approach, could place very different values on the same security, depending on their cash-flow projections and the discount rates they choose to use. Because of such ambiguity over the true value of a security, some analysts dismiss the notion of a fair value. Instead, they think of securities as having observed market prices and estimated cash flows, and simply use the implied discount rate in the market to compare securities to one another.

Many financial models assume a fair value exists

Whether or not it is sensible in practice to think about the fair value of a security, a number of financial models *assume* that there is such a thing as the fair value of a security. A quick trawl through published articles and working papers on asset pricing reveals that this is a very

popular assumption in academic work. Some models go further still: not only do they assume that there is a fair value to a security, but this fair value is known with certainty to some market actors, such as arbitrageurs. But how do the arbitrageurs *know* the fair value of a security? Most papers are mute on this subject.

Why would a model-builder make such an assumption?

Mainly because it creates a framework for thinking about markets which, through further analysis, can provide illumination on how markets work. The assumption that fair value can be known with certainty might come as a surprise to some arbitrageurs. To know the fair value for say, a stock, seems like a hopelessly unrealistic assumption. However, academic work sometimes makes simplifying assumptions, to reduce the complexity of a situation, and to make the mathematics more tractable.

According to Friedman (1953), the use of unrealistic assumptions does not invalidate the work, so long as the predictions are accurate. Thus, the notion of a fair value that is known to some, but not all, market actors is a simplifying assumption to help us understand the actions of arbitrageurs and the workings of markets. It is worth bearing this in mind when looking at financial models that rely upon such assumptions. Models can provide illumination on how markets work, but a trader must avoid the mistake of relying wholly upon the predictions of models.

The problem of simplifying assumptions

Some asset-pricing models make a further, important simplifying assumption about the process of arbitrage. They assume that traders can short-sell securities as easily as they can buy. For example, a widely-taught asset pricing model, known as the arbitrage theory of capital

asset pricing (Ross, 1976), assumes that there are no restrictions on short-sales, including full use of the short-sale proceeds. However, in practice, short-sellers must find securities to borrow, effectively pay securities lending fees and face collateralisation and margin requirements. These short-sale constraints limit the frequency and scope of arbitrage, and so could affect the price of assets.

So, we know that some models that seek to explain the pricing of assets make use of unrealistic simplifying assumptions.

Does this matter?

Are the predictions from such models accurate, or do they instead fail the 'Friedman test' that I mentioned earlier? In a canonical paper on short-selling constraints, Miller (1977) considers what happens to security prices if the two main assumptions discussed above are untrue at the same time.

While popular models such as the capital asset pricing model (see Sharpe, 1964) assume that investors have identical estimates of the expected return and probability distribution of returns from all securities, Miller suggests that investors in practice can have differing expectations about securities instead, due to uncertainty over future cash flows and the appropriate discount rate for an investment. He argues that when a divergence of opinion amongst investors is combined with barriers to short-selling, the price of a security is no longer set by the average investor, but instead by the beliefs of the most optimistic investors. Those investors with the most optimistic estimates of returns will own the securities, while pessimists and realists struggle to short-sell the overpriced asset because of constraints on short-selling. Miller concludes that

> the presence of a substantial number of well informed investors will prevent there from being substantially undervalued securities,

> but there may be securities whose price has been bid up to excessive levels by an uninformed minority.

This provides a simple explanation for why some securities might trade at inflated prices. Even if informed traders or investors know the fair value of a security, other less-informed traders push the price beyond that level, and it is difficult to short-sell the security back to its fair price. Mis-pricing develops because of ambiguity over fair value; and arbitrageurs are unable to correct the anomaly if there are barriers to short-selling.

A number of researchers have investigated Miler's idea. Although there is some dispute over its implications, Asquith *et al.* (2005) state

> that it is now widely accepted that if short-selling is costly and there are heterogeneous investor beliefs, a stock can be overvalued and generate low subsequent returns.

For a trader, the lesson is simple – asset pricing models can help us understand how markets work, but where the model relies upon simplifying assumptions, the predictions from the models might not always be accurate. A good trader should understand both the *predictions* of the model and the *limitations* of the model. Without both, a trader will be vulnerable – even if this vulnerability takes years to be revealed.

Informed traders versus noise traders

A noise trader is simply a trader who holds no new information about a security. Any knowledge upon which he trades is assumed to be already imputed in the security's price. Given this definition, it might seem that noise traders would be largely irrelevant to the functioning of markets. However, Gemmill and Thomas (2002) argue that the setting of prices in a market is determined through the interactions of

arbitrageurs and noise traders. Furthermore, many models for understanding how security prices are set are based on the notion that a market comprises informed traders (those who know the fair value of a security) and noise traders (those who do not know).

Who are these noise traders?

Although rarely made explicit, noise traders are implicitly assumed to include non-professional traders (e.g. retail investors) – even though it is likely that at least some retail investors have better investing track records than some professionals. Noise traders might also include traders forced to trade because of a need for liquidity. Dow and Gorton (2006) argue that "noise traders play an important role in modern finance theory", but state that their "identities, motivations and ability to persist" are not well understood.

In other words, we do not know much about a group of people that we believe plays an important role in the workings of markets. This is quite some confession!

Noise traders can have both benign and adverse effects on markets. Black (1986) argues that with more noise trading, markets will be more liquid, in the sense of having frequent trades that allow prices to be observed. However, security prices will reflect both the information upon which information-traders trade, but also the noise upon which noise-traders trade.

As noise trading increases, information trading becomes more profitable, because of the greater noise contained in prices. However, apparent 'information' may already be reflected in security prices, making it difficult to differentiate information from noise. Noise can create the opportunity for profitable trading, but simultaneously makes it difficult to trade profitably.

> “We do not know much about a group of people that we believe plays an important role in the workings of markets.”

Even without short-sale constraints, the existence of noise trading means that securities need not be rationally priced, and arbitrage becomes risky. Information can give a trader an edge, but not a guaranteed profit. Consequently, informed traders will not take large enough (i.e. risky enough) positions to eliminate the noise.

Black surmises that it will be difficult to show that information-traders perform better than noise-traders, and argues:

> there will always be a lot of ambiguity about who is an information trader and who is a noise trader.

Noise traders, through their uninformed trades, can set up mis-pricing opportunities for better-informed traders to exploit. But noise traders can also *overwhelm* informed traders, if their scale is large and they trade in a similar fashion to one another.

Noise traders should thus be applauded for creating opportunities for traders, but also feared when they move as a pack. Superior knowledge alone is not enough to guarantee success as a trader. We know from financial history that even well-informed arbitrageurs can be quite vulnerable.

Why smart arbitrageurs don’t always win…

Shleifer and Vishny (1997) describe one of the ways in which a well-informed arbitrageur can fail. A textbook description of arbitrage suggests that the process requires no capital, entails no risk and generates guaranteed and immediate profits. This kind of arbitrage would bring prices towards equilibrium and keep markets efficient.

However, the authors argue that:

> the textbook description does not describe realistic arbitrage trades and, moreover, the discrepancies become particularly important when arbitrageurs manage other people's money.

Types of arbitrage that appear to be simple, such as that between two similar bond futures contracts traded on different exchanges, can take on the characteristics of risk arbitrage when considered fully. Even mechanically hedged arbitrage positions, such as long stock/short future, can result in financial distress if the arbitrageur earns paper profits on the stock leg but is unable to meet the cash requirements arising from losses on the futures leg. Risk arbitrage bears risk of loss and requires capital – an important distinction from the textbook definition of arbitrage.

> "Superior knowledge alone is not enough to guarantee success as a trader."

The role of clients

Furthermore, the model of arbitrage assumed in many popular asset pricing models is inconsistent with how arbitrage is practised in financial markets. Instead of vast numbers of small arbitrageurs, arbitrage is conducted in practice by relatively few specialised professionals, who generally use outsiders' money to take large positions. An agency relationship thus exists between the specialised arbitrageurs and their clients. Where a prospective client seeks to place money with a hedge fund but has a limited knowledge or experience of arbitrage, he might simply allocate capital to those funds with the strongest track records. Consequently, the size of funds under management becomes related to the past performance of the arbitrageur.

This dynamic can generate some interesting outcomes for markets. As an illustration, assume the existence of noise traders, so that securities need not be *always* rationally priced. Idiosyncratic risk (risk that cannot be hedged) can deter arbitrageurs. Consequently, securities with idiosyncratic risk can remain mis-priced for some time. With the existence of noise traders, arbitrage positions can widen and the arbitrageur loses money. Some clients might react to these losses by seeking to redeem their fund assets. However, if we assume that any market mis-pricings will eventually be corrected, the expected returns from arbitrage positions are high exactly when past returns are low. Thus, arbitrageurs can be forced to close positions that offer high expected returns, exacerbating deviations from equilibrium.

The poor performance of many classes of hedge fund during 2008 was followed by large client redemptions, and presumably the closure of some attractive arbitrage positions. In so far as this created deviations from equilibrium, those traders with capital to deploy and an ability to spot the mis-pricings would find such a trading environment very fertile. For those risk-arbitrageurs who suffered redemptions, the need to liquidate attractive positions must have been a galling experience.

Where the price of a security moves far away from an estimate of its fundamental value, one might expect it to revert at some future point. But simply identifying a mis-priced security is not enough. It could remain over-priced for some time or the mis-pricing could even grow, resulting in losses and ultimately redemptions for the arbitrageur. The path the security price takes is important, because some market players might be unable to hold onto positions that produce losses.

Hedge funds attempt to mitigate the risk of clients redeeming in response to losses by using devices such as ‘lock-in periods’ and ‘gates’ that impose contractual restrictions on clients seeking to withdraw

funds. However, potential clients might fear being locked in to a poorly performing fund and so it could be more difficult to promote and market this type of fund. Only managers with strong track records are likely to be able to persuade clients to accept lengthy lock-in periods.

Educating clients about the need to hold on to attractive positions after losses is another important, albeit time-intensive, initiative to minimise redemption risk. Arguably, the best time to do this is when returns have been strong and the client can understand the principle of holding on to attractive positions that have experienced near-term losses. If education is left to the last minute, when the losses start appearing, there is a higher risk that the client's emotions will overwhelm the discussion.

Delayed arbitrage

Another way that arbitrageurs can deal with noise trader risk is via delayed arbitrage. This is discussed in an article by Abreu and Brunermeier (2002). They build a model for arbitrage that considers uncertainty about the market timing decisions of other rational arbitrageurs, and thus the timing of the price correction. They call this problem synchronisation risk. The model shows that rational arbitrageurs do not act immediately on knowledge of security over-valuation, but instead wait for other rational arbitrageurs to learn about the over-valuation. Acting immediately might lead to losses, if enough other rational arbitrageurs do not know of the over-valuation and fail to act at the same time.

The lesson from this model for traders is clear: arbitrage is more than just identifying mis-priced assets. A good short-seller should combine knowledge of mis-pricings with a catalyst. In this case, the catalyst is knowledge that other traders are about to short the security too. This concept of delayed arbitrage can help explain why apparently obvious

market bubbles can continue to grow. Short-sellers, the very people who might be expected to prick the bubble and bring over-valued securities back into line, can be absent when they are needed most. And they would be absent for good reason – they want to avoid being overwhelmed by a tidal wave of optimistic noise traders.

> “Arbitrage is more than just identifying mis-priced assets.”

Tidal waves and market bubbles

Such tidal waves of noise trading emerge much as fads and fashions do. Where market participants obtain information and opinions from the same source, or share opinions with one another on websites or other media, noise traders can begin to believe in a common story, to imitate one another's trading and to herd in their behaviour. As momentum builds, a fashion can develop into a bubble.

One of the most famous purported market bubbles from recent years involved the rapid ascent in technology, media and telecom (TMT) stocks from around 1998 through to March 2000 and their subsequent sharp decline (March 2000 – March 2003). Brunnermeier and Nagel investigated the activities of hedge funds around the time of this ascent and collapse in TMT stock prices. Their article was published in 2004, by which time the NASDAQ index had fallen over 75% from its peak of March 2000 and just about everyone grounded in realism agreed that the TMT stock phenomenon of the late 1990s had been a bubble.

One might expect that hedge funds were trying to short-sell egregiously over-valued TMT stocks in 1999 and early 2000, but the authors found that hedge funds were in aggregate *over-weighted* in technology stocks in 1999 and early 2000.

Why might this have been?

These hedge fund positions cannot be explained by barriers to short-selling: if short-selling was too difficult or too costly, a fund would simply hold a zero position in the security, or at the very least some under-weighted position relative to the benchmark weight of the security. Funds would certainly not have held over-weighted positions if they believed that the shares were about to fall in price. This notion is reinforced by a separate study by Geczy *et al.* (2002) that found that short exposure to dotcom stocks was neither costly nor difficult during this period.

In light of this evidence, Brunnermeier and Nagel concluded that hedge funds were 'riding the technology bubble', rather than short-selling apparently over-valued stocks. In a market with many optimistic noise traders, it might not pay to immediately short-sell over-valued stocks. Informed traders almost certainly knew that TMT stocks were over-valued, but feared the army of optimistic 'new paradigm' noise traders enough to stay well away from shorting TMT stocks…for years on end!

Don't be a hero!

The advice for traders tempted to short-sell assets that appear to be in a bubble is to avoid any isolated, heroic action. Sit it out until the tide turns, or (for the thrill-seeking) join in and ride the bubble, while keeping a very close eye on the exit door!

A number of high-profile investors and traders ignored this advice and paid the price with their jobs or funds. Amongst the best known victims of synchronisation risk and TMT noise trader madness were Julian Robertson at Tiger Asset Management, who closed his investment company in March 2000 after incurring losses; and, amongst long-only

portfolio managers, value investor Tony Dye, chief investment officer at Phillips & Drew asset management in London, whose employment ended only three days before the peak of the market.

Reverse broking

Traders can find shortcuts to the problem of synchronisation risk. In practice, arbitrageurs can enter immediately into seemingly attractive positions and then proceed to advise their known contacts, such as brokers and peers, of the attractiveness of that position. This is sometimes known as 'reverse broking'. In their observational study of a hedge fund, Hardie and MacKenzie (2007) observed the following situation:

> The trader asked his assistant to construct a spreadsheet of recent prices of the two bonds, which supported the view that it was indeed an anomaly and thus a trading opportunity. Having first made the necessary purchases and short sales to take advantage of it, the trader then phoned a contact in an investment bank to direct his attention to the anomaly – 'There is at least half a point in that trade, and there is zero market risk' – and sent him the spreadsheet.

The purpose of this activity is to encourage dissemination of the idea and to alert other arbitrageurs to the opportunity. This has two effects: first, it lowers the risk of greater divergence of the position from fair value, so limiting margin calls and the risk of performance-based arbitrage. Secondly, it might bring the trades of other actors forward in time, thus reducing synchronisation risk. This suggests a social dimension to arbitrage, well beyond simply identifying mis-priced securities. Where such reverse broking is based on the interpretation of

factual information (as opposed to false rumours) it is an entirely legitimate activity.

More complicated worlds

So far, we have considered a very simple world, populated only by informed arbitrageurs and uninformed noise traders. And yet this simple world has already led to a better understanding of arbitrage and risk, and has allowed for the development of bubbles.

What happens if we add in other market actors?

One example of a more complicated model is provided by De Long *et al.* (1990) who create a model with two assets: cash and stock. There are three types of traders: positive feedback traders, fundamental-versus-price-comparator investors and utility-maximising informed rational speculators.

- **Positive feedback traders** simply buy stock after its price has risen, and sell after its price falls. They are associated with price momentum trading or trend following, stop-loss orders (selling a risky asset after a price drop below some pre-defined level), dynamic hedging (selling a risky asset after a price fall, and vice versa), and the liquidation of positions by investors unable to meet margin calls.

- **Fundamental-versus-price comparator investors** are simply disciplined 'value' investors. They acquire stock when it trades below its assumed fundamental value and sell stock when it rises above its assumed fundamental value.

- **Informed rational speculators**, on learning some news about a security, not only trade in response to the news, but also trade additionally in anticipation of the positive feedback traders'

response to the rational speculator's trading. Stock price movements in response to news thus become exaggerated.

The model reveals patterns of stock prices that are consistent with the empirical evidence of positive serial correlation of returns over periods of weeks or months (i.e. price momentum), followed by mean reversion over several years. Such patterns could also be obtained without anticipatory trading by rational speculators, so long as positive feedback traders operate in the market. The authors argue that in the presence of positive feedback traders, it might be rational for investors to "jump on the bandwagon and not buck the trend" when prices are trending. This is exactly the sort of behaviour that Brunnermeier and Nagel found amongst hedge funds around the time of the TMT stock bubble.

The ecology of markets

Why build a model with only two or three types of actor? There is nothing to stop us from considering more realistic models, if these aid our understanding. We know that markets can contain index trackers, value investors, market makers, momentum traders, dynamic hedgers and many other participants. Together, these various parties make up the ecology of a market.

This way of thinking about markets is not yet dominant in the academic community, but has the support of a small number of influential thinkers. Perhaps it is the mathematical difficulty in modelling so many different types of agent that prevents its wider adoption.

Thinking about markets in ecological terms builds on work in sociobiology[1] and involves the application of evolutionary ideas to social interactions. Thinking about financial transactions in this way is

[1] See Wilson, 1975.

an alternative to the use of equilibrium models. Ormerod (2005) argues that equilibrium models, much admired in economics literature, are unrealistic in light of the actual behaviour of markets. Bernstein (1998) argues that evolutionary processes better explain the workings of markets than does the notion of equilibrium.

In currency markets, for example, it is common for traders to talk about the ecology of markets. It is widely accepted that two major types of players are not motivated by profit and so can create opportunities for others to exploit. First among these are a number of central banks that intervene from time to time in the markets in an attempt to hold their own currencies at desired relative levels, in accordance with national economic or trade policy. Secondly, some international industrial firms hedge their foreign exchange exposures as a risk control measure, rather than as a profit-maximising measure. Arguably, the ecology of the currency markets is such that it provides opportunities for traders to earn profits at the expense of non-profit-motivated actors.

Sociobiological ideas can be seen in any research that involves studying the survival rates of certain types of traders. For example, Hirschleifer and Luo (2001) examine the long-term prospects of over-confident traders within a securities market – a study into the survival of a flawed species of market actor. Arguably, when economists discuss business cycles and the creative destruction of capitalism, they are expressing evolutionary thoughts about markets.

In his book, *Education of a Speculator*, Victor Niederhoffer (1997) writes about markets as a collection of different players. He thinks in terms of an ecology of markets and defines ecology as "the study of the webs that link the players [in the various markets]". He argues that "slow-moving participants" such as the general public provide the losses or "energy source" upon which dealers, brokers and large hedge funds feed. He also explains how security prices can temporarily move

away from their equilibrium values as a result of the activities of trend-followers who use stop losses to protect themselves from unlimited losses, and of dealers who hedge their options exposure.

> “Evolutionary processes better explain the workings of markets than does the notion of equilibrium.”

Niederhoffer argues that the influence of prices in other markets and the behaviour of contrarian and value investors provides “homeostatic negative feedback” to any given market and helps to keep prices near to equilibrium value. His rich description of markets will be much more familiar to traders and investors than the simple asset pricing models that I discussed earlier. Of course, modelling such a complex eco-system can be difficult, and it is for this reason that many-asset pricing models consider only a small number of actors.

Some of the players in a market eco-system attempt to estimate the intrinsic value of securities. They place trades in an attempt to exploit apparent divergences from intrinsic value. A value investor would be the simplest example of such a player. By contrast, a momentum trader might follow trends in returns regardless of fundamentals, in the expectation that those trends will continue. Others players appear to have little interest in either value or momentum.

Consider, for example, a full replication index fund that must trade to match changes to a benchmark; or a retail investor who must sell securities at the prevailing market price to help finance a house purchase. Lo (2004) argues that:

> because human behaviour is heuristic, adaptive, and not completely predictable – at least not nearly to the same extent as physical phenomena – modelling the joint behaviour of many

> individuals is far more challenging than modelling just one individual. Indeed, the behaviour of even a single individual can be baffling at times, as each of us has surely experienced on occasion.

Nevertheless, we should be able to achieve a better understanding of markets by studying how different players interact with one another. Agent-based modelling of markets[2] attempts to describe the developing behaviour and interaction of market participants, by defining the behaviour of agents and simulating outcomes amongst them. These models show that prices fluctuate with internal dynamics caused by the interaction of diverse trading strategies. They need not necessarily reflect true values.

Ever-changing cycles

Patterns in prices that appear in one period tend to disappear as agents learn of the predictable behaviour of others and evolve profitable strategies to exploit them. However, these evolutions take time and apparent price anomalies may persist. New patterns may also appear over time. Such phenomena have also been observed in actual markets. For example, Niederhoffer writes:

> results that appeared significant in one period had a tendency to evaporate in subsequent periods. If a phenomenon truly exists, shrewd operators discover it and start anticipating it in following periods, thereby evening out the moves.

He calls this the phenomenon of 'ever-changing cycles', which makes it difficult to establish technical trading rules or to develop algorithmic trading strategies based on academic research. That is, the ecology of markets is in constant flux.

[2] See, for example, Arthur *et al.* (1997); Farmer and Lo (1999).

Adaptive markets

Lo (2004) introduces the adaptive markets hypothesis, in which the "dynamics of evolution – competition, mutation, reproduction and natural selection – determine the efficiency of markets" and the success or otherwise of investment strategies. The author argues that many of the common apparent mistakes made by investors (such as the tendency of investors to avoid realising losses) can be explained by "an evolutionary model of individuals adapting to a changing environment via simple heuristics."

If we think of markets in this way, then survival can become more important to a trader than maximising expected utility within a rational-expectations framework. Traders learn, through trial and error and natural selection, rules or heuristics for survival. In a relatively stable environment, these heuristics adapt to become roughly optimal solutions. If economic conditions change, there is a risk that such heuristics became maladaptive. Markets history matters, through the forces of natural selection. Furthermore, aggregate risk preferences are path dependent under this framework. Arbitrage opportunities do exist from time to time. As economic conditions change, new markets are created, new species emerge and others die out. Investment strategies will vary in successfulness, depending on the economic environment and market ecology.

> "Models show that prices fluctuate with internal dynamics caused by the interaction of diverse trading strategies. They need not necessarily reflect true values."

How does this ecological view of markets relate to more traditional perspectives?

According to Lo, the notion of efficient markets concerns "the steady-state limit of a population with constant environmental conditions" and behavioural finance concerns "specific adaptations of certain groups that may or may not persist, depending on the particular evolutionary paths that the economy experiences". Thus, the adaptive markets hypothesis can reconcile many of the apparent contradictions between the two dominant views on how prices are set.

The high mortality rate for hedge funds can be understood better by considering them as a species within the market eco-system. Prolonged negative returns hinder their economic viability and can lead to the exit, or death, of the hedge fund. By knowing who is vulnerable, who is making mistakes and from where your next meal is likely to come, the trader builds up an edge within the market eco-system.

In particular, good knowledge of popular strategies employed in the market, and an understanding of any behavioural anomalies in other agents, is required. Each player attempts to exploit the behaviour of others. In the short-run, optimal portfolio allocation rules depend on the ecology of the market, but in the long-run, under-diversified portfolios can be driven out by a small group of invading agents.

Cross-market trading

There is no need to confine our thinking to just one market. We can envisage a market eco-system that includes not only different types of capital instrument, but also derivatives and markets in different countries.

Strategies such as capital-structure arbitrage, for example, involve trading across more than one market in the securities of a single

company. It could, for example, involve buying bonds issued by a company but selling equity in that same company.

> “By knowing who is vulnerable, who is making mistakes and from where your next meal is likely to come, the trader builds up an edge within the market eco-system.”

Although designed to exploit arbitrage anomalies between markets, these strategies can be risky. Yu (2006) examined the expected returns and risks from capital structure arbitrage and found that significant losses occur with alarming frequency. Ofek *et al.* (2004) have examined violations of ‘put-call parity’, a ‘no-arbitrage’ relationship that one expects to hold in options markets. These violations represent a pricing anomaly between equity and option markets and should be arbitraged away soon after they arise, subject to some of the constraints on arbitrage and risks that we have discussed already.

But why should such cross market anomalies arise in the first instance?

One possible explanation is that there is segmentation between the equity and options market – in other words, some players are confined to only one market. For example, a long-only equity investment fund may not be permitted to trade in options. Such constrained players could actually exacerbate pricing anomalies between markets, if forced to trade within a single market segment regardless of price because of, say, client redemptions. Furthermore, they would be unable to correct pricing anomalies between markets through arbitrage.

For traders and risk arbitrageurs, this suggests that cross-market flexibility is important for maximising the opportunity set.

Free money

Examples of cross market anomalies abound. A notable case involves the issuance on 31 October, 2008 by the British bank, Barclays plc, of £4.3 billion of new mandatory convertible notes (MCNs) in an effort to raise additional tier-one capital during the economic slowdown that year. The MCNs were issued at more than a 22% price discount to the ordinary shares and yet offered a higher yield and a fixed conversion price (subject to adjustment clauses for any future equity issuance below the MCN conversion price). The discount offered by the MCNs created a clear arbitrage opportunity against the equities of the firm.

There was also good liquidity in Barclays' ordinary shares – the third panel of Figure 1.1 below shows that there was elevated trading volume in the ordinary shares on the day of issuance of the MCNs, with approximately £200 million traded. On 31 October, the firm's ordinary shares initially *rose* sharply in price, from 205.25p to 217p as the market absorbed the early-morning announcement of the issuance. Only then did they start to fall as expected, ending the day down at 172.59p.

Figure 1.1 - Barclays PLC share price, relative share price and trading volume around 31 October 2008 MCN issue

Source: Thomson Reuters

From publicly issued documents and regulatory news-service releases it is clear that at least one long-short manager that held short positions in Barclays equity bought MCNs in scale (thus covering at least part of their short position at a favourable price), and at least one long-only manager sold existing long positions in ordinary shares and bought a large number of MCNs. Both of these were rational trading strategies. Nevertheless, many millions of arbitrage profits remained available for those able to exploit the opportunity – there was good liquidity in the ordinary shares at prices well above the offered MCN price and there were hours to make the required trades. Why would millions of arbitrage profits be left to collect for hours on end?

If $100 bills were dropped on the sidewalks of Chicago at eight o'clock in the morning, would you expect them to still be there by lunch time?

And yet this appeared to happen on the London Stock Exchange on 31 October 2008.

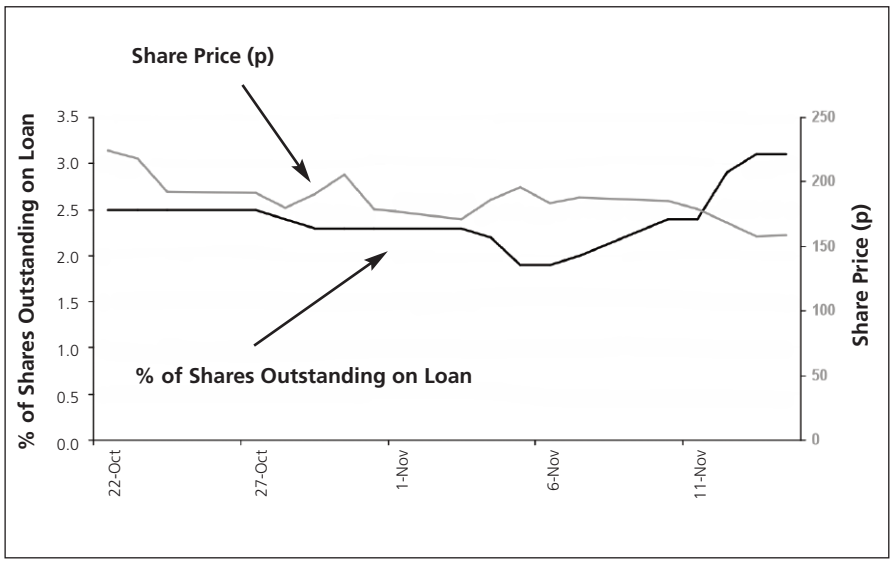
One possible explanation is that markets were segmented. That is, investors could not buy the MCNs by mandate, or at least were not sure if they could buy the MCNs (and could not get clarification from their compliance and legal teams quickly enough to take advantage of the open offer!).

Another potential explanation is short–selling constraints. About a month earlier, the UK Financial Service Authority had prohibited the active creation or increase of net-short positions in publicly quoted financial companies, although existing short positions were unaffected. This prohibited those traders without legacy short positions in Barclays ordinary shares from under-taking capital-structure arbitrage based around the issue of the MCNs. It is also possible that holders of existing short positions in Barclays' ordinary shares feared that they might have been unable to hold on to these positions until conversion of the MCNs.

Alternatively, they might have been unsure about how many MCNs they could obtain in the open offer (although this seems unlikely – there was a huge supply of MCNs on offer!). Finally, it could simply have been investor error: inertia or a misunderstanding of the nature of the MCNs.

Note from Figure 1.2 below that stock lending did not increase around the time of the MCN issue, consistent with the FSA ban on short-selling (although the increase in stock borrowing in early November is interesting!).

Figure 1.2 - Stock lending activity around 31 October 2008 MCN issue



Source: Data Explorers and Thomson Reuters

Two important lessons emerge for traders.

First, they should seek as much trading flexibility as possible (i.e. a broadly-worded mandate).

Secondly, they should approach any new capital instrument as an opportunity for capital-structure arbitrage; immediately reading the prospectus or similar documentation so as to understand the

relationships within the new capital structure. Together, these should allow the trader to exploit mis-pricing opportunities that arise as a result of market segmentation.

Short-sale constraints

Earlier, we considered the notion that short-sale constraints matter in markets, as they can prevent traders from exploiting mis-pricings and can lead to security prices remaining over-valued for some time. A short-sale generally requires the borrowing of securities to facilitate the settlement of the transaction[3]. However, it is not always possible to locate securities for borrowing. Also, the short-seller must generally pay a fee to borrow securities, and this can reduce the attractiveness of the short-sale. These problems, plus legal barriers, are known as direct short-sale constraints.

There are also many indirect constraints on short-selling, including the potential for unlimited losses and the risk of being caught in a crowded exit. In extensive interviews that I conducted with short-sellers and prospective short-sellers[4], interviewees identified no less than 34 barriers and difficulties with short-selling. There could even be more than this! These constraints tend to be risk-related, social or institutional in nature.

Perhaps one of the most interesting barriers mentioned is the perception that short-selling is a 'trading' activity rather than an 'investing' activity, so that it becomes unacceptable in the eyes of some stakeholders, such as trustees, consultants and ultimate clients. On the whole, our

[3] Naked short-selling and intraday shorting can be exceptions to this rule.

[4] These interviews took place between 2005 and 2009 and involved 31 experienced market practitioners.

> “Interviewees identified no less than 34 barriers and difficulties with short-selling.”

understanding of the risks associated with short-selling is limited. (I examine several of these in greater detail in the next few chapters.)

To what extent do short-sale constraints play a role in limiting arbitrage?

Nagel (2005) argues that institutions are important lenders of stock and that the supply of stock to borrow is likely to be sparser in companies with low institutional ownership. Accordingly, short-sale costs should be higher and constraints more binding in such stocks. Using institutional ownership as a proxy for short-sale constraints, he finds that short-sale constraints help explain apparent return anomalies across stocks, such as “the underperformance of stocks with high market-to-book ratio, analysts’ forecast dispersion, turnover or volatility.” However, direct short-selling constraints do not fully account for the cross-sectional return differences. Indirect short-sale constraints also matter.

Short-sale constraints can also lead to over-pricing due to the opportunity to speculate that arises when shorting is prohibited. Duffie *et al.* (2002) create a dynamic model of equity prices, stock lending fees and short-interest. They show that a stock price can initially be higher than the greatest valuation of any investor, because the price should include the benefits obtained from being able to lend the stock in future.

A stock price, when limited shorting is permitted, is initially higher than the price with no shorting permitted, as the shareholder expects to earn returns from lending the stock in future. This provides a rebuttal against

the common perception that easier access to shorting results in poorer performance for a stock. The authors argue that this can explain the negative stub-value effect associated with some corporate spin-offs (i.e. a negative implied market value for the portion of a parent company not spun off, even though equity is associated with limited liability).

This phenomenon was seen in March 2000 when 3Com sold around 5% of its stake in Palm and the latter went public on the NASDAQ market. 3Com planned to distribute the remainder of its Palm shares directly to existing 3Com shareholders in the ratio of 1.483 Palm shares for each share of 3Com held. An investor wanting to buy a stake in Palm could have bought, say, 1483 shares of Palm or 1000 shares in 3Com. The latter would ultimately have given him 1483 Palm *plus* a share of the assets belonging to 3Com. According to this logic one share of 3Com should have cost at least 1.483 times more than one share of Palm. However on the day of its IPO, Palm shares closed at $95.06 while the shares of 3Com closed at $81.81. This implied a negative stub value for 3Com shares.

In the Duffie *et al.* (2002) model, as lending fees decrease, so too does the valuation associated with the marginal investor and this leads to a decline in stock price. The model also shows that price declines associated with falling lending-fee effects are likely to be greater for companies with a smaller free-float (i.e. a smaller proportion of a company's shares being tradable in public markets) or with larger differences of opinion between investors (as proxied by higher turnover). This is consistent with poor average returns following an initial public offering, when investor opinions are likely to differ greatly (due to low levels of knowledge about the new company) and when free float is likely to be lower (due to lock-ins of stock held by directors and officers).

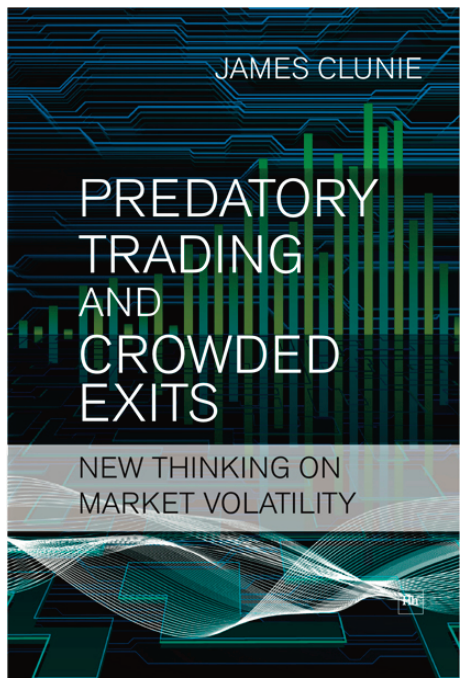
What next?

In this chapter we have seen that there a variety of reasons for securities prices to diverge from their equilibrium values. In the next chapters, I take a closer look at some of these reasons. In particular, I describe the theory and empirical evidence for each phenomenon, and suggest how traders can avoid mistakes by learning from this evidence. First, I consider predatory trading. This is a form of trading in which well-informed and well-capitalised players exploit weaknesses amongst certain other market players. The notion of predatory trading develops naturally from an ecological view of markets.

Predatory Trading and Crowded Exits

New thinking on market volatility

James Clunie



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