
The Liquidity of a Plasma Market

Focus on the Abnormal

In a classic 1999 paper called *A Framework for Understanding Market Crisis* financial risk manager Richard Bookstaber argued that we are analyzing financial risk in the wrong way. Financial risk models often remove the most extreme statistical outliers to create mathematically tidy and statistically convenient representations of risk arising from movements in asset prices.

Unfortunately this creates a risk management approach that works really well when no risk management is needed but doesn't work at all when risks are rampant, i.e. in a market crisis. Hence, financial risk models should throw out everything but the outliers and look to the structure of financial crises. It's like markets can take two forms, one where the normal rules apply and another when there seems to be no rules.

Since 1999 a number of tail risk measures has been brought forward such as kurtosis and skew, maximum drawdown and a number of VaR-varieties. With about a decade passed since the great financial crisis the meaning of these figures is however gradually fading in the mind of people in financial markets. Many that have entered the industry the last few years have only seen good times. The VaR-number is nothing abstract; it's the pain of watching your firm being shamed in media, the desperate outcry from customers over the phone line and the fear of losing one's job.

Much has changed in financial markets over the last two decades but unfortunately not always to the better. Bookstaber's understanding of how financial crises function is still highly relevant. In this text we will try to learn from one of the most experienced financial risk managers there is to see what can be said about today's market situation.

Apart from the already mentioned paper we draw on Bookstaber's books *A Demon of Our Own Design* from 2007 and *The End of Theory* from 2017. The author is the Chief Risk Officer at the pension fund University of California Board of Regents. Earlier he has been both a PM and a risk manager at numerous leading hedge funds and investment banks. Few have longer experience of financial risk than Bookstaber.

Bipolar Markets

According to the traditional academic theory of financial markets, changes in market prices are caused by new information. The market price discounts all available information and only when there is an addition to this bank of data will the price adjust to a new equilibrium. Apart from the trading from a handful of dim witted, to the theory later added 'noise traders', that is it.

Obviously this bears little resemblance with how we see market prices behaving. Prices move around most of the time – sometimes violently. And often without any obvious new relevant news being released. Bookstaber brings forward the view that it is actually the market participants' need for liquidity that dominates the trading of financial markets and subsequently the price movements. An investment bank needs to hedge a swap position, a mortgage desk needs to hedge its mortgage position and a fund manager who sells to meet liabilities are examples given by the author. It's (mostly) a liquidity driven market, not an informational market.

Bookstaber's market is a place where liquidity demanders meet liquidity suppliers. Liquidity demanders are demanders of immediacy - to them time is more important than price. Price levels are relevant but do not trump immediacy. Liquidity suppliers meet the liquidity demand

and for them price matters more than time. They have a view of the market and take a position when prices deviate too much from what the liquidity supplier thinks the value is. By keeping capital available for investment at the right price and exposing himself to the risks of doing investments the liquidity supplier provides a valuable economic function that is rewarded by a financial return.

Between the two sits the market maker, the transaction intermediary who's facilitating the trading. Market makers don't want to take risk and trade with a very short horizon to make money on the bid-ask spread. The market price clears where the immediacy of liquidity demanders balance the price sensitivity of liquidity suppliers. If the immediacy of demanders increases and prices drop, suppliers step in with larger volumes. Liquidity suppliers and demanders serve each other well. In normal markets that is. Suddenly the behavior changes.

To describe how the market changes into something very different Bookstaber uses a magnificent metaphor from physics. In normal times matter is solid and clearly distinguished. *"As energy increases, the constituents of matter blur. At low energy levels – room temperature – molecules and atoms are distinct and differentiated. As energy goes up, the molecules break apart and what is left are the basic building blocks of matter, the elements. As energy goes up even more, the atoms break apart and plasma is left. Everything is a defused blob of matter."* Matter is now an undifferentiated soup.

In normal times investors for example compare the PE-ratio of this stock to that stock, the credit risk of that bond to this bond, the potential future profitability of one company from another. Investors develop niches where they are comfortable to compete and sharpen their skill within their circle of competence. However, when the energy of the market goes up there is no time to look to the little things. It's time to ditch broader segments like cyclical stocks and high yield bonds etc.

When the energy level goes up further all risk assets look the same, correlations go to one and there is a rush for cash, gold and government bonds. All risk assets go down together offering no normal diversification. What matters isn't what characters assets used to have but who owns them and their immediate demand for liquidity. Risk assets are now an undifferentiated soup.

Critically, in this plasma market liquidity suppliers turn counter-economic. Normally, a lower price entice larger volumes, a larger supply of liquidity. Now a falling price triggers a flood of selling and despite the record low prices buyers are on strike – if they haven't turned sellers themselves. The buyers might already have lost more than their board can stomach, they have gone through their stop-loss levels, they are busy denying media claims of their firm defaulting, some might have already lost their jobs and all their customers are withdrawing their money. The market maker is flooded with sell orders with no one to take the other side of the trade at almost any price.

Hence, there is an in advance unknowable tipping point where lower prices suddenly counter-economically entice even lower prices in a death spiral of escalating velocity. These tipping points are obvious in retrospect but always missed and misunderstood in real time. Somehow markets and their complexity seem to be beyond our ability to comprehend.

For me reading the chapter on the 1987 crisis in *A Demon of Our Own Design* was a revelation. Why are researchers still debating what triggered the downturn? It's written out in black and white from someone who had the doubtful benefit of both a front row seat and the oversight and understanding to make sense of the event.

In short it was a combination of investor psychology, a mismatch in liquidity between the futures market and the cash equities market to act as a trigger and the widespread usage of portfolio insurance that created a self-enforcing negative loop of selling from liquidity demanders

while the liquidity suppliers backed away. In his books Bookstaber gives his accounts of all the large market crises of the last three decades to try to make sense of the market dynamics.

Complexity

Even though the volatility of the real economy has been declining for decades, as measured in the variability of economic growth, inflation and the like, the total risk of financial markets has instead increased. It can be argued that both the 2000/02 and the 2007/09 crises were generated from within the financial system and only later spread to the real economy. Shouldn't behavior of financial prices and markets reflect the behavior of underlying assets?

Bookstaber describes how a combination of financial innovation, complexity and tight coupling creates unforeseen events that often cascade through the financial system as a crisis. The complexity arises as the agents in the system change their behavior depending on other's behavior and events are often triggered by the use of derivatives. Due to the constant need for liquidity when using derivatives - and the often-high leverage - agents in the financial system are critically interdependent and the speed of the market trading gives little room for error or time for adjustment when things go wrong.

Time after time new financial products are launched without any real understanding of unintended consequences that can shock the system. Sometimes the risks are even deliberately ignored as the gains will fall to the banks' personnel but they will not face the losses. Combine our normal-times-based risk models with the non-linear effects of a constant stream of newly invented derivatives plus complex organizations with plenty of politics' aggravating decisions and you have an accident waiting to happen. That accidents occur in such a system is according to the author to be expected - they are so-called normal accidents that arise by the system's design.

SHARING OF FINANCIAL WISDOM

If we are to understand the market we should according to Bookstaber look beyond traditional economics and instead understand its four building blocks: 1) computational irreducibility - it is a system without mathematical shortcuts to describe it, 2) emergent phenomena - that the overall effect is different from the sum of the individual actions (nobody caused the economic crisis of 2007/09, but it still happened), 3) non-ergodicity - the concept that actions of one agent depend on and are shaped by history, context and the actions of other agents and 4) radical uncertainty - the fact that the system cannot be modeled by using historical events. The really important future developments will be unprecedented.

In effect Bookstaber is describing what others have called a complex adaptive system. When in time such a system reaches a tipping point, hurling it from one energy state to another, simply isn't knowable in advance.

The key point if we want to understand how such a complex adaptive system behaves during a crisis is the state of the agents in the markets such as the liquidity providers and demanders; *"what are their decision cycles; how much are they affected by market dislocations; and how critical is the market stress to their portfolio adjustments?"*

Further with regards to the market makers; *"what is their capacity for taking on inventory; and how long are they willing to hold these positions? And of the cycle of feedback: how are these answers affected by market dislocations; and how do they in turn further affect funding, leverage and balance sheets?"* Some agents will be under more pressure than others. Which assets will they hold and are those who are under stress holding the same type of assets?

In the end the market reaction is determined by the volume of liquidity driven selling, the ability of market makers to take on inventory and the time and price level required for liquidity suppliers to take the other side of the trade.

What About Now?

Since we always regulate the previous crisis the leverage of the banking system is much lower today than in 2007. According to Bookstaber the next crisis will instead be one primarily concerned with liquidity. As a matter of fact, many of the rules that were designed to lower leverage risks have increased the liquidity risks of the financial system. Leverage is observable for those who know where to look but the liquidity of good times is not the same as that of bad times. Hence, the problem we might be facing in the next crisis is less observable.

Looking at today's situation I would say that there are quite a few potential causes for economic misfortunes that come from outside the financial system. These are the things we tend to read about in the papers; the debt levels of some economically very significant states like Italy, Japan or China could cause problems in times of lower growth; the liquidity effects of quantitative tightening can turn out to be hard to manage; the more populist tendencies in global politics exemplified by events like Brexit and the flow of trade policy changes in the US-China battle for world supremacy; the monetary policy induced low growth caused by economic resources being locked in the many zombie companies that really should have been the subject of creative destruction long ago; or perhaps all the commentators are wrong and economic bull markets actually *can* die of old age.

Then there are the causes of trouble that hide inside the financial system. I'm bound to forget most of them and in reality what triggers a financial crisis tends to come from a direction where you are not looking. Still, a pair of distress candidates of mine would be firstly the fact that within corporate bonds the BBB-segment has ballooned to encompass half the investment grade market. Hence, the bonds with the highest credit risk have reached unprecedented size and the leverage of BBB-bonds in the US is also at historic record levels. If only parts of these securities would be downgraded this could totally dwarf the high yield market.

Further, even though the leverage of banks has moved in one direction – down – this doesn't mean that leverage hasn't moved elsewhere. The private debt market has seen a huge expansion the last decade. Not that this must lead to trouble, but booms in largely unregulated means to take on leverage has at least historically been good contenders for follow-on busts.

Irrespective of where the next crisis will originate there are also a number of factors present that can amplify the effects. The first category relates to Bookstaber's liquidity demanders. Not unlike the portfolio insurance in the 1987 drawdown, the number of portfolio strategies and market functions that today sell when prices goes down are abundant. There are all the risk-parity and trend following strategies, there are the strategies that scale down position sizes as volatility goes up and the massive selling from delta hedging of derivatives when there are larger price movements. On top of this private clients usually run for the hills at the same time.

The second category of amplifiers has to do with the market making function of today. New regulation has made it forbiddingly expensive for bank market makers to hold inventory that would aid the provision of liquidity. Further the Volcker rule has almost made banks' proprietary trading obsolete.

The order making is lightning fast and automated making the 'coupling tighter' than ever when it comes to market trading. Without much discussion on consequences a huge part of market trading has moved from underlying cash based markets, such as buying and selling stocks, to trading in ETF-units one layer up from the cash based markets. The effect of this is that the liquidity of normal trading of for example a credit-ETF can be great despite that the underlying securities – the corporate bonds - are hugely illiquid. Still, if the liquidity of the top layer would be exhausted in a crisis, the buying and selling drops down to the lower level where the size of the fire exit is made for ants, not a stampede of elephants.

Last of the potential amplifiers, is the category of liquidity suppliers that range from those with minimal time horizons to those that measure their horizon in multiple years. A large part of today's market liquidity is provided by high frequency traders. In normal times this helps boost liquidity. In more troubled times the evidence shows that the algorithms governing the high frequency trading simply make the HFT-funds exit the market. It's like the old story of the banker lending you an umbrella...

Related, but working on a different time scale, is that due to the lengthy underperformance the assets under management in active value investing portfolios have been dwindling. Value investors are the quintessential liquidity providers that buy when prices have gone down too far and by this prevent the drawdown from being too severe. Now they are clearly decimated and quant based value ETFs will probably not be of much help as I would guess that they are held by end investors who will try to exit the market in times of trouble.

Much institutional money has the last decade been allocated to so-called alternative assets like unlisted real estate, private equity, hedge funds, and infrastructure. The good thing is that these assets don't have daily pricing and therefore, at least on paper, are relatively unaffected by the first turbulent stages of a market crisis. The flip

Mats Larsson, March 5, 2019

SHARING OF FINANCIAL WISDOM

side of the coin is that with more funds in illiquid assets the forced selling of institutions due to for example cash calls related to collateral in currency hedging, the selling in what remains among liquid assets can turn out to be more indiscriminate and risk causing forced selling of assets that you really want to buy at the time. The Harvard and Yale endowments experienced this in 2008/09.

Now, private equity is also a potential liquidity supplier so more funds in PE could be of benefit. The problem here is the time lag, the period from the point that a PE-firm becomes interested is something to the time where a public stock company is bought out and taken private is several months. Hardly the liquidity provider to call on to stem an immediate market drawdown.

Nobody can predict when and from where the next large financial crisis will come, nor how it will spread through the financial system and the real economy. Despite this Bookstaber has made an important contribution in articulating and analyzing market functionality in a crisis situation and we are thanks to this at least in a position to clear away some of the fog in front of us.