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Is the Financial System a Predictable Network?

by Richard Morey

Once again, this month I'll be basing the report on the work of a European investment firm, in this case Fasanara Capital in London. This may be one of the best groups of economic and market researchers out there. They run quantitative hedge funds, and they appear to be uniquely insightful.

In order to grasp the import of Fasanara's research and current perspective, you need to understand the key components of computerized trading programs, at least in principle. Most input huge amounts of data, which is then sorted according to the variables the programmers deem most important. The programs search out combinations of market variables that have led to gains or losses, in as many markets as they plan to apply their resultant rules. For every investment goal a programmer has, the program can find the combination of factors that has lead to its success in the past.

The best programs also continually add in today's data, updating their "understanding" all the time. Markets continually change, so following the past precisely rarely works out. Instead, the best programs attempt to adapt and improve with new data that comes in. Once you have come up with the best rules to follow, rules which may be modified to reflect changes in markets over time, you create algorithms which select and then execute the trades in your portfolio. Turn the program on and let it trade.

Many of the programs use a large group of rules they discover and then combine. For example, Lyons Wealth Management, a superb investment firm that uses quantitative analysis, has 48 indicators they follow that tell them if they are going to be fully invested in stocks or fully in Treasuries. It's either all in stocks or all in bonds, and they are all in stocks until every one of their 48 indicators turn negative. (This occurred last December, so presumably they will now be sitting out the rest of this business cycle invested 100% in Treasuries.)

Looking at this industry from the outside, i.e. without seeing the algorithms which control the programs, it certainly appears as if it has advanced a great deal, particularly in the last decade. That being said, there are always two possible risks to most types of quantitative investment programs.

The first risk is that the programs won't deliver as expected. These programs have a distinct tendency to find rules that would have led to large gains in the past. Then when the program is turned on, they usually don't do nearly as well in the present. I have a close friend who creates advanced quantitative portfolios, and he tells me this happens all the time. Markets are changing every day, so simply following the past "verbatim" typically doesn't work.

Unfortunately, there is a second, much larger risk – one which it is impossible for the industry as a whole to avoid. While I find more wrong than right in Modern Portfolio Theory, I believe I recall they pretty much proved that any large group of investors (including programmers) will mirror the entire group of investors. In Modern Portfolio Theory language, at the end of the day, almost all the correlations do go to a negative one together, and this of course will include the stocks programmed traders are forced to sell – into crashing markets.

The fact is that a program may be superb, and appear very safe, on its own. However, when computerized trading becomes highly popular, such as today, most of the programs end up doing very similar things. The trader ultimately finds out that risk which would not have existed if the program was managing $1 million roar to life when a few others join in and now $2 trillion, or $4 trillion, is following algorithms remarkably similar to your own. The bulk of Fasanara's recent work involves mathematically analyzing this risk (and how to avoid and profit from it). The risk involved is the same one that brought the stock market down 22% in one day, on October 19, 1987.

Before looking at how this second risk is now positioned such that it conceivably could bring the stock market cascading down, I do want to mention we are strong proponents of superior quantitative investing. When done properly, it's almost impossible for any human investor to do as well as a properly-constructed program, especially if that program is incredibly "robust," meaning it is based on an intelligent study of all relevant variables for long time periods, and the program learns and continuously improves.

At Secure Retirement, we have been investing in up to five mutual funds, and two indexes inside fixed annuities, in which a computer program selects what to buy and sell, and when. Clearly, we support the idea of using the best algorithms, versus gut instinct, or emotions, when it comes to investing.

Human emotions remain the single largest obstacle to investment success. These emotions are also called greed, which is clearly in the ascendant today, and fear. Algorithms don't have greed and fear, so they begin with a huge advantage over us poor mortals. Plus, they can accurately sift through all the relevant data in a moment – work a human would take months or years to do by hand. It's really not even a fair fight.

Despite the above, one of the best of these types of investors, Fasanara Capital, now says computer programs have a significant probability of bringing the U.S. stock market down 20% in one day, and 60% in twenty-two days. That sounds scary, and it surely couldn't happen, could it?

Fasanara's principals include academics from Cambridge University – experts in machine learning, data mining, and related analytical fields. Perhaps the largest distinction between Fasanara and a thousand other quantitative investors is that they simultaneously analyze the markets from a complex systems perspective. The title of one of their reports, from November of last year, gives you an idea of the type of work they do in this area: *How To Measure The Proximity To A Market Crash: Introducing System Resilience Indicators.* They study "phase transitions" and a wide array of related phenomenon, always from an analytical framework. They then combine all the data on market action with the data from their analysis of complex systems.

Of all the quantitative investing systems I've seen, Fasanara's is, by very far, the most comprehensive. The picture it now paints is identical to the one seen by those we respect such as Lacy Hunt, John Hussman, Albert Edwards, William White, Carmen Reinhart, and numerous current and former central bank economists. In short, a financial tsunami getting ready to wash away an historically-large amount of bad debt.

Although the others who see this picture mentioned above also use a great deal of data and use in-depth, reliable analytical tools, Fasanara Capital exceeds them all, by an order of magnitude, when it comes to the comprehensiveness of their analytical system. Yet it paints the identical

picture. Fasanara's picture is simply much more well-defined, like looking at a television in HD versus standard definition. The three guys at Fasanara basically threw the largest net over the markets and economy and sorted the results using sound macroeconomic principles (for example accounting identities) as core assumptions on which the resultant algorithms are ultimately based.

This is, of course, why Fasanara's conclusions are the same as the others who are the most reliable when it comes to predicting the ultimate outcome of any given business cycle – they are all using the same essential set of macroeconomic principles. Fasanara doesn't tell me any of their core economic principles, the assumptions which guide their algorithms. They are, however, very easy to "reverse engineer" by seeing their results follow directly from the same principles the other best economists follow.

In other words, anyone who accurately follows sound core economic principles today is going to see the same picture, whether that picture is based on purely market data, includes systems analysis, or is based solely on the economic principles themselves without the fancy math. Common sense would actually work just fine. Regardless of the lens you look through, if you look closely, it's not hard to recognize that the bright light up ahead isn't fireworks celebrating a new stock market high but a train barreling down on us. By now, I must know dozens of the top economists and investors who are looking at this same picture. This bubble is a hard one to hide!

Fasanara's recent research shows one possible form the coming stock market crash may take. If the scenario they studied should transpire, we would see a much faster and more brutal crash than any time other than in the fall of 1929. Fasanara's research shows world markets are extremely fragile. When they use the term 'fragile,' it is a quantitative term they measure. When they describe what they mean, it is clear the market is fragile to an extent rarely seen throughout history. This means asset prices are so outrageously elevated that the entire system is now historically off-balanced. The stock market is teetering on the tippy top of a mountain peak. When markets are stretched beyond anything resembling their normal state, the further they have been stretched, i.e. the more fragile they are, the easier they are to topple, and the further they have to fall to reach a state that restores normalcy.

This is really just a way of saying markets revert to the mean, but that certainly wouldn't do justice to the remarkably clear picture Fasanara draws when analyzing the amount of fragility in different markets, and the ways in which that fragility could lead to a market meltdown. Still, any reliable market forecasting system must be based on the concept that markets, and almost everything else in economics, reverts to the mean – because they do. All of the quantitative funds we use are based on that principle. By doing so, they automatically proceed more cautiously as any market enters their definition of a bubble.

I think we can safely say Fasanara takes this process one step further, and I suspect their investments will turn out to be remarkably similar to ours at Secure Retirement throughout the coming recession and bear market. When stocks crash, there are basically four assets/strategies that profit substantially for U.S. investors. These are shorting stocks, having put options on stocks, Treasuries, especially 30-year Treasuries, and, usually, gold. All assets with any risk go down together during a crash. We won't short stocks because we consider it too risky for conservative investors, but we are investing in the other three asset classes that go up during

crashes. So, unless Fasanara is 100% shorting the stock market (which they could be doing for all I know), we're likely to end up owning similar things.

Fasanaa's recent research shows the markets most prone to an immediate crash are U.S. stocks and European corporate bonds. Regarding U.S. stocks, they analyzed the amounts of money in all types of computerized trading, and they analyzed the composition of the trades involved. If you do that study, you very quickly discover the largest groups of programs are all invested in the S&P 500, Treasury bonds, and/or cash. This makes sense, as the traders simply need highly liquid investments that are inexpensive to buy and sell quickly and easily. The largest stock market in the world is our market, and the most liquid, highest-quality bond market is the Treasury market, i.e. U.S. government bonds.

There are now computers moving trillions of dollars a day in and out of our 500 largest stocks. At the end of the day, we'll discover all the key algorithms turned out to be remarkably similar. One day a large number of certain types of quantitative programs will be triggered to sell. This would be the first wave in which trillions of dollars of S&P 500 stocks are dumped on the market, automatically.. (Fortunately for us, a whole lot of that money may be programmed to automatically buy Treasuries, i.e. our largest holding.)

Fasanara sees a day in which the market opens with $2 trillion of the S&P 500 stocks for sale. The stock market will have already been crashing, with Asia and then Europe selling the S&P 500 all night. Then when our stock market opens, it will gap down immediately. After attempting to open for the third time – the market will close for the day when it hits the third breaker at a 20% loss. This is called a "gap event," in its worst form.

I can understand quite clearly how this could occur, as the same thing happened, *with the same stocks*, back in October of 1987. If you read the best academic studies of that event, when stocks fell 22% in one day, you will find the cause was computers automatically selling the S&P 500 stocks. This is the exact same situation we see in computerized trading today – but the amounts invested today are vastly higher. Hmm…

What has changed since 1987 in computerized trading? A huge amount. As we'll see, some of these changes help explain how a one-day 20% loss such as we had in 1987 could cascade to a loss of 60% in the following three weeks based on today's quantitative investing world.

Today's algorithms are much more sophisticated than they were in 1987. Back then, companies sold what they called portfolio insurance in which they were always fully in stocks until they had gone down 8%, at which time they would automatically sell all their stocks. While history showed using those two simple rules would have led to large stock market gains over long time periods, with little risk, the problem was simply that every big investment company selling portfolio insurance had the same 8% stop on their stocks, meaning the computers were all programmed to sell all their stocks the moment the stock market had gone down 8%. Oops! When all the sell orders hit at the same time, stocks "gapped" down over 22%.

The added sophistication today in practice only means that this time around there would essentially be three waves of selling, each leading to a 20% drop. Keep in mind every computerized program that trades in the S&P 500 has sell signals which automatically trigger sales. The first wave of sales will then automatically trigger another algorithm to sell, and on and

on until trillions of dollars of the S&P 500 have been dumped on the market over a short time period.

In 1987, the simplicity of the system meant it would be a one-day phenomenon, as they were all triggered by a single, 8% drop in stocks. By the end of the first day it was over, as all the sell orders had been put through. This next time around, if it occurs, will lead to wave after wave of "forced" selling of the S&P 500. ***The losses would be greatly amplified by the vast amounts passive investors have in that same S&P 500 index.*** That last sentence is highlighted because that's the really, really big one. It means the entire market would be crashing if the quantitative funds are crashing. Quantitative funds can lead to a short crash on their own, but when the entire market is in the exact same overvalued assets, you shouldn't expect it to land until it has fallen a tremendous amount.

Sadly, one of the slowest methods in the analytical investing world is something called "risk-parity." The sad part is that this may be the largest amount of money, and is sold primarily to investors who believe they are very conservative. And they are safe the vast amount of the time. But if stocks go down 40% in two bouts of other programmed selling (short-term and then intermediate-term momentum funds at 20% each), they will lose another 20%, as risk parity sparks the third wave of losses.

Risk parity is essentially the same thing that brought down in the stock market 22% in one day in 1987. They are even using the same stocks! Yet, this time around they will be the last ones to sell and cash out, as they begin selling slowly, then continue to sell until they all dump the remainder at the same time. More money is invested in risk-parity than in any other quantitative system. This means the stock market would hit bottom, hard and fast, should the other programs all sell first.

Fasanara says that's basically how you get to a 60% loss in less than one month – while it would otherwise likely take nine months or more to fall that far.

Do I really think this will happen? I don't know. I'm nearly certain the fragility Fasanara has been researching and quantifying is real, and I know how dangerous that is. And I know scary amounts of money are trading in a way that can, and has, quickly lead to what Fasanara's studies indicate could occur again – on steroids! I tend to believe there is a not inconsequal chance the scenario Fasanara describes may come to pass, but we'll see.

Fasanra is also not saying it will happen, simply that it is mathematically possible, and the math happens to be supported by a lot of economic theory presently mirroring the mathematical analysis.

This doesn't mean it will happen, but something extreme like this is the very highly likely outcome of the current bubbles. They may burst anywhere first. Yes, the stock market crashing due to the sheep-like behavior of computer algorithm-driven programs is a valid possibility. Even if not the first bursting, this is going to happen again, at least in terms of the losses the programs end up sustaining. The stock market could already be coming down for another reason, so the programs might never be the spotlight. But there is a very high probability whole sectors of analytical programs will be wiped out around the bottom, as every single one of them sells every last bit of stock they own. I'm still not sure how much, but this is many trillions of dollars.

The fragility Fasanara Capital is measuring exists in markets around the world, and it's beyond my ability to predict which little thorn will prick these hideous asset and debt bubbles. Fasanara says the most danger is in U.S. stocks and European corporate bonds. I agree, though I also know the entire system around the world is in one form of bubble or another. Personally, I wouldn't be surprised to see it pop first anywhere, for practically any reason.

Below are three excerpts from Fasanara's most recent analysis. They sort of write in short-hand, leaving out much more than they say. But these three young genuises may be the best economic and market forecasters ever. In fact, I wouldn't be surprised to see them compared favorably to Warren Buffet by the time they are done. More on that topic later.

The article is entitled:

Cascade Effects In Modern Undiversified Passive Markets

The Ideal Environment for Overnight Gap Risk

"We attempt a Liquidation Agent Based Model, offering a numerical simulation of a liquidity gap event using a network model of the market, and show how select indexes could fall up to 60% for rather limited shocks to some of its constituents."

The Ideal Environment For Gap Risk And Chaotic Market Behaviour

Daily liquidity vehicles, be it ETFs or several other formats in major economies, have never been as large as they are today. **Passive auto-pilot vehicles**, either in the form of fully-quant funds, systematic, quantamental, CTA or supposedly-active-but-turned, risk parity, risk premia, have never been as large a share of the total as they are today. Fickle **retail investors** have never had as easy a direct access to markets as they have today through ETFs of the most disparate natures, often overselling liquidity (way above that of their underlyings) and diversification (often a fraction of what is portrayed).

Unlocked investors / hot money, retail driven / weak hands, passively managed: the daily liquidity risk is highly underestimated today. With it, the so-called 'gap risk', especially overnight gap risk. Which bring us to the real danger in markets these days being the market itself. **The risk of a some $2trn daily margin call or redemption event in markets is not just a theoretical exercise; it is rather now a workable assumption.** How would a market showcasing 'phantom liquidity' take it? What would trigger it? When the **top three asset managers alone command a staggering $14trn of AUM (assets under management), for the most part retail/daily/passive**, this should be a major issue for every market participant/regulator, and is not. **Against that, there is no FED, ECB nor BoJ put together. A massive move overnight is then made entirely possible, by undiversified retail passive daily money.**

The Real Danger Is The Undiversified Passive Market Itself

With a market as full of potential energy and ready for transition as the one we operate in, a catalyst is not needed. Or at least not a major catalyst. A small perturbation can be all it takes, at some unidentified point in proximity. **The real danger is not trade wars, nor US recession, nor the FED, nor China, nor European Banks, but rather the structure itself of the market, which can implode under its own weight at a moment's notice.**

Our **blueprint for the next crisis** is not 1929, 1987, 2000 nor 2008, but rather the '**Quant Quake' of August 2007** - also referred to as the '**August factor**'. At that time, renowned quant funds, including the famed Goldman Sachs QIS fund, lost 30% in short order: without any apparent reason - which itself says a lot about market brittleness. **Except this time around it may be 10-fold worse, insofar as it would not be isolated to quant funds.** Rather, it will be sprawling across fast through the undiversified passive financial network.

Modelling Shock Waves Cascade Effects

In the quantitative analysis that follows, **Fasanara Capital's quants Alessandro and Yaniv created a network model simulation and presented a possible outcome of an idiosyncratic shock to a handful of stocks, and subsequent fund redemptions in chain-effect.** The results suggest that, in a healthy system, these kind of events should not trigger market-wide distress. However, the loss cascades observed in the market model suggest unhealthy conditions of market fragility. These loss cascades suggest that the structure of the market, as well as unsustainable behaviour by its biggest players, is jeopardising the stability and resilience of the system. That is, the research suggests that there is a systemic fragility in the market, and this may put it at risk of collapse. The note attached shows **the impact on the NASDAQ of a cascade event triggered by a rather moderate idiosyncratic shock to a single stock**, under the current levels of fear and liquidity. It can be noticed that **such an event could result in a market-wide drawdown of up to 60%, primarily caused by repeated withdrawal of capital.** This is in response to bad performance that, in turn, forces
an asset manager to liquidate additional assets and put increasing pressure on prices, eventually causing a market meltdown."

Conclusion

A person might be confused by Fasanara calling an S&P 500 index fund investing in "the undiversified passive financial network." It owns 500 stocks, so isn't that diversified? Actually, no, it isn't. The largest of those 500 companies are worth far, far more than the average company in the group. Most importantly, almost every single one will fall in tandem the moment risk hits (with the few exceptions most likely being gold mining stocks).

Before concluding, I want to mention a few thoughts about Warren Buffett versus algorithmic programs. The answer is actually the same answer Mr. Buffett's daughter gave when asked why her father never uses a computer (except to play bridge). She said his brain is a computer, so he doesn't need one. Warren Buffett can actually do the calculations quantitative programs do *in his head*. Of course, he doesn't do a fraction of the number of calculations the programs do. Instead,

Mr. Buffett begins with the assumption that pretty much everything he needs to know can be found in a company's annual report history. He reads the annual reports of several thousand companies, remembers all the relevant numbers, and can do the key calculations based on their financials in a moment. In a real sense, you could say Warren Buffett's brain is the best quantitative investment program ever created! Of course, Mr. Buffett's time frame is forever, a fact that isn't the case for most regular retired people I know. We'll know in a few decades, but I think Fasanara Capital may give Mr. Buffett a run for his money. Their program is remarkable.

Keep in mind the article excerpted above is in a series Fasanara calls "Scenarios." It is one outcome consistent with the data. The point to take away is not that the stock market is going to drop 20% in one day and 60% in the following three weeks.

Instead, the point to take away is that the state of the economy and markets themselves are so off-balanced, the path forward as the imbalances are corrected is going to involve traumatically large losses for stocks, corporate bonds, and other types of corporate debt, throughout the world. Yes, given the current state of the entire worldwide financial system, the path forward is highly likely to involve very fast, large losses. Cascading losses sparked by gap risk is but one possible expression of the coming worldwide debt liquidation event. Keep that term in mind, 'worldwide debt liquidation event,' as we move forward, as that will be the term you hear describing the severe conclusion to this very long, very strange business cycle.