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Contagion

Dr Brown prescribes an adequate understanding of the word before we start applying it too freely . . .

*Tis now the very witching time of night,
When churchyards yawn and hell itself
breathes out
Contagion to this world*
William Shakespeare, *Hamlet*,
Act III, sc. ii

The 1997 Asian financial crisis made contagion a hot issue in modern financial risk management. In July of that year, Thailand floated the exchange rate of its currency, the Baht. At the time, Thailand was the 41st largest economy in the world, with a total stock market capitalization less than one-tenth the capitalization of the world's largest companies. Despite the apparent small significance of the event, it seemed to touch off a crisis that devastated the economy of the four East Asian "Tigers," caused the largest point decline in the Dow Jones Industrial Average up to that time, pushed the price of oil down to \$8/barrel, and caused severe financial pain in Latin America and Eastern Asia. The fall in oil price and pressure on Eastern European assets contributed to the Russian



So, if it sneezes, do we all catch cold ...?

default of 1998, which triggered further problems, including the demise of Long-Term Capital Management. The effects on Latin America helped cause the 1999 financial crisis in Argentina, which also had global repercussions.

A decade later, contagion is in the news again. A spike in delinquent payments of US subprime mortgage loans seems to be causing a liquidity crisis among banks, massive dislocations in the money markets, a flight to quality, and losses at hedge funds pursuing a wide variety of investment styles. There are about \$1.3 trillion in US subprime mortgages, less than one per

cent of the \$150 trillion world economy. Investors always anticipate significant losses in these securities. The fear that those losses might be higher than expected is an event roughly the size of an average week's net growth in total world assets. How can something that small shake the world? And a more subtle question: why did subprime losses cause massive dislocations in some markets, such as money markets and high-quality mortgage loans, without affecting other markets, such as equity and commodity? Finally, is this only the story of the month for investors, or will it lead to further unraveling over a year or more?

Contagion

For all three questions, and other similar ones, the usual answers include the word "contagion." That's a sign of ignorance, not knowledge. The word "contagion" was originally applied in medicine to any transmission of disease, whether genetic, bacterial or viral — whatever the vector — and even was used for a common cause that affected individuals independently. It meant little more than "lots of people have the same condition all of a sudden, and we don't know why." Advances in medical science have restricted the term to infectious diseases transmitted by direct or indirect contact, and the term "contagious disease" is no longer needed, as it has become synonymous with "communicable disease."

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Finance is behind medicine. We still use “contagion” when lots of (usually bad) things happen around the same time and we aren’t sure of the relations among them. This usage is bad risk management for three reasons. First, anything we don’t know is a risk, and covering it up with a word makes it a hidden risk, and therefore more dangerous. Second, people can agree on the word while holding conflicting ideas about causes. This damages communication, which is another risk. Third, contagion is a powerful metaphor, and a misleading one. It suggests that the first bad thing to happen is the cause of all subsequent ones and that the rational reaction is to isolate your portfolio from any sectors that are affected, or that might be affected. It makes it seem natural to let the “infection” burn out wherever it has manifested itself, rather than risking a broader “epidemic” by helping victims. In the past, people would often flee areas with outbreaks of contagious disease, spreading the problem, instead of taking useful actions such as building sewers or draining stagnant water. In finance today, the reaction to “contagion” might similarly spread the problem, when it would be rational to strengthen infrastructure and nurse at least some victims back to health. If it is more prudent to quarantine the sufferers and let many die, that should be decided by careful analysis, not metaphors.

Questions about financial contagion are old, but not ancient. Perhaps the first modern example is the 1719 collapse of John Law’s Mississippi Scheme in Paris, which apparently reached across the English Channel to pop the South Sea Bubble in London the following year. Despite nearly three centuries of additional data and theoretical advances, we are left with the same four basic theories advanced at that time. Some people emphasize real assets and economic transactions; others blame virtual, financial forces. Within each camp, there are people who focus on the run-up in prices before the crash, and those who worry instead about the triggering event.

“We all agree that pessimism is a mark of superior intellect.”
— John Kenneth Galbraith

The real pessimists point to real trade links among markets that cause asset prices to inflate

in all of them. A speculative boom in one country and industry generates demand for products and services from other industries in other countries. These revenue increases in secondary companies induce managers to expand and investors to pay more for securities the companies issue. This makes people richer, which causes them to consume more and to invest more, both of which feed the boom. Self-reinforcing waves of overexpansion and security price inflation continue until some random, minor event ends the party. The decline occurs by the same mechanisms as the increase, but it happens much faster. It is not that problems in one region and sector spread to the rest of the world; it’s that the process was unsustainable from the beginning. It required increases everywhere. As soon as that condition fails, everything that got caught up in the process falls down; everything collapses under its own weight.

While this makes a nice story, it’s hard to support empirically. It’s true that contagion usually occurs when asset prices in affected sectors are high in fundamental terms, but there are plenty of counterexamples: weak fundamentals without crises and crises when fundamentals are strong. The spread seems faster than real transactions can explain, especially in earlier history, and contagion often bypasses sectors with strong real transaction links to jump to remote sectors. Moreover, the theory says nothing about which event will end the good times. It’s usually possible to find lots of sectors where prices seem high. If we always have to regard all of them as subject to a common “contagion” risk of crashing simultaneously, it’s hard to do much financial business. An investor can stick to only out-of-favor sectors, but by definition, most don’t. And a bank cannot restrict itself to only the customers who don’t want to do any business.

“We all live every day in virtual environments.”
— Michael Crichton

These considerations led some pessimists to virtual theories. One of the arguments that financial instruments are the transmission vector is there is little evidence of financial contagion except in places with at least the beginnings of

modern banking systems. Financially primitive societies are unable to make much use of good luck, like unexpected agricultural surpluses or technological breakthroughs. It takes leverage to exploit opportunities.

In good times, leverage tends to build on itself. A prudent bank might lend out ten times its capital. But some of that capital might consist of deposits in other banks, and some of those loans may be to already-levered businesses, doing business with levered customers. While most of this leverage supports legitimate, if possibly overenthusiastic, business, some goes to crooks and idiots.

When something goes wrong in one sector, it can take down a bank, which spreads the problem to other sectors with deposits in the bank. It exposes some crooks and idiots, which undercuts investor confidence in all leverage. The problem can spread to related and unrelated banks. As leverage disappears, even normal business transactions are inhibited. Failed loans mean assets must be liquidated at fire-sale prices, which undercuts the security of good loans.

In this story, the financial crisis comes first and is often followed by a real contraction in business activity. The real contraction is caused by a combination of disruption in real transactions, scarcity of leverage, and emotional depression of consumers, investors, and entrepreneurs. Government actions, at least historically, have often served to exacerbate rather than alleviate the problem.

This version has more empirical support than the real pessimist theory. It suggests cycles of increasing leverage followed by crashes, which does seem to happen (although with enough variation in timing and degree to frustrate schemes to profit from the pattern). It gives some basis for predicting when crashes might occur, and what sectors might be related via shared leverage.

The weakest empirical part of the theory is the link to real contractions. It postulates fundamentally irrational behavior in the financial markets, then suggests real business decisions are changed as a result. It has trouble explaining why such dysfunctional financial institutions were designed in the first place, and why they survived at the expense of sensible arrangements, and why people making real decisions with real assets would

throw away wealth paying attention to financial scatterbrains. Adherents get to say, “I told you so,” every few years, but they must forego the pleasure of getting rich in-between times.

“Pessimism never won a battle.” —Dwight Eisenhower

The key assumption of both pessimist schools is the linking of the crash to the preceding boom. The real problem is the speculative inflation of asset prices, the “irrational exuberance;” painful correction is the inevitable result. However, a new bull market always follows the crash, bringing the economy to a higher level than the peak of the previous run-up (it will not be higher in every index; some sectors are damaged permanently, but it is higher in overall production). So optimists see the crash as necessary demolition to prepare for the new construction.

I think one reason the optimist camp has always been smaller is there is no finger pointing in good times. Everyone is trying to take advantage of new opportunities; no one spends a lot of time worrying about how we got here or who is to blame.

In bad times, however, there are plenty of underemployed people with nothing better to do than write and read books. At that time, it’s natural to write books about the current situation, and link it to the recent past. The current troubles grow out of the past excesses. It’s hard to explain why in a manner that is consistent with both events and human rationality, but with a high moral tone, loose definitions, and enough pages, it’s possible. Most authors are less ambitious. They do not bother with facts and use words like “mania” or “frenzy” to signal they have no idea why people did what they did. More or less by definition, the people writing the books are not the people seizing the new opportunities created by cheap assets and labor, and whatever new ideas will fuel the next boom. The latter group is too busy, and not interested in spreading the information they intend to use to get rich.

It’s also important to keep in mind that a contraction is not bad for everyone. Decline in asset prices hurts people who have more than their share of assets, but it opens up opportunities for everyone else. The economic change it

brings hurts people with large specialized investments in human and physical capital but helps people with flexible minds, lifestyles, and assets. It’s hard to get a job, but food and other necessities are cheap, so it’s relatively easy to devote yourself to a long-term project. The social problem is there are too many poor people, not that times are particularly bad for poor people.

The inverse is also true: bad things generally do not lead to economic contractions. Wars and natural disasters stimulate the economy both in the short term, via an increase in demand, and in the long term, as the capital assets destroyed are replaced by more up-to-date versions. There is a limit to this, a level of destruction that cripples economic progress for a generation, or causes massive emigration. But this is usually caused by ongoing problems rather than a discrete disaster.

The real optimists point to the restructuring necessary to embrace innovations. When steam power replaced wind and water power for milling grain, it was not a continuous process of small steam mills gradually increasing their share of the work. Mills have to be relocated, new roads and railroads have to be built, and coal mines have to be developed. People have to learn new skills and schedules. Suppliers of grain and consumers of flour have to revise their businesses. And all of this is happening in a dynamic economy with many simultaneous innovations. Much of the changeover occurred in the aftermath of the panic of 1793, the worst in England since 1720.

It might seem possible to keep the old technology running while infrastructure for the new one is built. In practice, that’s as hard as replacing your car transmission while the car is running. People have to change to get a carrot in the future — some of them are shortsighted — so it takes an immediate stick to accomplish the shift.

Real optimists point to innovation as the vector for contagion. Technological, demographic, and other changes create strains in existing infrastructure. Sooner or later, something breaks in some sector. That could result in a local repair, but sometimes there is sufficient strain in related sectors that a global renovation is optimal. In the short run, that creates layoffs and write-offs, and reduces production, but in the long run, it contributes to economic growth.

Like the real pessimists, real optimists do not see sectors pulling each other down. There is a real underlying condition that requires many sectors to retrench at the same time. The first one to collapse may trigger the general downturn, but the ultimate cause is deeper changes in economic organization.

Synthesis

Real optimism has more empirical support than either of the pessimist theories, but it does not come close to explaining everything about downturns. People who have to predict, as opposed to explain, find that combining theories gives the best results. At any given time, there are people over-optimistically betting on growth within the existing economic structure, and other people supplying the optimists with too much leverage. Still other people are working on disruptive inventions. A problem in one sector puts real economic pressure on suppliers and customers to that sector, and financial pressure on entities that share the same leverage. At the same time, it creates opportunities for emerging ideas, which threaten further disruption. Most of the time, the problem is contained within the original sector, but sometimes it spreads, with each new collapse causing more than one additional collapse, in a self-sustaining reaction.

Although this is not an elegant explanation, it is useful for risk management. When analyzing a risky investment, we look not only at the business itself, but also conditions among its suppliers and customers. We also determine where the business gets its leverage, and what other entities are drinking from the same pool. Finally, we consider new ideas that might cause restructuring in this business and other sectors at the same time. All of these are sources of dependence that are not apparent in correlations measured during good times. Careful analysis can help us prevent overexposure to optimism in one market, or to one pool of liquidity, while identifying prudent hedge investments. Without this attention, it’s easy to make the same bet in many different ways, and to overlook attractive hedges.

The one thing this combined approach does badly is explain the timing and sequence of downturns. Financial markets should recognize

the growing probability of a contraction, and the associated growing correlation among bets. Additional risk capital should be set aside to compensate for the reduced value of diversification. Cost of leverage should increase while equity returns fall, shifting the advantage from existing, capital-intensive, high-leverage businesses to emerging ideas funded entirely with equity. The mild business slowdown and decline in asset prices should encourage liquidations in overbuilt sectors. Individuals should take advantage of the period of low wages and prices to work less and consume more, and to retrain for the next boom. Thus, the financial markets would react first, and gently guide real business decisions down the proper paths.

The actual picture is quite different. Normally, we see a series of business disasters that are ignored by the financial markets, although in retrospect they are the beginning of the disaster. Then the financial markets crash, usually without obvious business news. Sometimes that's the end of it, the financial markets recover, and life goes on as before. Other times, there is a business contraction, but it can occur months or years after the financial crash, and its size and duration seem unrelated to the size of the financial crash. The contraction is not gentle, and people do not enjoy their newfound leisure, nor take advantage of the purchasing opportunities. Neither businesses nor individuals restructure and retrain aggressively to prepare for the next boom.

This is the starting point for financial optimists — the smallest camp, but the one that includes me. We feel that the timing is the important thing. Both the real economy and the financial predictions of it will naturally go up and down. Sectors will have correlations based on their economic links and shared underpinnings. This needs no explanation. The puzzle is why the upswings are slow and the downturns fast. We don't have to explain increased correlation during the downturns; that is an artifact of their speed. The fast pace of asset-price declines means if we keep calendar time constant, we are measuring correlation over a longer effective financial time interval in crashes than in normal times.

We also prefer explanations that do not require irrationality. That's not because we think people are always rational, but because if you postulate irrationality you can explain anything, which means you explain nothing. Financial institutions have evolved over many years and been subjected to intensive analysis. If crashes were an artifact of design defects, you would expect them to have been eliminated long ago.

**“There is nothing so contagious as enthusiasm.”
—Samuel Coleridge**

The speed of declines is the clue to their optimistic character. Suppose you are in a crowded elevator or subway car, and new people get on. The people closest to the door are forced to move back, packing themselves tighter. But people farther away from the door benefit by not moving. People will push into them, reducing some of their space, but by not moving they retain all the space on the other side. The faster they react to the increased crowding, and the more they react, the worse off they are.

Now suppose some passengers get off. In this case, the fastest people to react get the most space. Generally speaking, it's rational to react more quickly to new opportunities than to new dangers. The most aggressive, ambitious people are constantly seeking opportunities, and rush to any candidate. It is the most fearful, conservative people who are alert to danger, and they are constitutionally slower to react.

In the financial optimist story, equity prices fall not because the expectations of future cash flows of existing companies decline, but because the rate of return on equity investment increases. This makes much more quantitative sense. It's hard to imagine news that could come to the market in a short period of time that would revise future cash flow predictions by 10% or more, but it's easy to imagine news that would change real discount rates by 0.2% to 0.4%, which has about the same effect on valuations.

The new opportunities in the economy mean that entrepreneurs are willing to pay a higher return on equity capital, and that demand for equity versus debt financing increases, further pushing up the equity return. However, investors

find the stock market a riskier place. They cannot simply buy the existing index; many of the companies in it will be hurt, not helped, by the changes. Investors must instead sort through new ideas, without history to estimate expected return and risk, and, more important, to estimate correlations to form optimal portfolios. So, on the investor side, new opportunities increase the required rate of return on equity.

Although the new ideas do not require leverage at this stage, leverage is needed to liquidate existing capital assets. Both pre-existing and new leverage is riskier than it was in the past, for the same reason the equity markets are riskier. Risk-free interest rates generally fall due to the reduced overall demand for leverage, but yield premiums for risk increase. Some commodity prices fall because demand will be less under the new regime; other commodity prices fall because new infrastructure will increase supply.

Contagion is transmitted through financial parameters, primarily risk premia, but also interest rates and commodity prices. It's difficult to forecast which sector will trigger the asset-price collapse, and the degree to which other sectors will be affected. More to the point, it's too expensive to try to forecast. Being right and early costs you more money than it saves. Being wrong but prudent is both easier and better.

Financial optimists do not believe crashes can be predicted—that's why they are so sudden. Risk management consists of making sure you have enough assets left afterwards to take advantage of the emerging opportunities as they become apparent. That, in turn, means maintaining some exposure to sectors and securities that will retain not value, but liquidity or cash flow, in the various foreseeable contraction scenarios. Long-term success comes from aggressive exploitation of good times and survival in bad times, not good performance in all times.

Ambrose Bierce, in his *Devil's Dictionary*, defined “optimism” as “The doctrine that everything is beautiful, including what is ugly, everything good, especially the bad, and everything right that is wrong. . . . It is hereditary, but fortunately not contagious.” Fortunately, he was wrong. Optimism is contagious.