

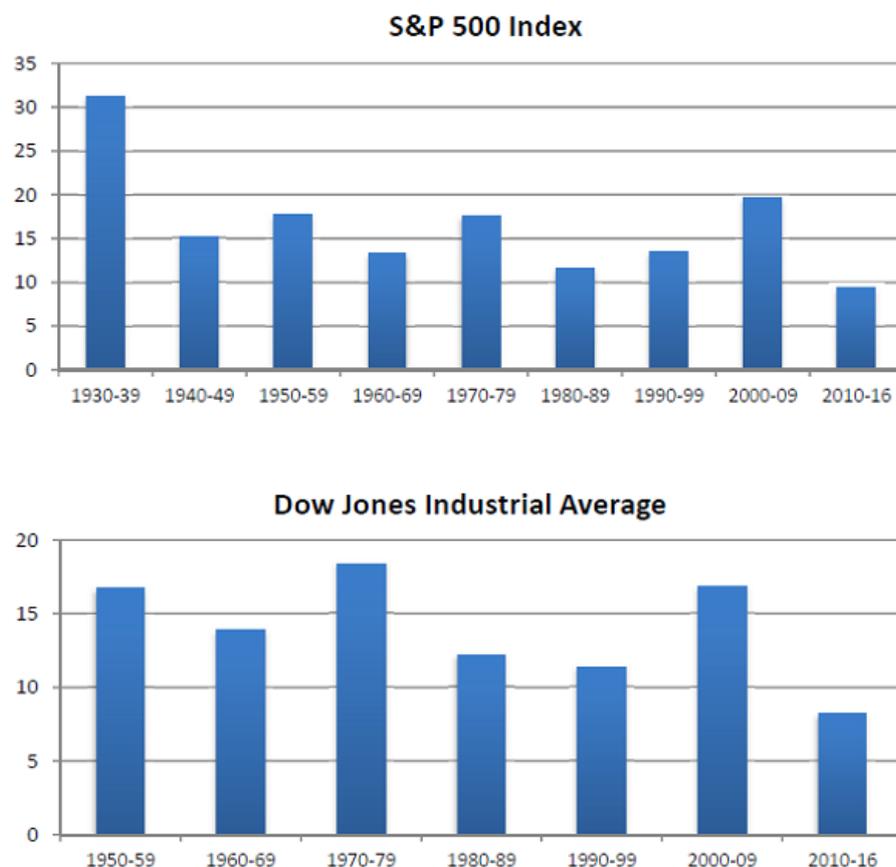
## The dramatic decline of risk - part 3 - Financial market risks

Dr Woody Brock | SED | 22 May 2017

In this final part of this new PROFILE looking at the transformation of risk confronting investors, we consider the third of three risks – risk in financial markets, specifically equities.

On the one hand, it is straightforward to quantify the behavior of stock market risk over time. Figure 2 presents decade-by-decade standard deviation data on the riskiness of the Dow and the S&P. There is a modest trend towards reduced volatility, but a trend one fifth as great as the corresponding trend in GDP data (Figure 1).

Figure 2: Decade-by-decade standard deviations of stock market volatility



Source: Standard & Poor's; SED

On the other hand, it is not straightforward to interpret these data. For while overall market risk has declined modestly during the past 80 years, the nature of risk has changed greatly during this time, a point obscured by these data.

To understand this, it is necessary to know what causes market risk, and how this causality has changed.

### THE TWO DRIVERS OF MARKET RISK

Prior to 1980, efficient market academics believed that the primary driver of stock prices was news about fundamentals such as interest rates, earnings, dividends, and the state of the economy. Robert Shiller of Yale University along with other scholars then demonstrated that changes in fundamentals could explain at most 20% of observed market risk. The great question in finance then became: "Where does the rest of market risk come from?"

Over the following three decades, the principal answer to this question was advanced by Behavioral Finance scholars: "The additional risk stems from various forms of irrational behavior that cause markets to overshoot/undershoot the news." Much of this irrational behavior originated in the psychological biases people exhibit when interpreting the news and making decisions, e.g., framing bias.

The problem was that, while there was much truth to the findings of behavioral finance scholars – we all do exhibit biases – these scholars failed to produce a satisfactory general equilibrium model showing exactly how such biases increase price overshoot and overall market volatility. There were many interesting suggestions along these lines (e.g., noise-trading models), but no rigorous results.

In our view (and we have written much about this), the approach adopted by Mordecai Kurz of Stanford University succeeded in accomplishing what Behavioral Finance failed to achieve.

Kurz introduced the concepts of investor mistakes (wrong probabilistic forecasts) and the related concept of the correlation of investor mistakes. The greater the magnitude and correlation of investor beliefs, the greater market volatility would be. A footnote summarises this new theory of Rational Beliefs<sup>1</sup>. Using this approach, Kurz and his colleagues showed within a proper general equilibrium model that some 85% of overall market risk could be explained once these new variables were needed or included in the model. Furthermore, no assumption of irrationality (properly defined) was introduced.

This was a remarkable accomplishment. What matters most for us is that his theory clarified when and why markets overshoot/undershoot the news. That is, his theory confronted the issue of causality.

**Conclusion:** There are two entirely different sources of market risk. First, there is news about fundamental variables. Second, there is overshoot risk stemming from market mistakes and, possibly, from irrationality. The former is known as exogenous risk, whereas the latter is endogenous risk. Total risk is the algebraic sum of exogenous and endogenous risk, i.e.;

$$(I) \text{ Total market risk} = \text{Exogenous Risk} + \text{Endogenous Risk}$$

We now use this identity to understand what has happened to market risk in recent decades.

### RESOLVING THE PARADOX UNDERLYING THE DATA OF FIGURES 1 & 2

To the extent that stock markets are driven by news about fundamentals – that is, by exogenous risk alone – our data suggest that market volatility should have dropped by over 80% over the past 80 years. For this is how much exogenous risk dropped, as seen in Figure 1. Yet, there was only a 20% decline in overall market volatility, as seen in Figure 2. What was going on?

There is only one explanation. Given the large decrease in exogenous risk, endogenous risk must have risen very significantly for total observed risk to have declined by only a modest amount. This follows from identity (1) above.

What might have caused a significant increase in endogenous risk?

A tentative list of answers include:

1. The dramatic increase in leverage made possible by the invention of derivatives and by financial innovation in general;
2. An apparent increase in trend-following behavior which has served to increase the correlation of investors' beliefs, and to amplify volatility;
3. A series of significant and highly correlated mistakes (bad forecasts) due to investor ignorance as to how complex modern economies work. These include:
  1. Why oil prices shot as high and fell as low as they did;
  2. Why inflation rose as high as 14% by 1981;
  3. Why inflation has been much lower than expected between 1990 and today;
  4. What the true impact of the Digital Revolution was on the economy and earnings;
  5. What “money printing” really is, and why it need not be inflationary;
  6. Why productivity growth cannot have declined as the official data tell us.

Such misunderstandings lead to market mistakes which amplified volatility.

4. Increasing levels of "Pricing Model Uncertainty" due in part to investors' inability to know how to price the shares of an ever greater number of large technology-driven companies where the determinants and the meaning of earnings growth is hard to fathom;<sup>2</sup>
5. The advent and rampant popularity of ETFs – how significant increases or decreases in investments in a given fund will cause the prices of all its constituent shares to rise or fall in tandem, thus increasing market volatility;
6. The correlating role of certain popular quant algorithms and related hedge fund strategies. One client told us, "we will increase the utilisation of one of our algorithms the more we learn that other managers are using it, too." [The author knows little about this issue.]

This list is tentative, and may not be wholly correct. It must be remembered that the concept of endogenous risk is a new one, and much work needs to be done to explain what developments cause it to rise or fall. In our view, the two most significant drivers have been increased leverage and increased Pricing Model Uncertainty.

But regardless of how little we may know about these individual drivers, the reality revealed by Identity 1 is that total endogenous risk has increased dramatically over the decades. Much more research needs to be done to determine why.

## ENDNOTES

1. Suppose that an investor believes that house prices almost always go up and almost never drop. Suppose he acts upon this view by borrowing to acquire residential real estate. Suppose additionally that almost all other investors share this belief (i.e., the beliefs are correlated). Finally, suppose that they all prove wrong in their bets and house prices start to drop. The combination of significant leverage and a "correlated market mistake" results in a panic – a collapse, not a mere decline, of house prices. This is "overshoot" in the extreme, and we witnessed it in the US between 2007 and 2010. Classical financial theory based upon the now discredited doctrine of "rational expectations" cannot predict an overshoot or risk of this kind, for rational expectations imply that investors are never wrong – they are all assumed to know the correct probability of future prices. All that does matter to the magnitude of price changes (volatility) are unexpected news announcements about fundamentals. If God tells them that earnings of a stock will be 10% lower than expected, then they all know from a "correct" God-given pricing model known to all that the stock price will drop exactly, say, 7.9%. No more, and no less. There is no overshoot. This was the model Shiller tested, and found it was unable to predict, much less to explain, some 80% of market risk over many decades.

2. As we have shown in previous research, the greater the inability of investors to know the "correct" price of a stock once "news" has been announced, the greater the resulting market overshoot/undershoot will be. The reasons for this are counter-intuitive and based upon advanced game theory. Specifically, the greater the Pricing Model Uncertainty, then it will be rational for traders to herd and extend price trends further than they would if they knew the true Pricing Model. Recall that, in classical efficient market theory, all investors are assumed to know the "correct" Pricing Model for every asset. Therefore, overshooting-the-news is a non-well-defined concept in classical finance. Market volatility will be much less in such models than it is in reality.



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