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## Why the excess volatility?

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In 1981, Robert Shiller compared actual stock price behavior over a century to the present discounted value of dividends. His diagram is reproduced below:

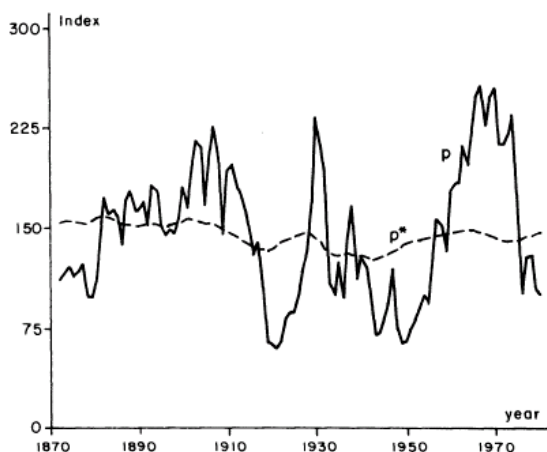


FIGURE 1

Note: Real Standard and Poor's Composite Stock Price Index (solid line  $p$ ) and *ex post* rational price (dotted line  $p^*$ ), 1871–1979, both detrended by dividing a long-run exponential growth factor. The variable  $p^*$  is the present value of actual subsequent real detrended dividends, subject to an assumption about the present value in 1979 of dividends thereafter. Data are from Data Set 1 Appendix

In this picture, the line marked “ $p$ ” indicates the actual behavior of the S&P500 index since 1870. At each point in time, the line marked “ $p^*$ ” indicates the price that could be explained by the actual subsequent dividends. Naturally, subsequent dividends at each point in time are not known. However, that fact could only cause the line “ $p^*$ ” to fluctuate more than the line “ $p$ ”. As can be seen, the opposite is clearly true.

One can argue with Shiller about the assumption he made about the terminal price (year 1979 in his sample). Indeed, that terminal price contains some risk, news about which could explain fluctuations in the actual price. However, that explanation would be insufficient, by orders of magnitude, to explain the degree of fluctuation of the actual price.

The conclusion follows: “Stock prices are ‘too volatile’ to be justified by subsequent dividends.” That conclusion is in line with the intuition of the man in the street, as well as that of the financial analyst, who see the prices of stocks fluctuate every day by amounts much larger than can be explained by company “fundamentals”.

If there is excessive volatility, we must try and understand the reasons for that state of affairs. A number of possible reasons come to mind.

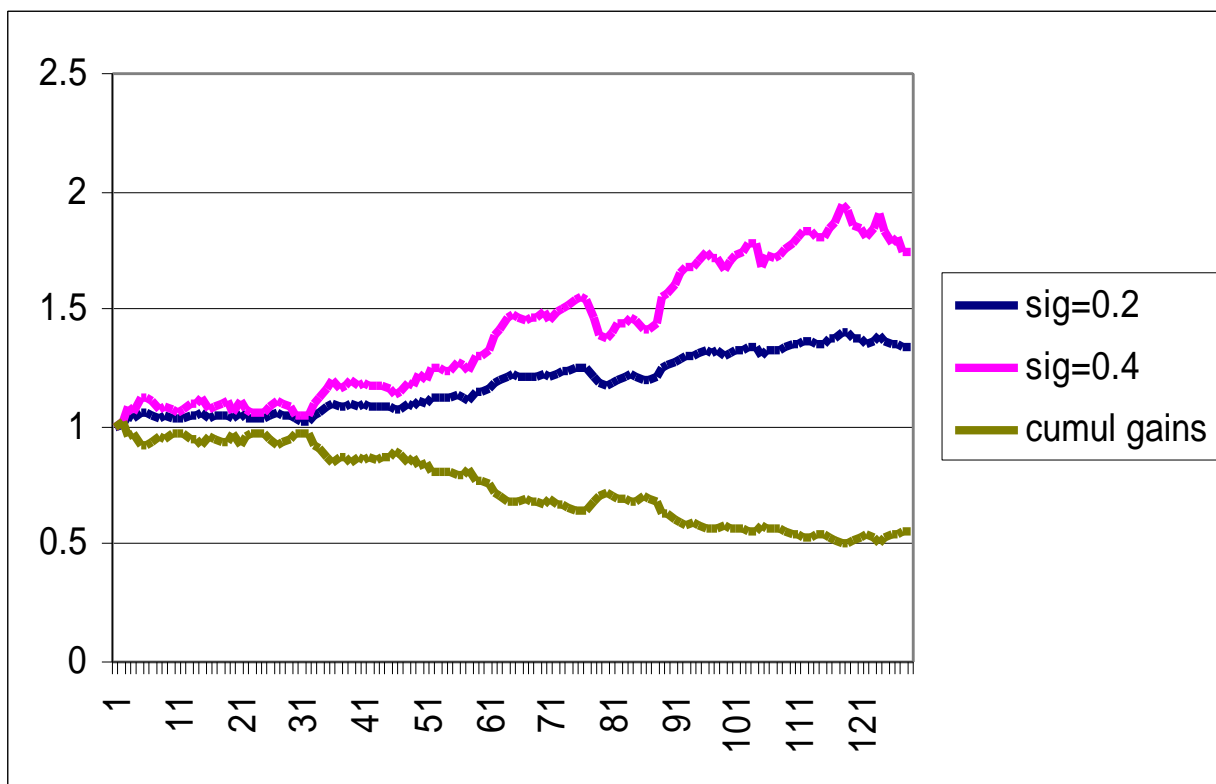
It could be that one category of traders has an irrationally random demand for stocks (like “noise traders”). For instance, they could behave *as if* they have state-dependent utility (randomly fluctuating tastes). Or, more interestingly, they might behave on the basis of information signals that are bogus, but that they believe in. For instance, they could have ungrounded fears about future dividends.

Another potential explanation is that financial markets are vastly incomplete. I.e., some dimensions of risk, such as the risk of a person’s future labor income or the risk of future housing prices, in practice cannot be traded. In that case, investors’ private valuation of non-traded securities “rocks the boat” of traded prices. It is hard to imagine that this effect is large enough.

A third and final possible explanation is “stock market bubbles”. Bubbles are associated with the uncertainty in the “terminal” price of a share of stock, as opposed to the uncertainty about medium-term cash flows. The risk of future bubbles appearing or bursting could be fluctuating over time, creating fluctuations in stock prices.

If there is excessive volatility, one can argue that this is evidence of financial market inefficiency. In that case, one should be able to develop some “volatility arbitrage” that would reap profits. In particular, if the reason for excess volatility is irrationality of one or several categories of traders, one should be able to find a way for rational traders to take advantage of their behavior? That is not easy to conceive. The appropriate strategy probably varies depending on cause of excess volatility.

One naïve answer to that question is incorrect. Students often reason as follows. If volatility is excessive, there must be time at which the security is undervalued relative to its fundamental value and times at which it is overvalued. If it is undervalued, the security should be bought, as it will no doubt “come back” towards the fundamental value. That, however, is a fallacy, similar to the fallacy of the person who believes, in the game of coin tossing, that a series of heads increases the probability of subsequent occurrences of tail, on the grounds that on an average there “should be” as many of each. Alternatively, this wrong reasoning is based on a confusion between excess volatility and mean reversion in stock prices, as the assumption of coming back is crucial in that reasoning. At any rate, a simple simulation disposes of the fallacy. In the picture below, a series of random draws is made to generate the behavior of a share of stock over 130 years under the correct assumption of volatility equal to 20%/year and under the incorrect assumption of 40%/year. The latter is assumed to be the quoted price and the former the fundamental value. The picture shows that a strategy of buying when the security is undervalued and selling when it is overvalued frequently produces losses:



Even in the presence of excessive volatility, an undervalued stock can remain undervalued forever and even become more so over time.

The goal of setting up a “volatility arbitrage” suggests an option strategy. However, one cannot just buy or sell options on stock. This would be a bet on a *change* in the volatility. We are concerned with volatility that is *always* excessive. It is assumed to be excessive in the sense of Shiller. That means that it is excessive relative to the volatility of dividends. Hence the arbitrage should involve options written on price arbitrated against options written on each year’s dividends. The latter type of option does not seem to exist. The only options available are options on shares, which represent an infinite future sequence of dividends. Some unbundling of derivative securities would be needed to achieve our goal.

But perhaps we can achieve it indirectly. If volatility is excessive and shares go ex dividend at discrete points in time, then the excess volatility of prices implies some change in the volatility of prices over time. As one approaches an ex-dividend date, the stock price is more influenced by the immediate dividend than it is at other times. Consider then two options written on the same share of stock, one maturing just before an ex-dividend date and one maturing just after the same ex-dividend date. If price volatility is generally excessive, the latter option should have a larger implied volatility than the former option. In other words, the longer option bought, together with the shorter option sold make up an option on the dividend. Perhaps, this combination could serve to achieve our goal.

## Conclusion

Excess volatility in financial markets probably arises from fears about the *distant* future. Unfortunately, volatility arbitrage instruments, such as derivatives, if any could be put together, would tend to be short-term instruments, as experience has shown that longer-term derivatives tend to have a very low trading volume. If, indeed, *volatility arbitrage in practice is difficult*, that would explain that volatility remains excessive. However, given the large degree of excessive volatility, adequate arbitrage instruments should be in high demand. This puzzle needs to be cleared away.

The reduction of volatility in financial markets by the initiative of rational traders is a worthwhile undertaking. A sizable reduction in market volatility would reduce enormously the cost of capital to corporate firms as the cost of capital is linearly related to the square of volatility. For instance, a reduction of volatility from 20%/year to 10%/year implies a drop in the equity premium from 6% to 1.5%.