

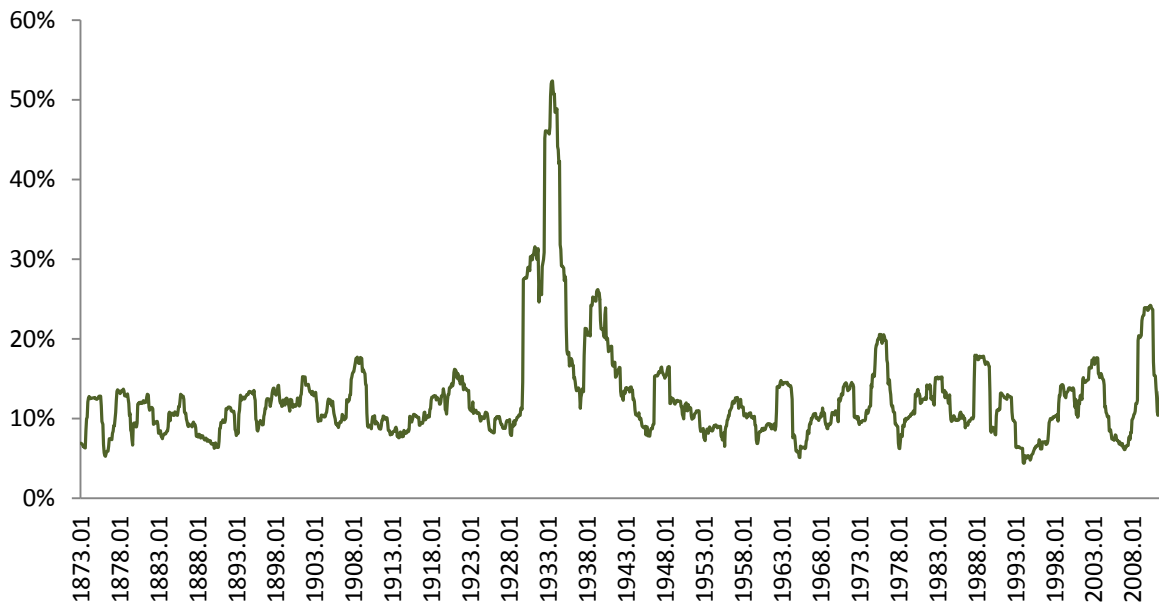
Zeroing in
on the Structural Break

Despite what historical volatility levels suggest, there is a significant structural break in equity markets that is not gauged with standard financial mathematics.

Emotions and intuition should not be part of the professional capital market environment. This much has been pointed out and agreed upon by market participants and academics alike. And yet we were given that mysterious shortcut generating machine by Mother Nature for a reason. Is not that purpose to protect us from our seemingly rational reasoning?

Most professionals by now agree that we are experiencing some form of a structural break in the equity markets. But this conclusion is often based on the intuition alone and not backed by hard facts. The rational and non-emotional part of the profession looks at hard facts; our tools and measures designed to gauge the market health do not exhibit anything at all out of ordinary. We are tempted to look at the single most important such gauge: the volatility (Figure 1).

Figure 1: Standard deviation of realized monthly returns of S&P 500. Here and elsewhere in the paper S&P return source is "Irrational Exuberance" Princeton University Press, 2000, 2005, updated R. Shiller



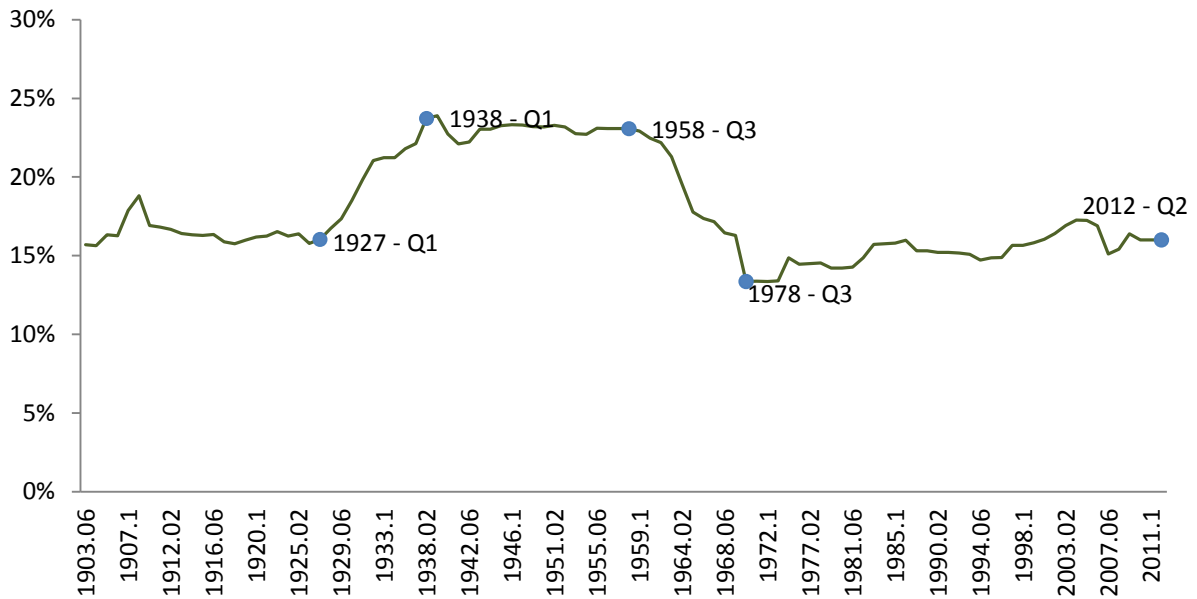
Although volatility is not great at indicating the level of risk in the future, it is not a bad indicator of concurrent stress in the market. Figure 1 suggests that we have a marginally elevated level of volatility, but nothing out of ordinary at all. So everyone's intuition must be wrong.

Of course, the volatility in Figure 1 is what we call a trader's volatility – standard deviation of monthly returns for the rolling two years. It could be argued that since pension funds and insurance companies have a buy-and-hold behavior, a longer term volatility measure is appropriate. We calculated the long-term volatility¹ based on the same dataset and found even fewer reasons to be

¹ Standard deviation of annual returns over thirty years.

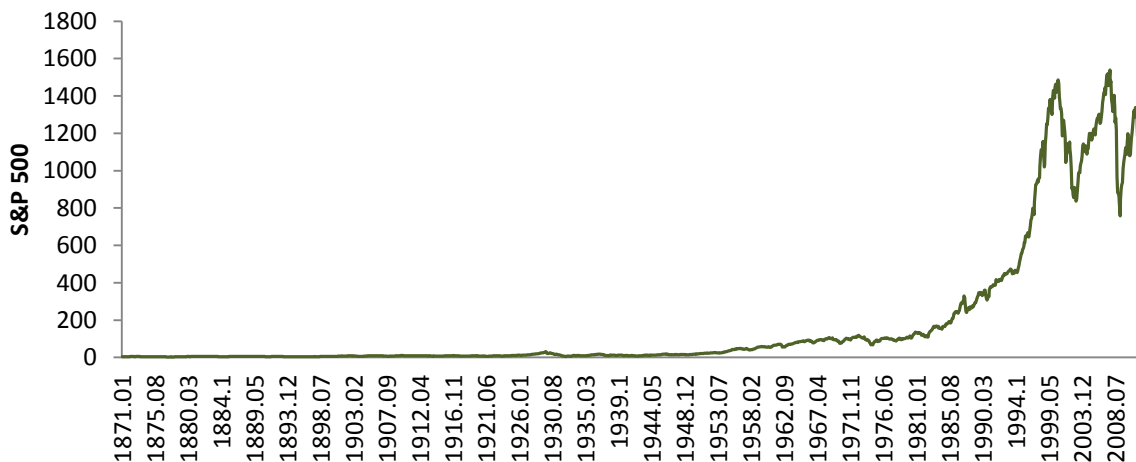
alarmed (Figure 2).

Figure 2: Standard deviation of realized annual returns of S&P 500 over rolling thirty years.



And yet there is still “the nagging feeling” – the emotional and intuitive hint that tells us there is something wrong with our conclusion. We have that feeling when we simply look at the S&P 500 price series over the longer term (Figure 3). The analysis above is guilty of the most common mistake in financial analysis: using a mathematical expression without defining what it is meant to measure. What is unsettling in Figure 3 is the amplitude of change given a period of time – something volatility apparently fails to capture.

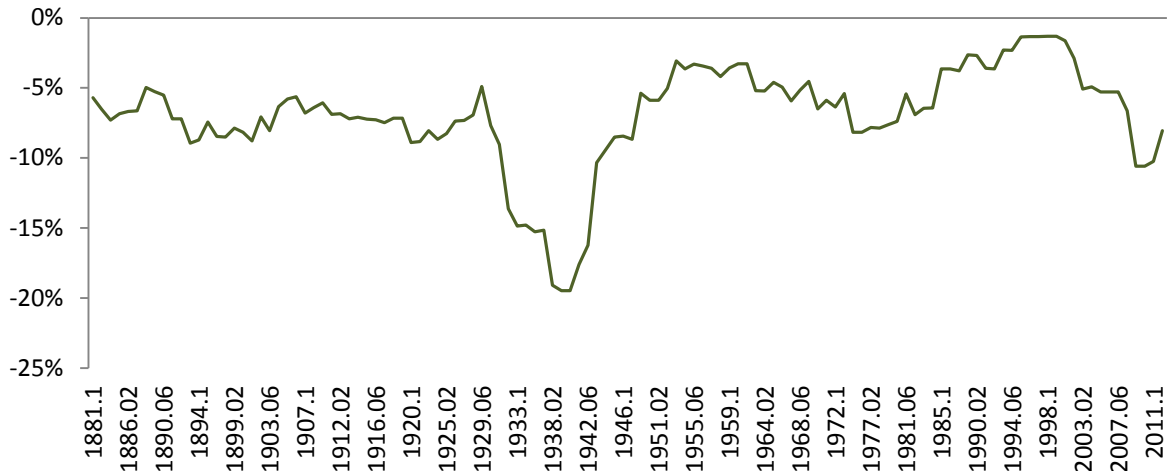
Figure 3: S&P 500 price series



One way to measure the amplitude is simply to calculate the size of average annual drawdowns from the beginning of the year to the lowest point in the year for rolling ten years (Figure 4). In this graph

the anomaly of the recent years is somewhat more pronounced. We had such large and abrupt annual drawdowns only in the period between 1929 and 1952.

Figure 4: Average annual drawdowns of S&P 500 for rolling 10 years



The analysis in Figure 4 does not suffer from the convexity of volatility: squaring differences generates bigger gaps between small and large numbers. However, this analysis is still missing the time dimension. We defined the problem as **the amplitude of change given a period of time**. What we actually need to measure is the size of the difference between the highest level and the lowest level of the index **per unit of time** (Figure 5).

Figure 5: Percentage change of S&P 500, annualized

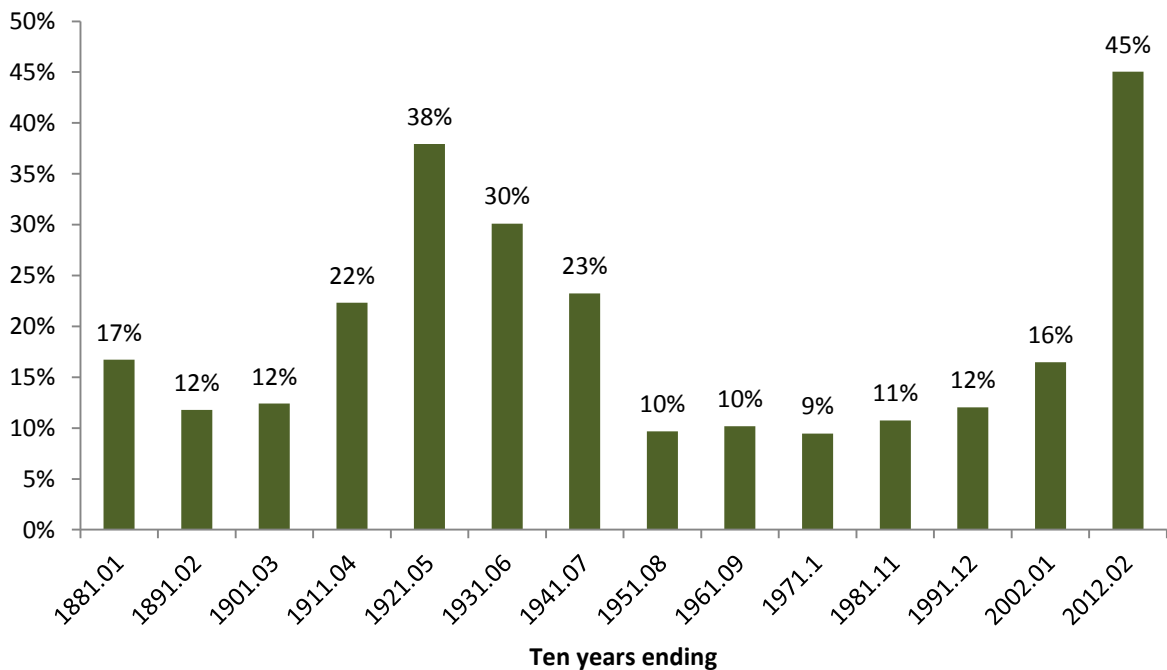


Figure 5 is the appropriately quantified expression of the intuition that we had all along: something is wrong. What it shows is that in the last decade S&P 500 had the highest gyrations per unit of time (in this case per year) ever in the history.

Conclusion

This short exercise raises several questions. Firstly, it is often the case that we spend too little time on defining the problem or the question, and too much time solving or answering it with whatever mathematical expression we have at hand. Secondly, the question of intuition comes to the forefront: is it still valid to ignore the intuition in a mechanistic investment process?

But by far the most troubling issue is the fact that Figure 5 makes our intuition tangible: there is clearly a change in the behavior of equity markets that has not been observed since 1950s, and so far the magnitude of this change is larger than ever in the history of capital markets. Yet again resorting to the intuition, we can merely speculate what the reasons are for such a break: unfavorable demographics which cause lower growth rates, lower savings and interest rates and technological breakthroughs that cause disintermediation and puts pressure on the services sector. Quantifying this intuition, however, is an entirely different exercise.

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