



Market Ideas: Fact or Fiction?

*Always remember to;
#1. Welcome all ideas in trading, and
#2 Reserve your opinion until you have independently validated the idea!*

Working Paper: Why the Surprise in Jump in Volatility?

Working Paper

After years of relative calm February 2018's jump in volatility has caused many investors and traders to wonder what is happening. This comes as a surprise to me as extreme price movements are not as uncommon as some like to think.

In this paper I want to review the common understanding of price change distributions and shed some light on why;

1. Traders should always expect the unexpected (jump in volatility) and
2. It's a poor choice to short volatility, despite many years of steady returns.

Market Theory Believes Price Changes are Normally Distributed

Many financial models are built on the assumption that price changes are both normally distributed and random. These are keystone assumptions underlying many widely accepted and well respected theories on how markets behave. They include;

- CAPM Capital Asset Pricing Model
- EMH Efficient Market Hypothesis
- RWT Random Walk Theory
- MPT Modern Portfolio Theory
- Option Pricing Black and Scholes option price model
- VAR Value at Risk

First up I'd like to say I'm no mathematician however I want to attempt a high (and possibly) rudimentary review of market price changes to determine (in my mind) whether they are in fact normally distributed.

If they're not normally distributed then no one can then claim surprise by a sudden market move.

In addition it will make you question the motivation behind those people/institutions who develop products like the recently publicised inverse VIX ETN (Volatility Exchange Traded Notes) instruments that were forced to shut down after one days sudden move.

Wish me luck as I try to be a little scholarly here.



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Market Portfolio

For this paper I will be restricting my work to the SP500.

Market Data

Data: Spot cash prices.
Market: SP500
Period: 1980 – 2018, 37 years.
Source: Data from Norgate Investor Services; www.premiumdata.net

Software

I do all my own programming using VBA (Visual Basic Application) for Excel. To view the VBA editor in Excel simply open a workbook and hit "Alt F11".

The Task

In this paper I want to investigate whether SP500 price changes are normally distributed. You may be asking why this is important. Well that's a good question. Its important because many big theories on market behaviour rely on a key assumption prices are normally distributed. The assumption is imbedded in these important models.

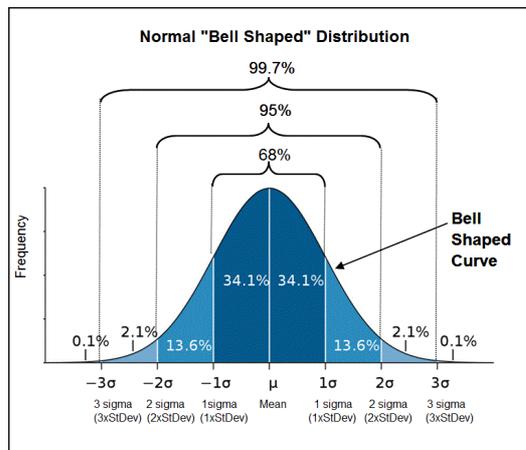
Due to this assumption and belief any large movement outside of what is expected for a normal distribution becomes a "surprise".

Well, I think it shouldn't be it.

And if we all think the same, that large price shocks should not a surprise, then there is no way an inverse VIX ETN type product should be allow to be promoted

The assumption believes, for example, that the distribution of daily price moves in the SP500 should fall symmetrically either side of an average daily move and should not experience a move beyond 4 standard deviations of the average.

The theory says the distribution of SP500's daily moves should form a shape similar to a bell curve.





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Normal Distribution Moves

Move	% Inside STD Move	% Outside STD Move	Approximate frequency for daily event
1 x STD	68.27%	31.73%	Twice a week
2 x STD	95.45%	4.55%	Every three weeks
3 x STD	99.73%	0.27%	Yearly
4 x STD	99.99%	0.01%	Every 43 years (twice in a lifetime)
5 x STD	99.9999427%	0.0000573%	Every 4776 years (once in recorded history)
6 x STD	99.9999998%	0.0000002%	Every 1.38 million years (twice in history of humankind)

Source: https://en.wikipedia.org/wiki/68%E2%80%9395%E2%80%9399.7_rule

As the table above shows;

- 68% of all normally distributed events should fall within one standard deviation of the average.
- 95.45% of all normally distributed events should fall within two standard deviation of the average.
- 99.73% of all normally distributed events should fall within three standard deviation of the average and
- 99.99% of all normally distributed events should fall within four standard deviation of the average.

That's the theory.

But how's reality?

Well let's look at the SP500 between 1928 and 2018. During the period it had a daily average move of only 0.03% with a standard deviation of 1.17%.

Accordingly a 4 standard deviation daily decline would be -4.65% while a 4 standard deviation daily rally would be 4.71%.

As you can see from the table above a move beyond 4 standard deviations should be almost impossible! It should only occur 0.01% of the time, or once ever 43 years.

However over the last 90 years the SP500 has experienced 75 moves below -4.65% and 134 moves above 4.71%!

It's quite obvious the SP500 is not normally distributed.



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What Happen on Monday 5th February 2018?

On Monday 5th February 2018 the SP500 cash index closed down 4.2% from 2,762 to 2,645. For the SP500 that was a 3.6 standard deviation move, a move that should only occur once in every 6 years. Yet looking at the frequency of moves below you can see it's a move that occurs more frequently than that.

SP500 Daily Returns	Number of Days
-10%	3
-9%	4
-8%	8
-7%	6
-6%	20
-5%	34
-4%	71
-3%	179
-2%	459
-1%	1,859
0%	8,175
1%	9,031
2%	2,067
3%	460
4%	136
5%	70
6%	22
7%	14
8%	10
9%	7
10%	11

Summary

We know the assumption that prices are normally distributed is embedded in many financial models. Yet market behaviour clearly demonstrates, well at least for the SP500, that daily price changes are not normally distributed and that you should expect to see large outlier moves.

You would think that with LTCM's demise in 1998 along with the 2008 financial crises that the academics would have come to the realization that markets do not follow a normal distribution.

I suppose many continue to believe in the normality of markets due to its convenient simplification and easy use of statistical methods. It's just a shame that this convenient simplification keeps the door open for market participants, who should know better, to create and promote instruments like Credit Suisse's inverse VIX ETN that rely on markets being normally distributed. Holders of those notes saw their value drop overnight from \$114.55 to \$4.22.

Morale of the story ... *learn to expect the unexpected and resist the temptation of collecting easy premium from selling options.*

Good validating, good money management and good risk management.

Brent Penfold

Helping traders since 2001

Sydney, Australia

March 2018



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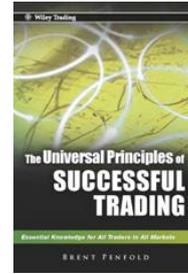
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Brent Penfold

Trader, Advisor, Author and Educator



Brent Penfold
Helping traders since 2001.



Brent Penfold is a 30-year veteran trader having begun his career in 1983 as an institutional trader with Bank America. In addition to being a professional trader Brent is an advisor, author and educator. Today Brent trades a diversified portfolio of global markets covering indices, currencies, interest rates, energies, metals, grains, softs and meats.

He is the author of two books;

- ***Trading the SPI*** (Wiley 2005) and
- ***The Universal Principles of Successful Trading*** (Wiley 2010).

The *Universal Principles of Successful Trading* has become an international best seller that has now been translated into Polish, German, Korean, Japanese and simplified and orthodox Chinese.

Brent has a third book coming out in 2018;

- ***The Universal Tactics of Successful Trading*** (Wiley 2018).

Brent publishes daily newsletters for active index, currency and commodity traders and is a popular and sought after international speaker who has presented to traders throughout the Asia Pacific region including Australia, New Zealand, Malaysia, Singapore, Hong Kong, Vietnam, Thailand, India and China.

Brent holds a Master of Commerce (Finance) degree. To learn more about Brent Penfold and his services you can visit his web site:

www.IndexTrader.com.au

Please read the following Warning on the next page.



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Warning – Please read

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This Working Paper does not contain any trading advice, personal advice or general advice.

This Working Paper is educational only and is designed to encourage traders to independently verify trading ideas before they consider using them in the market.

When researching certain trading ideas this Working Paper does not take into account individual trader needs, their individual financial situation or their individual investment objectives.

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By receiving this Working Paper you acknowledge that you understand and accept these warnings.