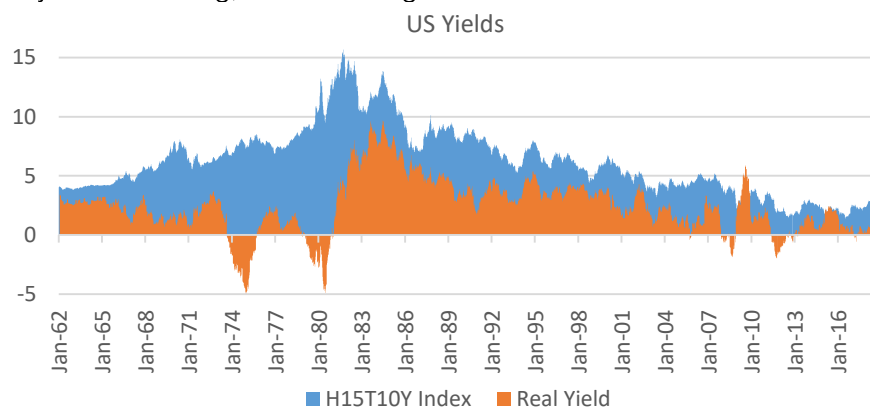
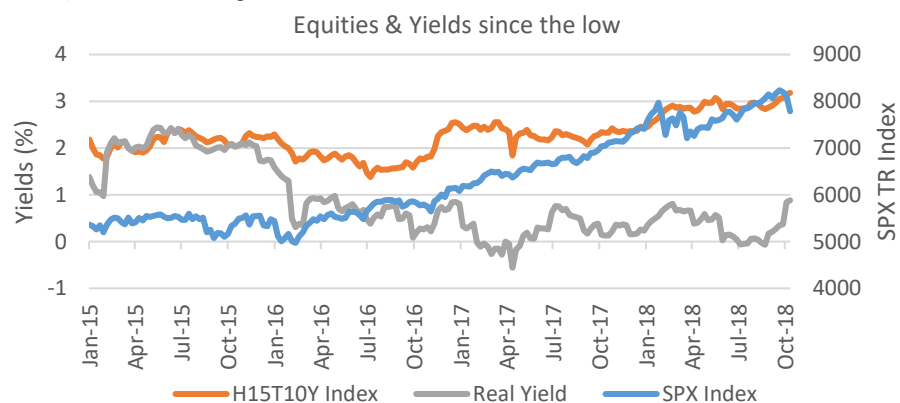


US government bond yields have been rising for around two years since the low point of 1.35% on the US 10-year Treasury in July 2016. Current levels of 3.1% mean we are already 1.80% higher, but there is concern about what the implications would be if yields were to continue to rise.

Through the long lens of history in the chart below we can see that even after the significant increase recently, long term yields are still more accommodative than at any time pre-GFC on a nominal basis. Meanwhile, real yields (nominal yield less inflation) are also very low relative to history, but they are also rising, now hovering close to 1%.



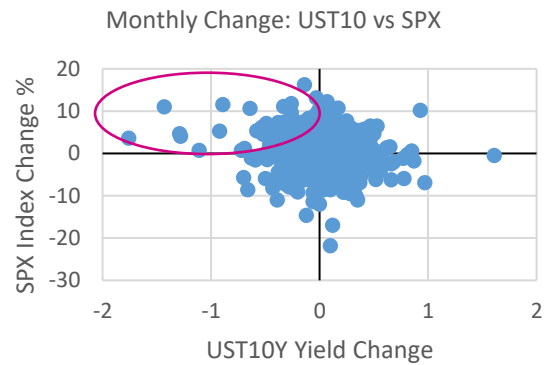
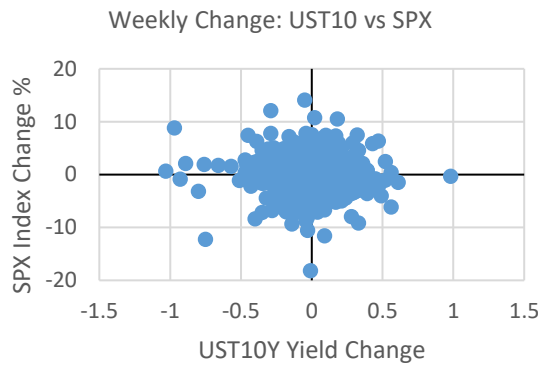
The last three years is a useful period for a really rough and dirty view of the impact of rising or falling yields. There have been periods when yields are falling, when they are stable, when they are trending up and when they move aggressively upwards. Throughout the period, the S&P500 Index (SPX Index) has posted gains.



This is clearly a very short and potentially unrepresentative period of time, so I have extended the analysis with data back to 1962 and looked at both weekly and monthly changes in long term nominal yields, real yields and inflation versus the S&P500 Total Return equity index.

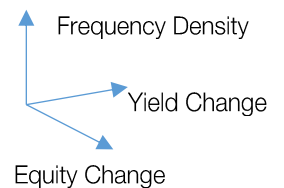
Yield changes vs equity changes

The charts below plot the weekly and monthly changes in the 10-year US Treasury note versus the coincident percentage change in the total return equity index. These charts could be a great example of “no correlation”, but on closer inspection, there are some features to these distributions that are worth considering.



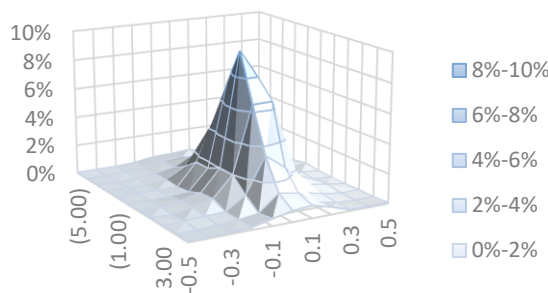
The first one is that over longer (monthly) horizons, falls in yield do seem to be appreciated by the equity market given the skew of data points circled in the chart above. In order to gain a better understanding of these features, I looked at the frequency density of equity returns versus yield changes using both weekly and monthly data (back to 1962).

Chart axis titles in 3D charts starts to get quite messy, so for each such chart, the axis orientation displayed opposite has been used.

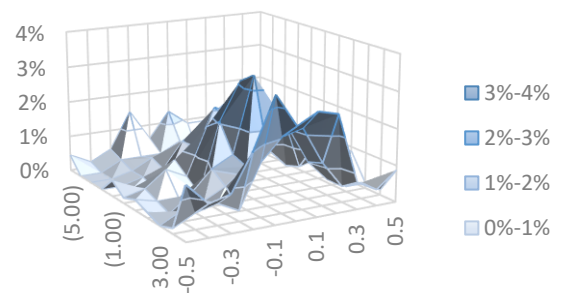


I provide a simplified result shortly, but first it is useful to note that the distribution over a slightly longer horizon (monthly versus weekly) is less smooth than over shorter horizons. My interpretation is simply that there are more factors at work influencing market returns over longer horizons, thus making causal links between variables far more complicated and arguably less reliable.

Sensitivity to UST10 (Weekly)



Sensitivity to UST10 (Monthly)



A simplified view of this complex frequency density distribution is obtained by adding up the frequency of occurrences for rises and falls of equities and yields. The last row in the table shows that over both horizons equities are more likely to be rising than falling when yields are rising (>0). In fact, irrespective of which direction yields are moving, history tells us equities are more likely than not to be going up. In other words, rising yields are not clearly a cause for falling equities.

		Weekly		Monthly	
		Equities			
		<0	>=0	<0	>=0
Yields	<=0	13%	40%	14%	38%
	>0	13%	35%	17%	31%

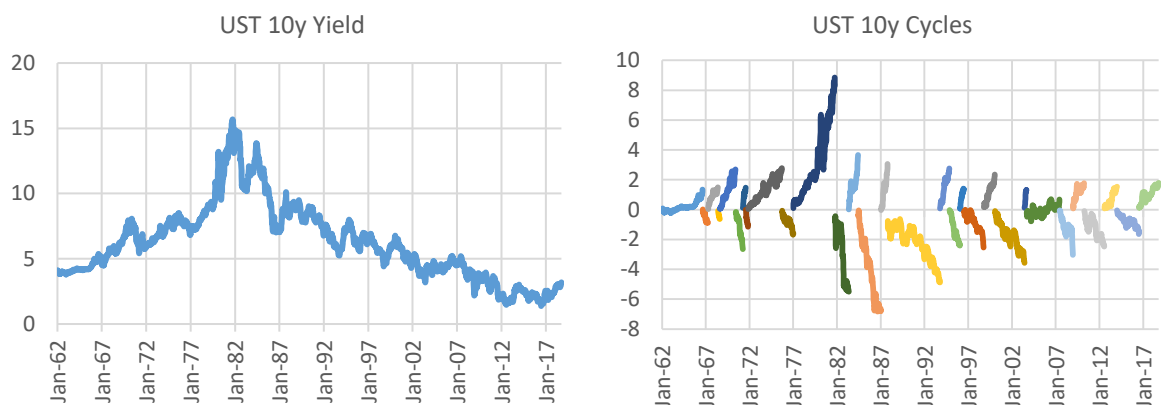
So, if nominal yields don't provide much information, what about inflation or real yields? The results are shown in the table below showing essentially the same result. Irrespective of the directional change in real yields or inflation, equities coincidentally tend to be more likely to rise than to fall. A similar result was identified in the paper titled "Inflation: Goldilocks or the Big Bad Wolf" in April 2018 where we saw the probability of loss in equities (over a 12 month horizon) being roughly constant at 15% irrespective of the change in core CPI (over a 12m horizon). Conversely, the change in CPI (including food & energy) did see more variation in probability of loss, highlighting that other factors were at work that led to losses in equities, i.e. war, energy shocks, etc.

		Weekly		Monthly			Monthly	
		Equities					Equities	
Real Yields		<0	>=0	>=0	<0		Inflation	<0
	<=0	13%	40%	16%	37%	17%		41%
	>0	12%	35%	16%	31%	14%		28%

The Tipping Point

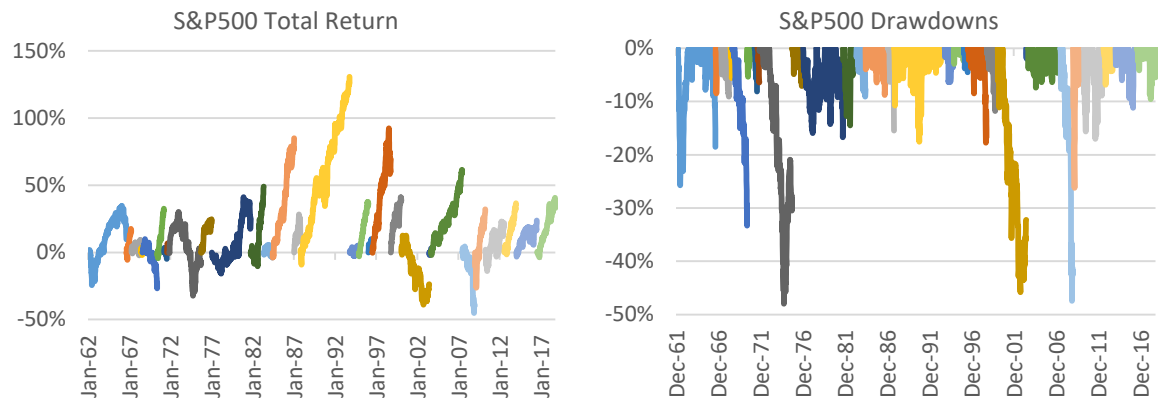
The analysis above uses weekly and monthly observations for changes in yields and equities, where we see very little sensitivity of equities to incremental yield moves. So the next question we must ask is whether there is a tipping point of cumulative yield changes that leads to a difference in observed equity market performance. The answer here is "yes".

Shown in the chart below is the evolution of the 10Y US Treasury since 1962. I have manually parsed through the series and selected peaks and troughs of changes in yield that I believe are representative of a trend change in the direction of yields. These individual cycles are shown in the chart on the right as up cycles and down cycles of which there are 15 of each.



The first observation is that there are very few yield increases of more than 2.5%. Indeed only two in the post-Volcker era, occurring in 1994 (the Bond Market Massacre) when Greenspan started the policy rate hiking cycle after 5 years of rate cuts and being held at a low 3% for two years) and 1999/2000 (the dot.com boom) when the Fed was raising rates in response to "irrational exuberance".

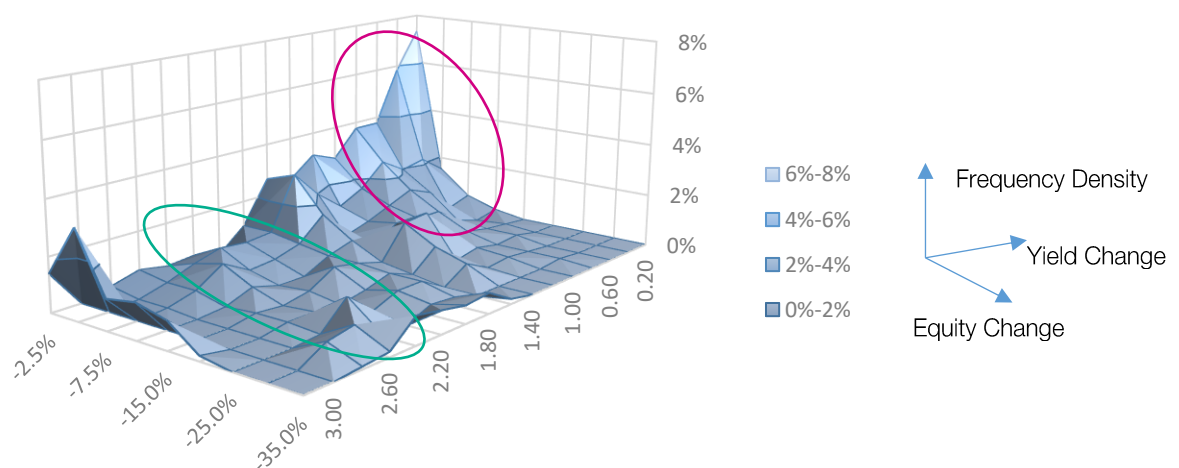
Next, I look at equity market total return and maximum drawdowns over the course of each cycle.



I'll be the first one to admit there isn't much obvious to me, with the exception that there are not 15 periods during which equity total return is negative (so rising yields are not always negative for equities). Also, there are several cycles where the equity market appears to peak before the rate cycle comes to an end.

An alternative way of analysing these periods was needed, so I created another frequency density analysis to look at the frequency of occurrences of different levels of equity drawdowns for given levels of cumulative rate increases. The chart below uses the same orientation as the previous charts. We can see the chances of a significant bear market (more than 10% drawdown) is pretty negligible for rate increases up to about 1%. The chart is heavily skewed in the pink circled area. As the cumulative yield change increases, the surface becomes much flatter, telling us there are not only increasing chances of significant equity drawdowns, but also the chances of small drawdowns and significant drawdowns are similar (turquoise circled area).

Equity Drawdown Sensitivity to Cumulative Rate Increases



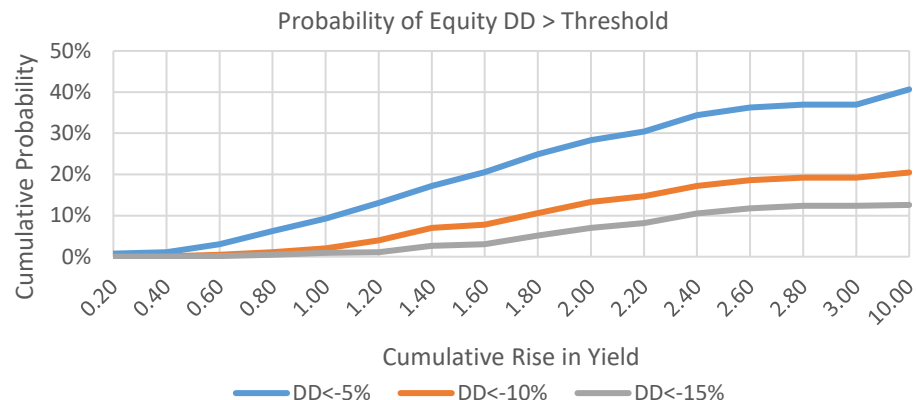
Looking at the same data in another way, I compute the cumulative probability of equity drawdowns in excess of certain thresholds, given a cumulative rise in yields.

Specifically, that is adding up the area under the probability surface from a specified (threshold) equity drawdown level and cumulative yield change, out towards the limit for equity drawdowns and back to the origin for yield changes.

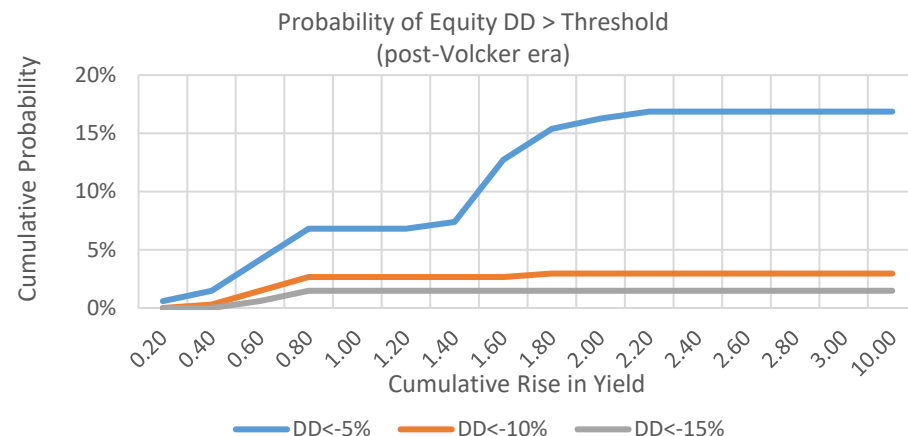
It measures the probability of equity losses in excess of the threshold, irrespective of when the loss occurred prior to the given cumulative change in yields. See next page...

The chart below shows the same data in an easier manner to interpret. For example, for a 1% cumulative rise in yields, there is a 20% probability (based on historical data with weekly observations), that the market will have experienced a drawdown of 5% or more at some point during that 1% cumulative rise in yields. Once we reach 1.8% (the level by which yields have risen since the July 2016 lows), the probability of a drawdown of:

- 5% or more increases to 25%
- 10% or more increases to 11%
- 15% or more increases to 5%



Given the current median Fed dot plot for 2019 is 3.125%, we could see the 10Y yield breaching 4%. That is a rise of 2.5% from the low of 2016 which sees all the probability functions above reach their plateau, meaning we are close to the maximum risk of a major market drawdown based on historical evidence. This picture is even more troublesome if we look only at rising yield cycles since 1993, in the post-Volcker era.



Conclusion

Simplistically, we are at or close to reaching peak risk of a major equity bear market (drawdown more than 15%). The probability of this occurring due to/ coincident with the rise in yields caps out at around 15%, i.e. there is a 85% chance that the drawdown will be less than 15%.

But still, peak risk is peak risk. I see good reasons, therefore, to start the process of reducing our active risk tilts in equity portfolios to mitigate against the risk of a protracted bear market, whether that is caused by a tipping point in yield increases or any other factor.