CERNO CAPITAL

Predictability:
Does the CAPE ratio tell us anything?

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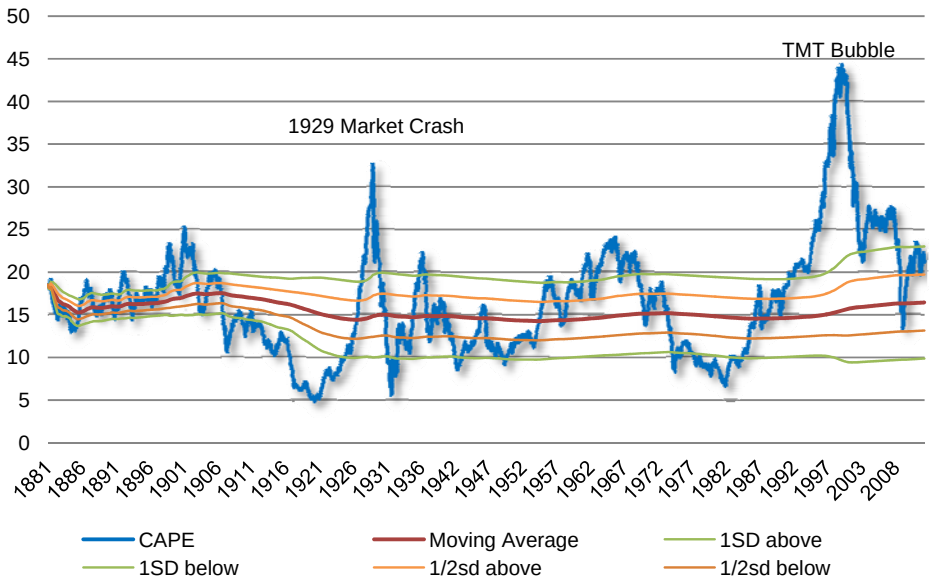
The Cyclically Adjusted Price Earnings (CAPE) ratio, also known as the Shiller PE, was developed by Robert Shiller, a Professor at Yale University. At the company level, it is a measure of the relationship between the share price and average real earnings over a ten year period. At the market level, it is the ratio of aggregate market capitalisation of the market to aggregate average real earnings. A study of a series of CAPE measurements can be used to indicate whether a stock or market is overvalued or undervalued against its history. Its methodology differs from the conventional calculation of a PE ratio whereby the latter is based on the current share price and a single year's earnings, normally one year forward. The CAPE is more comprehensive, with ten years of data smoothing out the volatility of one business cycle, and is useful in analysing the valuation of economically sensitive assets, such as company shares.

In this note we examine the efficiency of the CAPE in helping us to form a view on future expected returns and forecast market trends. We can approach the problem in two ways, by looking at i) prospective investment returns, and ii) the probability of losing capital associated with varying levels of CAPE valuations. We will start by examining the historic US series, which comprises of just over 120 years of monthly data beginning in 1881 through to 2012. Regrettably, European and Asian series will not be covered in this note, since the data series are too short to draw any statistically meaningful conclusions. The longest data for these countries traces back to 1979, this means that their average will be distorted to a great extent by the high valuations during the Tech-Media-

Telecoms (TMT) Bubble in late 1990s, which in turn will warp our perception of what their long-term fair value should be.

Exhibit 1: US CAPE with Anchored Average from 1881 to 2012



To begin with, in Exhibit 1 we have plotted the historic US CAPE series against its long-term anchored mean, as well as ½ and 1 standard deviations about this mean, where each calculation is based exclusively on historical data up until the relevant point in time. We specifically chose not to encapsulate the entire 120 years using a single constant mean in order to eliminate any foresight from our observations, as the actual CAPE average observed at any moment in time will be different to the constant full period average. On that basis we found that the mean fluctuates between 14.3x to 18.5x, with the current long-term average sitting comfortably in the middle of the range at 16.4x. This implies that, the current US market at 21.1x is overvalued on this metric relative to its long-term mean by roughly 29%, or just under ¾ standard deviation.

We have analysed the CAPE series from 1914 onwards (for inflation data consistency), deeming the market to be expensive when the CAPE is one standard deviation above the mean and cheap when it is one standard deviation below. From the chart, we

can identify four distinct periods in history where the US market appeared to be cheap and four where it was expensive: the all-time high was prior to the TMT Bubble in 1999 where the CAPE peaked above 44x, the 1929 Stock Market Crash comes in at second place with a CAPE of 32x, followed by the boom eras in the 1940s and 1960s. The secular bottoms typically trailing the bull markets saw CAPE valuations plunge to single digits lows in the periods 1917-25, 1931-33, briefly in 1942 and 1947, and during 1977-84.

Timing is critically important, even one year can make a huge difference on investment returns. With the exception of 1975, had an investor entered the market when it was cheap on this measure, the average 12 month return would be +21.8% (or +16.2% if we ignore the anomalous +50.1% return in 1933), and would consistently produce positive returns between +4.7% to +15.1% for the real annualised trailing periods of 3, 5, 7 and 10 years as observed in Exhibit 2. This also seems to be true for several other European and Asian countries, although in most cases we were only able to model one such instance due to limitations of the data.

Contrarily, if one buys into the market at one standard deviation above average, the returns transform into a very different set of numbers as seen in Exhibit 3. The average trailing returns for the relevant time periods give a meagre range of -0.4% to +5.5%, noting that +5.5% was the 12 month average derived from exceptionally volatile returns. However, looking at the return profiles case by case reveals a more complex scenario with regards to the probability that an investor will suffer a capital loss. In some cases, there is an initial gain as valuations continue to rise followed by a sharp decline, or vice versa should the investor be patient enough to see through a market recovery. For such cases in 1955 and 1959, the gains were +5.5% and +2.3% annualised over 10 years, respectively. In the event of these market conditions, the returns were heavily dependent on the time taken for mean reversion to occur, and the level of overvaluation at the time of initial investment. The worst scenario is where the drawdowns were exceptionally long, longer than 10 years, which was the case for an investor who entered the market in 1927, 1936 and 1969. But in the case of 1991 and 2002, the prolonged overvaluation of the market actually means no capital is lost prior to the burst of the TMT bubble and the

2008 financial crisis. Similar computations for initial investments at three-quarters of a standard deviation above average (current valuation) gives a slightly higher, but still far from ideal range of -0.1% to +3.0%, a signal for caution under historical context.

Exhibit 2: Buy into the market at 1SD below the long-term CAPE average (cheap)

	12M	3Y	5Y	7Y	10Y
1925/08	+18.6%	+22.1%	+14.7%	-1.8%	+2.7%
1933/04	+50.1%	+25.7%	+5.0%	+7.0%	+1.9%
1942/12	+17.1%	+19.1%	+2.7%	+3.2%	+5.6%
1949/03	+17.4%	+13.1%	+9.5%	+16.0%	+12.0%
1975/11	+6.3%	+0.8%	-2.6%	-1.8%	-1.0%
1985/01	+21.4%	+10.2%	+12.1%	+8.8%	+6.9%
Average	+21.8%	+15.1%	+6.9%	+5.2%	+4.7%

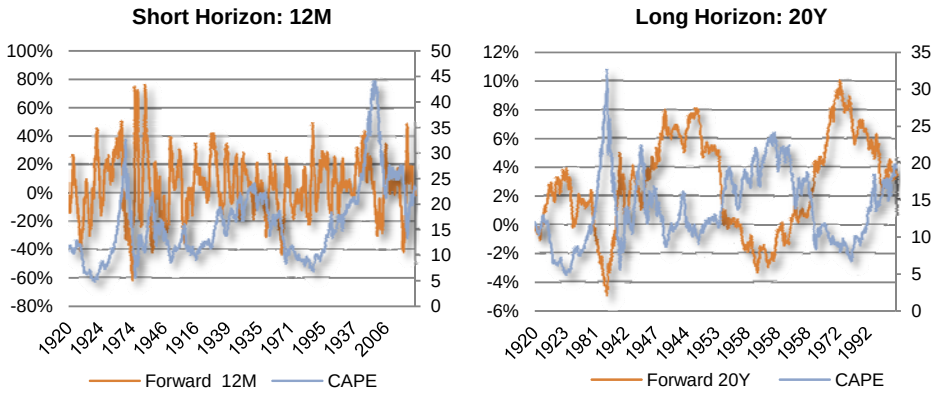
Exhibit 3: Buy into the market at 1SD above the long-term CAPE average (expensive)

US	12M	3Y	5Y	7Y	10Y
1927/11	+36.0%	+0.9%	-11.5%	-5.1%	-2.4%
1936/08	+1.8%	-9.6%	-9.6%	-7.1%	-2.5%
1955/09	+3.7%	+0.9%	+2.4%	+2.1%	+5.5%
1959/08	-6.2%	-1.7%	+5.4%	+2.8%	+2.3%
1969/03	-15.6%	-1.8%	-5.8%	-5.8%	-6.3%
1991/08	+4.1%	+3.0%	+8.1%	+12.7%	+8.8%
2002/09	+14.8%	+8.8%	+8.4%	+0.1%	-
Average	+5.5%	+0.1%	-0.4%	+0.0%	+0.9%

In terms of forecasting power, it is difficult to draw a solid conclusion from empirical data on whether the CAPE has any correlation to investment returns over short time horizons. By mapping the CAPE against forward investment returns in Exhibit 4, the charts for 1 and 20 year horizons demonstrate the great discrepancy between the short-term volatility of the returns compared to the more predictable profile over the long-term. This is the consequence of the market pricing in the economic realities

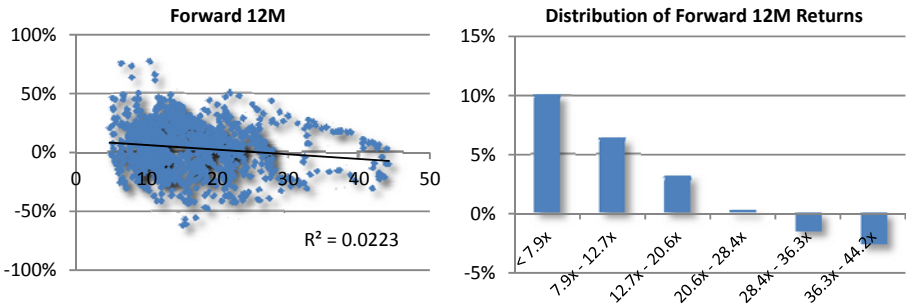
over time, hence diminishes the short-term implications of a sentiment-driven market.

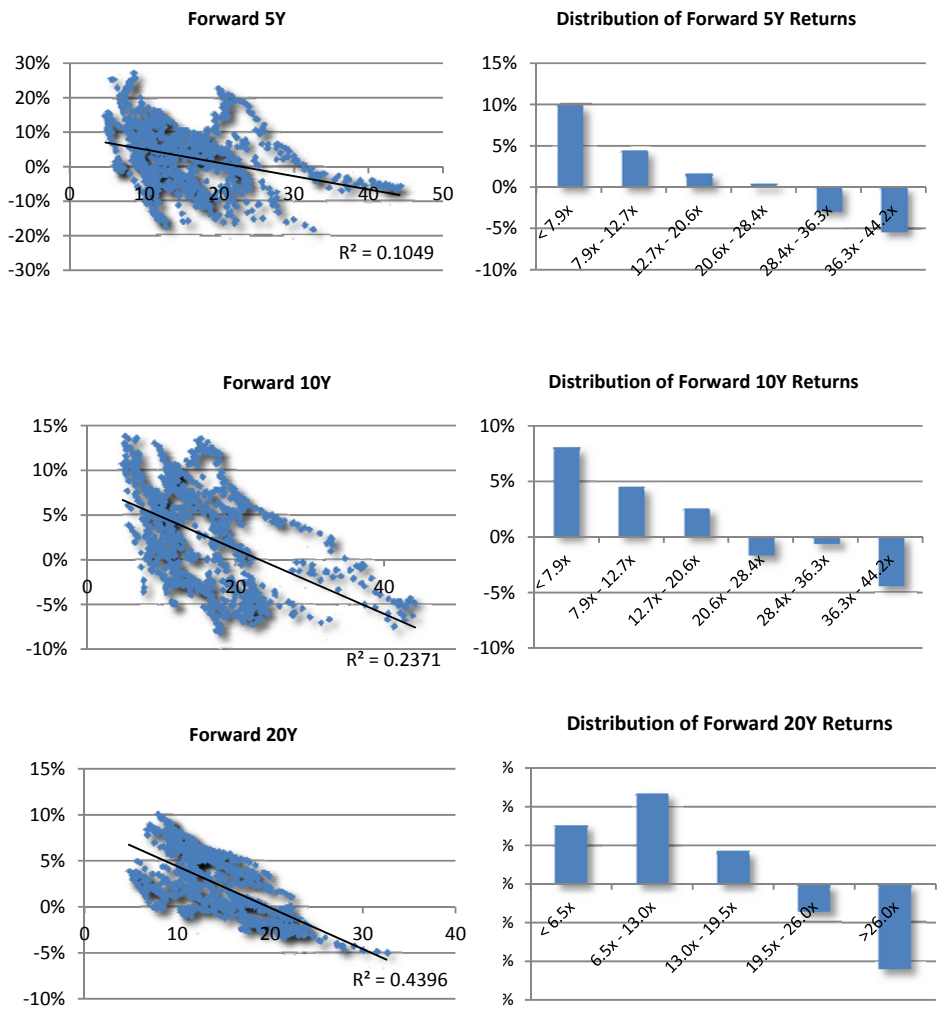
Exhibit 4: CAPE vs. Short (12M) and Long-term (20Y) forward real returns



Furthermore, the scatter charts on the left in Exhibit 5 plotting initial investment at different levels of CAPE valuations against the subsequent annualised returns of the S&P 500 Composite over 1, 5, 10, and 20 years from 1914 onwards also illustrate a clear trend as the effect of longer investment horizons becomes more pronounced. The 12 month forward returns have a very low R-squared number of 0.02 with respect to CAPE. By contrast, the 20Y returns with an R-squared of -0.43 is much more significant. The bar charts on the right displaying the distribution of the average return figures for the same periods reinforces the theory that as the CAPE increases, the forward returns are expected to decrease (true even for 12 month returns). In addition, that the average annualised returns contracts for longer holding periods. The two set of charts shed some light on typical return expectations for similar market conditions in the future, hence we can make a reasonable proposition that there exist an inverse relationship between CAPE and investment returns, at least over the long-term.

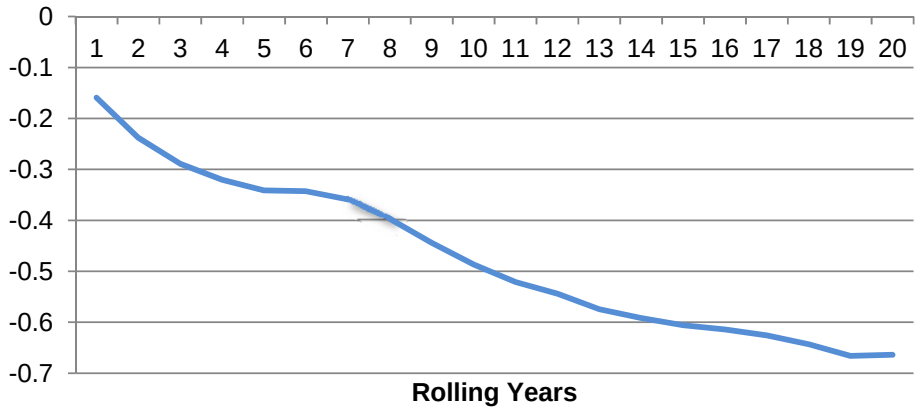
Exhibit 5: Charts displaying distribution of returns for different holding periods





Looking at the correlations for four distinct rolling year returns against CAPE in Exhibit 6 gives even more evidence in support of our theory. For the 12 month rolling period, the correlation is very low at -0.16, but as the periods extend, we observe a definite strengthening of the inverse relationship as it reaches the -0.50 level around 10-11 years, and gradually levelled out to -0.66 for the long-term 20 year rolling period.

Exhibit 6: Correlation of CAPE vs. Rolling Years Returns



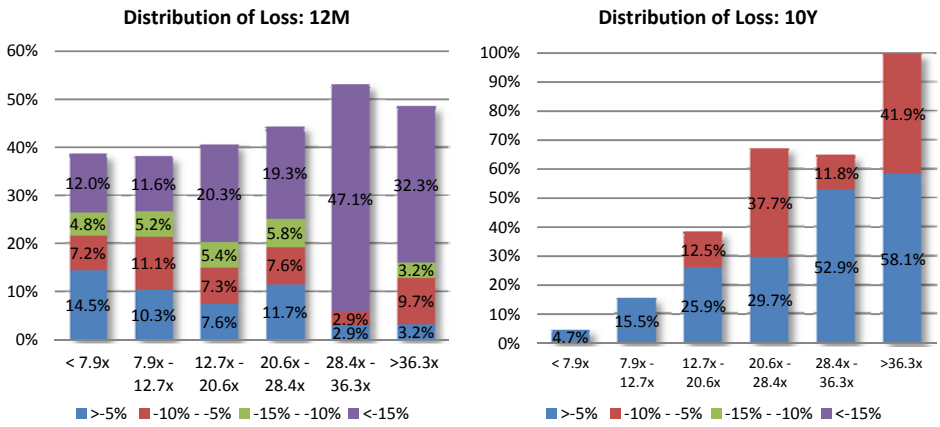
To highlight the risk of loss, we examine the frequency of returns failing to keep up with inflation in Exhibit 7. Using inflation-adjusted returns again, the frequency of losing capital is much higher for high valuations, and becomes more apparent as the investment horizon lengthens, with the exception of the short-term 12 month data. We observe that for valuations in the 20.6x - 28.4x interval, which is the position we currently stand (21.1x), the probability of loss ranges between 44.7% and 92.2% for the different holding periods. This suggests that, using history as a guide, an investor should be cognisant of the valuation risk should he/she enter the US equity market at current valuations.

Exhibit 7: Probability of Loss for different levels of CAPE

	Forward 12M	Forward 3Y	Forward 5Y	Forward 10Y	Forward 20Y
< 7.9x	38.1%	25.6%	14.0%	4.7%	2.3%
7.9x - 12.7x	38.3%	31.5%	30.5%	15.6%	6.5%
12.7x - 20.6x	40.4%	36.3%	39.9%	36.1%	28.8%
20.6x - 28.4x	44.7%	49.1%	54.5%	66.7%	92.2%
28.4x - 36.3x	52.9%	55.9%	67.6%	64.7%	100.0%
>36.3x	48.4%	93.5%	100.0%	100.0%	-

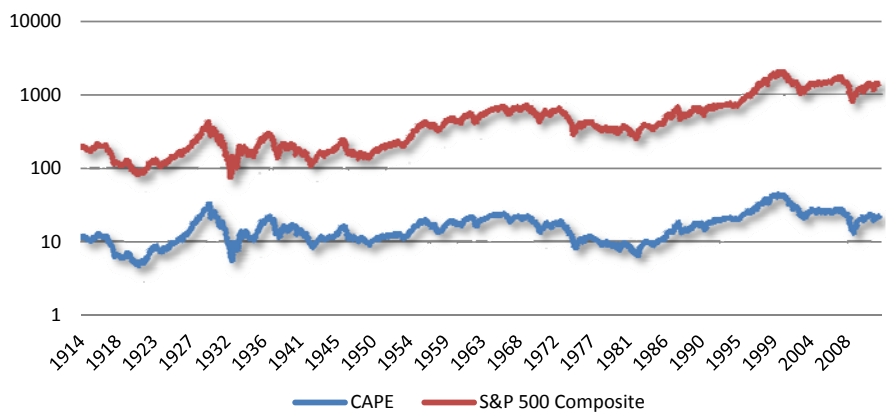
We can investigate the loss profile in more detail by calculating the probabilities for several loss tolerances in Exhibit 8. Using 1 and 10 years as an example, as anticipated, the distribution in the short-term seems fairly random, particularly at higher valuations. And worryingly, a large proportion of the loss is over 15% per annum, whereas the loss band for the longer horizon is tighter and more consistent, with the majority of the loss contained within 5%-10% per annum.

Exhibit 8: Distribution of loss in the short (left) and long (right) run



Ultimately, in order for CAPE to be helpful in projecting future returns, the crucial element depends on knowing when the market will revert to fair value and how long it will last, under the assumption that the CAPE is a mean-reverting series. However, this is a very difficult exercise as this process may vary from a few months to almost a decade. Comfort lies only in extreme valuations on either end (+/- 1SD), where it can be said that there is a high probability of mean reversion, although the investor will likely underperform for some period of time before the patience is rewarded. This would be regarded as shouldering a very high career risk in the eyes of a rational asset manager, as often suggested by Jeremy Grantham of GMO.

Exhibit 9: Logarithmic Chart of CAPE vs. Inflation-Adjusted S&P 500 Composite



Placing the CAPE and S&P 500 alongside each other on a logarithmic scale in Exhibit 9, it shows that the CAPE tracks the inflation-adjusted price of the S&P 500 composite index almost exactly, but offers no indication of an ability to lead market trends. Therefore in the sense of market timing in the near term, the predictive power of the CAPE can said to be negligible. All we can determine at the present stage from our findings is merely what the long-term forward return expectations could be for a given valuation.

As a final comment, we should always bear in mind the peculiar, and therefore perhaps irreplaceable set of factors that led to the US equity market's 6.5% per annum real return of the past century. According to data compiled by the National Bureau of Economic Research, the average business cycle has been considerably shorter for the recent 11 cycles between 5-6 years (measured peak to peak/trough to trough)[1]. Further, given the sustenance of a large disparity between the CAPE and prospective earnings data for some time now, and the vested interests of sell-side firms in touting stock, it is no surprise to hear of questions as to whether earnings are indeed mean-reverting. Some claim that there has been a permanent shift upwards in earnings, which renders the historical CAPE less constructive as a forecasting instrument, but we think this is a dangerous allegation to make. Indeed, our statistical analysis of the historical data suggests that CAPE is a valuable metric despite its simplicity although it should be used in conjunction with other economic and valuation indicators that reference income yields, inflation rates, expected inflation, interest rates and so on.

[1] Observation made by Jacob Wolinsky from Valuewalk.com in the article: 'Stock Market is Overvalued: Shiller PE at 23.66 – Full Analysis'