Did markets overreact to China sell-offs?

Analysis of recent volatility shows the limitations of single-factor models, write Katherine Macleod **and** Damian Handzy

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As international markets gyrated over the past several months it seemed to us that participants possibly adopted a "hair-trigger" or reactionary approach and thereby exaggerated both the impact and contagion of what would otherwise have been localised market events. Specifically, we wanted to examine if markets overreact to single-factor events by evaluating if stocks are oversold relative to single-factor exposure. China's dramatic and unprecedented June and August sell-offs are good candidates for such a study. As we discuss here, for a variety of reasons we found June more representative of single-factor events than the August sell-off and therefore limit our analysis to the June sell-off.

Beginning with the peak on June 12, the Shanghai index did not reach its local trough for 26 days, for an accumulated 32% drop in the SHCOMP (Shanghai) index. This registered as a -3.6 sigma event given its then recent 180-day historical volatility. We examined the returns of the constituent stocks of the US S&P 500 index during the same period by constructing a model that takes into account each stock's direct exposure to Chinese markets by incorporating that company's fraction of revenue from China. We consider this a natural way to construct such a model and expect that this is a common approach to analysing similar situations.

We start with the standard capital asset-pricing model (CAPM) model of linearising each stock's returns through a beta approach:

$$\text{Return}_{stock} \sim \beta * \text{Return}_{S\&P}$$

The beta term in this model takes into account the sensitivity of the stock's return to US markets as represented by the S&P. Since we chose the very stocks that make up the S&P 500 Index, we feel this is an appropriate choice of benchmark for US exposure. We then added to this model an additional term representing the sensitivity to Chinese equity market exposure as represented by the Shanghai index. But because not all US stocks have direct exposure to China, we weighted the contribution of the S&P sensitivity and the Shanghai sensitivity by the stock's percent revenue from China. For stocks with no revenue originating from China, the model would revert to the formula above and the stock would be represented only by sensitive to the US equity markets. If 100% of the stock's revenue were from China, the model would show no sensitivity to US markets and would only be sensitive to Chinese markets. The fraction, f, of revenue from China weights the two components:

$$\text{Return}_{stock} = \overbrace{(1\text{-}f) * \beta * \text{Return}_{S\&P}}^{\text{US sensitivity}} + \overbrace{f * \text{Return}_{Shanghai}}^{\text{China sensitivity}}$$

We considered including a beta-to-China factor in the China sensitivity term but were wary of incorporating a low beta based on the prior period's steady-state rise; such a beta would dampen the very effect we were trying to isolate. Instead, we built the model using each stock's percent revenue from China as its effective beta to the Chinese market. But for completeness, we did examine the results of including the additional beta-to-China in the second term – the results were nearly indistinguishable from the 'S&P only' model as suspected.

The analyses below are based on time series data from Bloomberg and revenue segment data by region from FactSet.

We consider three models:

1. US CAPM only takes into account the stock's sensitivity to the US markets:

$$\text{Return}_{stock} = \beta_{S\&P} * \text{Return}_{S\&P}$$

2. China CAPM extends this with a term representing Chinese sensitivity using the percent revenue from China (f) as weights for the two sensitivities:

$$\text{Return}_{stock} = (1\text{-}f) * \beta_{S\&P} * \text{Return}_{S\&P} + f * \text{Return}_{Shanghai}$$

3. China Beta CAPM adds the additional factor of the beta to the Chinese markets:

$$\text{Return}_{stock} = (1\text{-}f) * \beta_{S\&P} * \text{Return}_{S\&P} + f * \beta_{Shanghai} * \text{Return}_{Shanghai}$$

The comparative results for the two models for June are shown in graph 1. Each point in the plot represents one day's actual return for the stock (x-axis) and the model's prediction of its returns (y-axis). The solid line is drawn to show what a perfectly accurate model would have predicted.

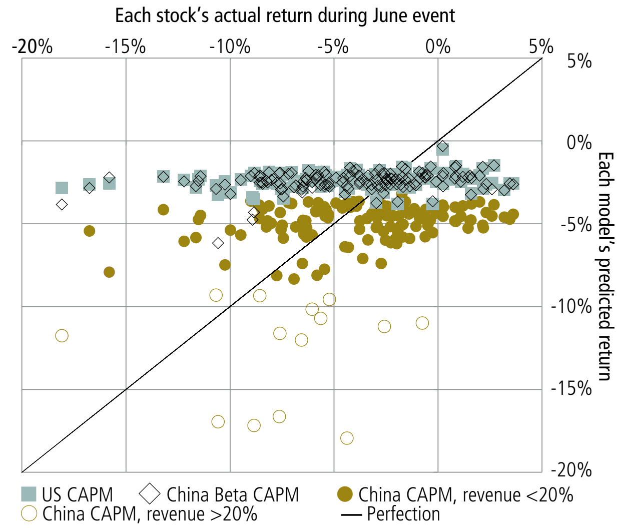
We note that, as expected, the China Beta CAPM model is hardly distinguishable from the US CAPM model due to the very low value of the stocks' betas to the steady-state Shanghai index. None of the models does a particularly good job of reproducing the returns of the stocks and none of them stands out with respect to any of the standard goodness of fit measures. We separated the stocks with the highest percent revenue coming from China and plotted them in open circles: for these stocks, the China CAPM model systematically over-predicts their losses.

Our expectation was that stocks with larger percent revenue from China would have larger losses, and indeed this is what we see in graph 2.

When bucketed by revenue from China, the US stocks show a clear pattern of increased losses with increased Chinese revenue, but this dependence did not translate into a linear dependence on revenue from China. Indeed, stocks with less than 15% of their revenue from China showed no difference in average aggregate losses than stocks with no revenue from China. It was only when we considered stocks with 15% or more of their revenue from China that we saw a measurable effect, but the low number of such stocks makes drawing broad conclusions about them as a separate class questionable.

Analysing the August downtown did not add clarity to the situation as all

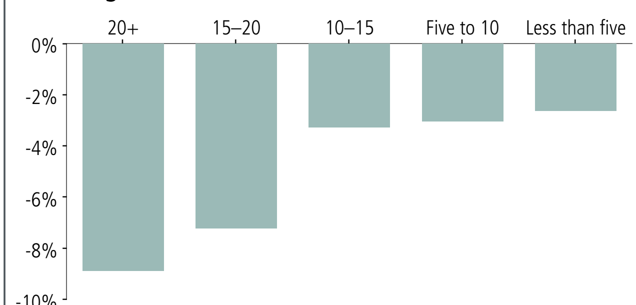
1 Actual performance of stocks during June 2015 vs predictions of three models



Circles are the result of the model under consideration – open circles for stocks with 20% or more of their revenue from China.

Source: Factset, Bloomberg

2 Average return June



When US stocks are bucketed by the fraction of their revenue from China, a strong relationship is shown for the stocks with the largest fraction of revenue from China.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A. China revenue and June losses

Symbol	Industry	% revenue from China	June return
SWKS	IT	66.5	-9%
YUM	Consumer discretionary	52.2	-4%
QCOM	IT	48.2	-8%
AVGO	IT	47.8	-9%
QRVO	IT	47.4	-11%
MU	IT	39.7	-30%
EXPD	Industrials	32.1	-8%
TXN	IT	31.8	-7%
MJN	Consumer staples	30.4	-3%
ALTR	IT	29.9	-1%
SNDK	IT	29.6	-18%
MCHP	IT	27.1	-6%
APH	IT	26.1	-6%
BRCM	IT	24.0	-5%
XLNX	IT	23.3	-9%
DLPH	Consumer discretionary	22.5	-11%
INTC	IT	19.4	-6%
NVDA	IT	19.1	-7%
GLW	IT	18.9	-8%
WDC	IT	18.1	-16%
AMAT	IT	17.2	-5%
TEL	IT	16.9	-10%

stocks, regardless of percent revenue from China, were down similarly through the period: for the same buckets as we used above, the respective returns were -8%, -7.4%, -6.9%, -7.9% and -8.3%. We concluded that August, as a multi-factor and much-anticipated event, was not worth examining in detail to help understand the US market's sensitivity to China.

Among the stocks with the most revenue from China, above 15%, the ones with the largest losses in June did not have the largest percent of their revenue from China. In fact, the most striking similarity between these stocks is simply their industry. The table below shows the stocks in the S&P sorted by percent revenue from China; those losing double digits in June are highlighted. The range among this group is from a loss of 1% to a loss of 30%. The highest losses are somewhat randomly dispersed among this group, revealing no systematic relationship between revenue from China and experienced loss.

While on a stock-by-stock basis, the models we examined did not do a good job of explaining stocks' returns during the June China downturn, it's clear that stocks with higher revenue from China suffered a larger impact than those with little or no revenue.

Our recommendation for analysts is rather than using a detailed model based on individual stocks' characteristics to the single-factor event, at least in the case of China, it's probably better to estimate such sensitivities using broad-stroke approaches, grouped by sectors or generalised buckets, to indicate specific risk to the single factor under analysis. ■

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