Market Insight

When Hurricane Sandy Closed Wall Street

The Impact of Storm-Related Market Closures on Risk Analysis

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November 2012

Abstract:

The US equity market closures necessitated by Hurricane Sandy posed the potential for returns or risks to spike once the markets reopened. We examine a number of RiskMetrics and Barra risk models in the aftermath of the storm, concluding that markets largely returned to normalcy, and no special model treatment of those days was necessary.

Why This Matters:

- While precedents for Hurricane Sandy exist in terms of economic impact, the storm was unique as a natural disaster by forcing closure of equity markets in the US.
- Unscheduled market closures require some degree of risk modeling assumptions, and it is important to assess whether simple assumptions were sufficient in this case.

Introduction

In a separate note,[1] we examined the impact of a number of historical storms with comparable economic impact to Hurricane Sandy. That report concluded that there has been little consistency in the behavior of markets after such storms, and no pattern that would suggest any revised risk forecasts in the medium term. An important difference between Sandy and the earlier storms, however, is that Sandy struck a financial center, causing two days of market closures. This paper examines the days following the reopening of the US equity markets, and assesses the consequences of treating the market closures in risk models as zero return days.

In Search of Surprises

The first concern is whether the broad markets produced any surprises in the days following the storm, and if so, whether these surprises might be attributed to how risk models handled the two days of market closures.

In one of our November 2012 *Risk Monitor* reports,[2] we examine the evolution of risk forecasts under a standard RiskMetrics model[3] for a number of global risk factors. Among the 12 risk factors in this *Risk Monitor*, two of them (the MSCI USA Index and the VIX) covered markets that were closed on October 29 and 30. For both of these factors, the model assumes a zero return for those two days, and so the volatility forecast for October 31was slightly less than the forecast prevailing after the market close on October 26. The question is, did this simple treatment of the closures produce any noticeable shortcomings in the risk forecasts?

The November 2012 *Risk Monitor - RiskMetrics* report shows that volatilities for most factors were generally low in October, compared to the previous twelve months. Moreover, we note that since the storm, none of the factors have produced a daily return in excess of two forecasted standard deviations. In other words, none of the 12 risk factors covered—which include both markets directly impacted by the storm and markets that might have been affected by flight to quality effects—demonstrated returns in the days following the storm that could be considered as surprises given the prevailing risk forecasts.

In fact, rather than a flight to quality event, the one day after the storm where returns did approach the level of risk forecasts was November 1, when markets rallied broadly, with most equity markets up and many risk indicators (implied volatilities and credit spreads) falling.

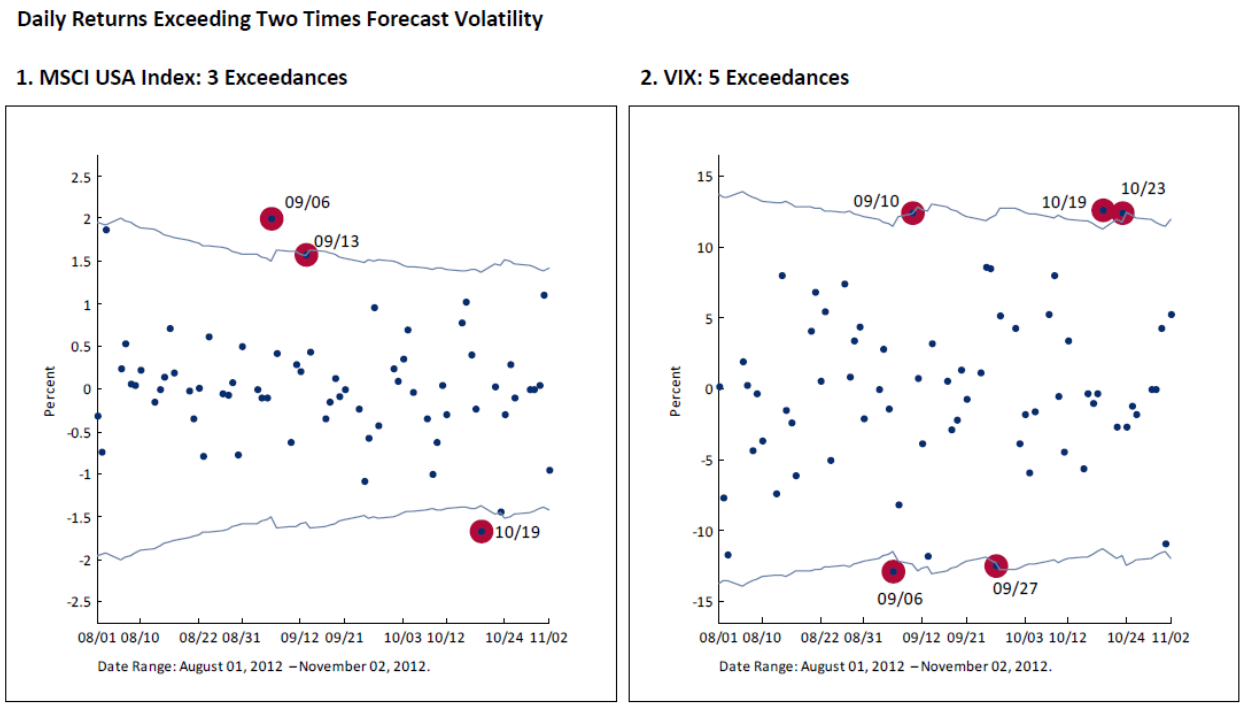
In particular, on page eight of the November 2012 *Risk Monitor - RiskMetrics* report, the return for the MSCI USA Index is close to the upside exceedance band (set to two times the forecasted volatility) while the return for the VIX is close to the lower band (see Figure 1). The market rally on this day, however, had more to do with positive US employment news than anything related to the storm, and so it is difficult to assert that any storm-related forecast adjustments would have been warranted.

[1] Ruban, O. After The Storm. MSCI US Market Report. November 2012.

[2] MSCI Risk Monitor: RiskMetrics. November 2012.

[3] Exponentially weighted moving average volatility, with decay factor of 0.97.

Figure 1: From the *MSCI Risk Monitor – RiskMetrics* report for November 2012.



Correlation Evidence

Besides the potential to cause underestimations in volatility forecasts, the two days of assumed zero returns could possibly depress correlation estimates, leading to under-forecasted risk on portfolios. To examine this potential, we modeled the risk on four index portfolios with varying exposure to the markets that were closed:

- The MSCI USA Index, which is exposed entirely to securities impacted by the closures,
- The MSCI World Index, which is exposed in part[4] to the impacted US markets, with the remaining exposure to unaffected markets, and
- The Barclays US Government Bond Index, which has no direct exposure to markets that were closed.

We modeled each of these indices based on their constituents, meaning that the risk forecasts are driven by security-level estimates of volatility and correlation. In each case, we modeled risk under three different model settings:

- Monte Carlo simulation, with exponentially-weighted moving average (EWMA) with a decay factor of 0.97 for both volatility and correlation estimations,
- Historical simulation, with three years of equally weighted data, and
- Monte Carlo simulation, with a hybrid model consisting of EWMA for volatility estimation, but three years of equally weighted data for correlation estimation.

[4] Roughly 55 percent, as of August 2012.

We focus on November 1 again, since this was the one day after the storm with significant market moves. The returns for that day, along with the 95 percent risk forecasts under three different model settings, are displayed in the table below.

Table 1: Downside and upside VaR estimates (95% confidence) for November 1, 2012.

		Downside and Upside VaR (%)					
	Return (%)	Monte Carlo, EWMA		Historical Simulations		Monte Carlo, Hybrid Model	
MSCI USA Index	1.12	-1.11	1.13	-1.74	1.69	-1.80	1.85
MSCI World Index	0.90	-1.20	1.18	-1.80	1.73	-1.81	1.79
Barclays US Government Index	-0.14	-0.29	0.29	-0.37	0.38	-0.37	0.41

In the market rally of November 1, the government bond index posted a moderate loss, though this was well within the VaR bounds under any of the model settings. The MSCI World Index gained almost one percent, though again this move was well within the VaR ranges of all of the models.

Only the MSCI USA Index, for which all of the underlying constituents were flat during the market closure, posted a return that approached the 95 percent VaR level. Interestingly, the VaR level that was almost exceeded was the 1.13 percent upside VaR from the full EWMA model. Under the hybrid model, which utilized the same volatility but different correlation estimates, the upside VaR was appreciably higher, at 1.85 percent. This one event is still not enough information to condemn the zero return treatment for the closed markets, or to suggest that any model adjustments were necessary. This must be seen as a narrow conclusion, however, as a longer market closure, or a closure during a more volatile period, could well require model adjustments.

Finally, our results do highlight the potential benefits of the hybrid model generally, which will be the subject of a forthcoming paper on backtesting.

A Closer Look at the Equity Markets

Confident that there are no pressing issues with the market closure's impact on risk assessment, we move to an assessment of the impact of the storm on US equity returns. Table 2 presents the top 10 and bottom 10 factor returns between October 26 and November 1, ranked by their Sharpe Ratios. The Sharpe Ratios are calculated as the ratio of realized return over the two days over the risk forecast from the short term Barra US Equity Model (USE4S) taken on October 26 and scaled to a two day horizon.

The overall picture of factor returns is largely consistent with the industry discussion in the aforementioned note.[5] Among the biggest winners are industries such as Industrial Machinery, Building Products, Electrical Equipment, Construction and Household Durables. The only style factor to make it into the top 10 is Non-Linear Size, which proxies the mid-cap effect in the market. Among the biggest losers are Insurance and Utilities industry factors.

[5] Ruban, O. After The Storm. MSCI US Market Report. November 2012.

Table 2: Biggest winners and losers in the aftermath of Hurricane Sandy.

Top 10 Winners

	Return	Forecast Risk	Sharpe Ratio
Industrial Machinery	3.08	0.68	4.56
Automobiles	4.78	1.06	4.50
Commercial Services	1.49	0.36	4.11
Building Products	5.23	1.45	3.61
Electrical Equipment	2.22	0.64	3.46
Speciality Retail	2.51	0.80	3.13
Non-Linear Size	0.58	0.21	2.79
Construction and Engineering	1.96	0.76	2.56
Speciality Stores	2.03	0.80	2.55
Household Durables	1.82	0.80	2.26

Top 10 Losers

	Return	Forecast Risk	Sharpe Ratio
Insurance	-2.16	0.51	-4.23
Pharmaceuticals	-2.10	0.59	-3.55
Oil Gas Consumable Fuels	-2.45	0.84	-2.92
Growth	-0.22	0.08	-2.59
Electical Utilities	-1.35	0.59	-2.29
Gas Utilities	-1.54	0.68	-2.27
Dividend Yield	-0.17	0.10	-1.79
Oil and Gas Equipment	-1.88	1.25	-1.50
Water and Power Utilities	-0.92	0.62	-1.49
Biotechnology Life Sciences	-1.20	0.82	-1.47

Conclusion

The evident human and economic costs of Hurricane Sandy, along with the market closures that were unique to this storm, prompt an evaluation of market risk models in the days immediately following the disaster. We see that the market risk environment just prior to and after the storm was benign, and that no market surprises seem to have occurred as an artifact of a simple treatment of the market closures in our risk models. Moreover, from a risk-adjusted return perspective, the equity markets in the days following the storm behaved as intuition, discussed in our prior note, would suggest.

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[1] *As of June 30, 2011, based on eVestment, Lipper and Bloomberg data.*