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How Stale is your Risk Model?

Daily Risk Changes in September 2008

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1. Introduction

Traditionally, commercial risk model providers have updated their risk models on a monthly basis with daily updates only for the exposures of assets that undergo significant corporate actions. The monthly approach to risk model updating works only if market conditions remain relatively stable. Unfortunately, when market conditions change rapidly, the underlying data upon which the risk model is constructed, including data unrelated to corporate actions, can quickly become stale, the quality of the risk predictions made by a monthly risk model can deteriorate, and portfolio adjustments made in response to market movements using a monthly risk model may be suspect.

In this short article, we use Axioma's daily-updated US risk model to report some of the dramatic risk changes that occurred during September 2008, and quantify the inaccuracies that occurred with a monthly risk model. The results show that stale risk models seriously misestimated risk during the second half of September. In times like these, there is no justification for using anything other than a risk model that is updated daily.

2. Changes in Predicted Risk

In order to quantify the changes in risk prediction that occurred during September 2008, we construct a series of long-short, dollar-neutral portfolios and calculate the risk for each of these portfolios using Axioma's fundamental US risk models on August 29, 2008 and September 30, 2008. We keep the portfolio weights the same on each date, so as to isolate risk prediction changes due to the risk model.

The portfolios hedge or reduce the risk associated with a particular sector or industry. The portfolios are constructed as follows. First, the universe of securities is defined using the assets in the Russell 1000 benchmark on 8/29/08 minus those securities that do not survive through 9/30/08. This eliminates any risk differences stemming from assets not covered by the risk model. Next we select those assets that belong to a particular sector or industry and take long positions in each of these assets in proportion to its market capitalization. Then, we take short positions in the other assets in the universe in order to minimize the total risk of the combined, dollar neutral portfolio.[1]

Table 1 shows the difference in risk predictions for the Russell 1000 benchmark and the ten GICS sectors. The long-only benchmark risk grows from 17.4% to 19.8% between 8/29/08 and 9/30/08, a difference of 2.4% that is driven principally by factor risk. The largest, dollar-neutral sector change occurs in the Financials sector, which grows from a hedged risk of 11.6% to 16.6%, a difference of 5.0%. Most of the difference in this sector hedge is attributable to factor risk. A number of other sectors also experience substantial increases in risk.

Table 2 shows similar results for the GICS industries. Only the largest 15 and smallest 5 of the industries are shown.[2] The largest changes occur for industries in the Financial and Energy sectors. Note that risk change for the Energy sector was not especially large, while the Independent Power Producers & Energy Traders is the second largest industry change. For the industries with large changes, the changes in total, factor, and specific risk are substantially larger than those shown for the ten GICS sectors shown in Table 1. This is due to the number of long

[1] In addition, we do not permit shorting of any assets that have restricted short sales as of 10/7/08. The results change only slightly when restricted short sales are permitted.
[2] One industry, Transportation Infrastructure, had no assets in the Russell 1000 universe and was not considered.

assets being held being smaller in number and more homogeneous, both of which reduce the diversification of the portfolio.

Portfolio	# Long Positions	Total Risk		Total Risk	Factor Risk	Specific Risk
		Start Vol	End Vol	Δ Vol	Δ Vol	Δ Vol
Benchmark	999	17.4%	19.8%	2.4%	2.4%	0.2%
Sector Hedges						
Financials	194	11.6%	16.6%	5.0%	5.0%	1.5%
Consumer Staples	59	6.8%	8.2%	1.4%	1.5%	0.2%
Telecomm. Services	18	11.9%	13.2%	1.3%	1.7%	0.6%
Materials	65	8.4%	9.6%	1.2%	1.3%	0.3%
Industrials	130	6.0%	7.0%	1.1%	0.9%	0.6%
Energy	85	12.3%	13.2%	0.8%	0.6%	0.6%
Information Tech.	135	8.1%	8.9%	0.8%	0.8%	0.2%
Utilities	57	8.1%	8.9%	0.8%	0.6%	0.5%
Consumer Discretionary	160	6.6%	7.0%	0.5%	0.4%	0.2%
HealthCare	96	7.9%	8.0%	0.1%	0.1%	0.2%

Table 1. The difference in risk predictions for the Russell 1000 benchmark and the ten GICS sector-hedged portfolios.

	Portfolio	# Long Positions	Total Risk		Total Risk	Factor Risk	Specific Risk
			Start Vol	End Vol	Δ Vol	Δ Vol	Δ Vol
1	Thrifts & Mortgage Finance	13	26.4%	39.3%	12.9%	6.5%	11.4%
2	Indep. Pwr Producers & Energy Traders	7	14.6%	27.1%	12.5%	11.9%	5.6%
3	Capital Markets	30	14.3%	22.3%	8.1%	6.4%	4.8%
4	Insurance	54	9.2%	16.8%	7.7%	4.0%	6.8%
5	Diversified Financial Services	11	21.0%	27.7%	6.6%	6.9%	2.3%
6	Commercial Banks	33	17.2%	22.1%	4.9%	2.6%	4.2%
7	Consumer Finance	6	21.1%	26.0%	4.9%	4.9%	1.6%
8	Real Estate Investment Trusts (REITs)	43	12.5%	16.5%	4.0%	3.9%	1.0%
9	Automobiles	4	27.1%	30.7%	3.6%	1.5%	3.4%
10	Industrial Conglomerates	7	14.4%	17.8%	3.4%	2.5%	2.4%
11	Construction Materials	3	24.1%	26.6%	2.5%	1.3%	2.1%
12	Containers & Packaging	12	11.9%	14.2%	2.3%	0.8%	2.4%
13	Water Utilities	2	19.7%	22.0%	2.2%	0.4%	2.6%
14	Paper & Forest Products	4	16.5%	18.7%	2.2%	2.8%	0.7%
15	Airlines	6	27.0%	29.0%	2.0%	2.3%	0.7%
62	Life Sciences Tools & Services	11	10.6%	10.7%	0.1%	0.1%	0.0%
63	Personal Products	6	20.0%	20.0%	0.0%	0.2%	-0.1%
64	Health Care Technology	3	19.3%	19.2%	0.0%	0.1%	-0.1%
65	Energy Equipment & Services	33	13.4%	13.3%	0.0%	-0.2%	0.3%
66	Pharmaceuticals	18	9.8%	9.7%	-0.1%	-0.3%	0.2%

Table 2. The difference in risk predictions for the Russell 1000 benchmark and the GICS industry-hedged portfolios.

3. Risk Predictions Throughout the Month

The previous section reported the differences in predicted risk from one month to the next. In this section, we report the daily changes in predicted risk for two particular portfolios: the benchmark portfolio and the hedge of the GICS Financial sector.

We compare three different risk predictions:

- A fully up-to-date risk model (graphed in blue).
- A partially up-to-date risk model: up-to-date factor exposures but factor-factor covariance from 8/29/08 (solid red).
- A completely stale risk model: factor exposures and factor-factor covariance from 8/29/08 (dashed red).

Figure 1 shows the daily risk predictions from each of these models for the benchmark portfolio. All three models predict the same risk on 8/29/08 (17.4%). The up-to-date risk model (blue) experiences sharp increases in risk during the week of 9/15 – 9/19 and then again on 9/26. The completely stale risk model (dashed red) is, of course, constant throughout the month. The partially up-to-date risk model (solid red) actually predicts a decrease in risk starting on 9/18, the day the Federal bailout was announced. Both stale risk models incur large risk corrections on 9/30/08 when the model's factor-factor covariances are updated.

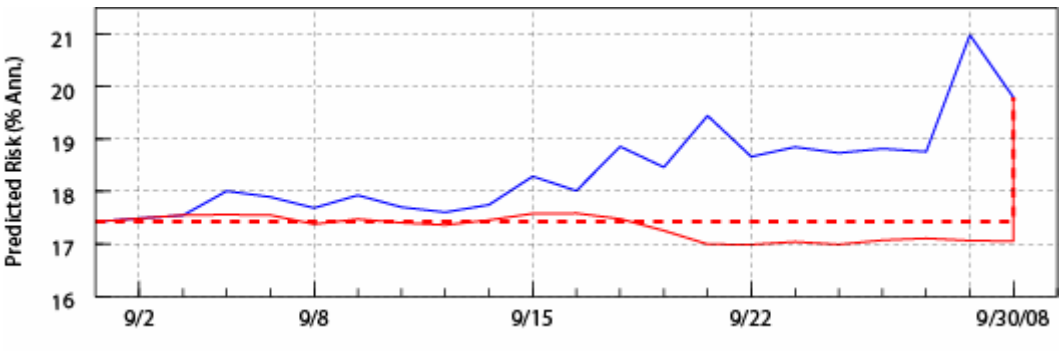

Figure 1. Daily risk model predictions for the Russell 1000 benchmark from 8/29/08 to 9/30/08. Blue = up-to-date model; solid red = updated exposures, stale covariance; dashed red = stale risk model.

Figure 2 shows the daily risk predictions from each risk model for the hedged, Financials sector portfolio. The largest risk increase for the up-to-date risk model occurs on 9/18 when the portfolio risk goes from 13.3% to 16.3%, an increase of 3%. For this portfolio, the partially updated risk model increases modestly during the second half of the month, but still incurs a 3.2% jump (13.4% to 16.6%) on 9/30 when the risk model is updated. For this particular portfolio, updating just the exposures improves the risk prediction a small amount, but still does not capture all the current market information available as of that date.

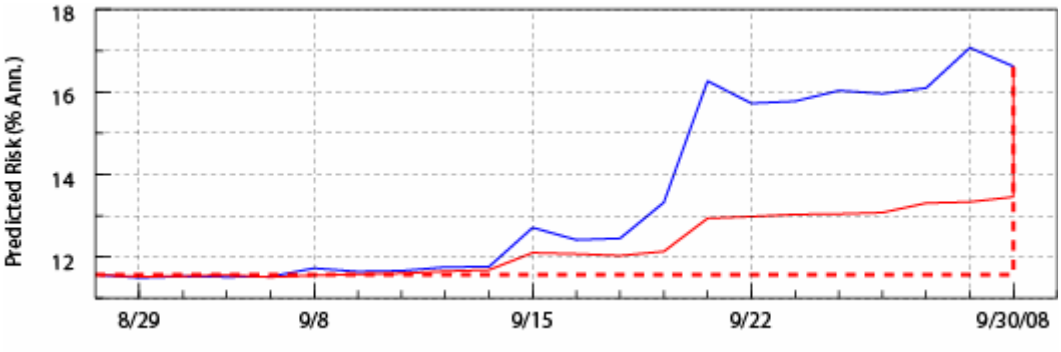

Figure 2. Daily risk model predictions for the hedged, Financial sector portfolio from 8/29/08 to 9/30/08. Blue = up-to-date model; solid red = updated exposures, stale covariance; dashed red = stale risk model.

4. Conclusions

September 2008 was a difficult month for investors, and no one should be surprised that risk model predictions increased substantially during the second half of the month. The sectors and industries with the largest month-to-month differences are those that have been in the headlines the most – mortgage providers, energy producers, capital markets, and insurance – and the magnitude of the risk changes has been substantial.

For professional money managers who needed to respond appropriately to daily market movements as they were occurring, not having an up-to-date risk model would have been a serious handicap. The largest market changes occurred on 9/18 and 9/26, not 9/30. The changes in risk predicted by stale risk models when they were updated on 9/30 were, in fact, as large as or larger than the largest daily changes that occurred during the month. The market continued to exhibit high volatility in October as well. The predicted risk of the Russell 1000 benchmark

increased 9% from 19.3% to 28.2% in the two weeks from 9/30/08 through 10/14/08,[3] and the changes in the hedge portfolios have been as large as they were in September. For many money managers, having daily risk model updates in September and October was not a luxury but rather a tool essential for doing their jobs.

[3] The risk on 9/30 is 19.3% for the benchmark weights as of 9/30 and 19.8% (Table 1) for the benchmark weights as of 8/31/08.

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