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The Signpost Up Ahead: Risk Danger Zones

What Multiple Risk Models Can Tell Us About Future Drawdowns

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In this article, we show that multiple risk model predictions can potentially identify "danger zones" associated with future market drops. We use two risk metrics – average predicted risk and the maximum difference between Axioma's four risk model predictions – to identify conditions when the maximum, forward, 90-day drawdown has been significant.

Two danger zone stand out, both associated with moderate levels of risk. Historically, when risk is moderate but risk model predictions are all similar, there is a higher chance of a large future drawdown.

In addition, when risk is moderate but risk models predictions are all dissimilar, there is a high chance of a moderate future drawdown.

The results give investors additional insight into what risk changes may portend.

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What Multiple Risk Models Can Tell Us About Future Drawdowns

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April 11, 2012

Do differences in risk predictions across a range of risk models provide market insight? Axioma produces four different risk models[1] for each country and region, each with its own risk estimate calculated by looking at the data from a different perspective. In 2008 our short-horizon statistical models reacted more quickly and with more factor risk than our medium-horizon, fundamental models. The reason? The statistical models picked up a factor that was not "seen" by the fundamental models—a situation that persisted for several months while Washington decided how it was going to respond.

In this article, we show that multiple risk model predictions can potentially identify "danger zones" associated with future market drops. We use two risk metrics – average predicted risk and the maximum difference between Axioma's four risk model predictions – to identify conditions when the maximum, forward, 90-day drawdown has been significant.

For a large number of universes and geographic regions, we have observed two danger zones associated with large future drawdowns, each corresponding to a moderate level of risk. When the difference in risk model predictions was small, historically, there have

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[1] Fundamental short and medium horizon risk models as well as statistical short and medium horizon risk models.

been large drawdowns, and when the differences in the risk model predictions were large, historically, there have been moderate but highly likely drawdowns.

The analysis performed here provides insight into current market conditions that would be impossible to obtain from a single risk model. Specifically, the market surge during Q1/2012 has been characterized by moderate risk levels but differences in risk prediction have steadily grown. The current large differences in risk prediction at a moderate level of risk may indicate moderate future drawdowns.

The Russell 1000 Index

We start with US large caps using the Russell 1000 Index. Figure 1 shows four daily time series from 1998 through 3/29/12: the cumulative benchmark return; the maximum, forward, 90-day drawdown; the risk predictions of Axioma's four risk models (AXUS2-MH, AXUS2-MH-S, AXUS2-SH, and AXUS2-SH-S); and the maximum difference in those four risk predictions (sometimes referred to as the risk model spread).
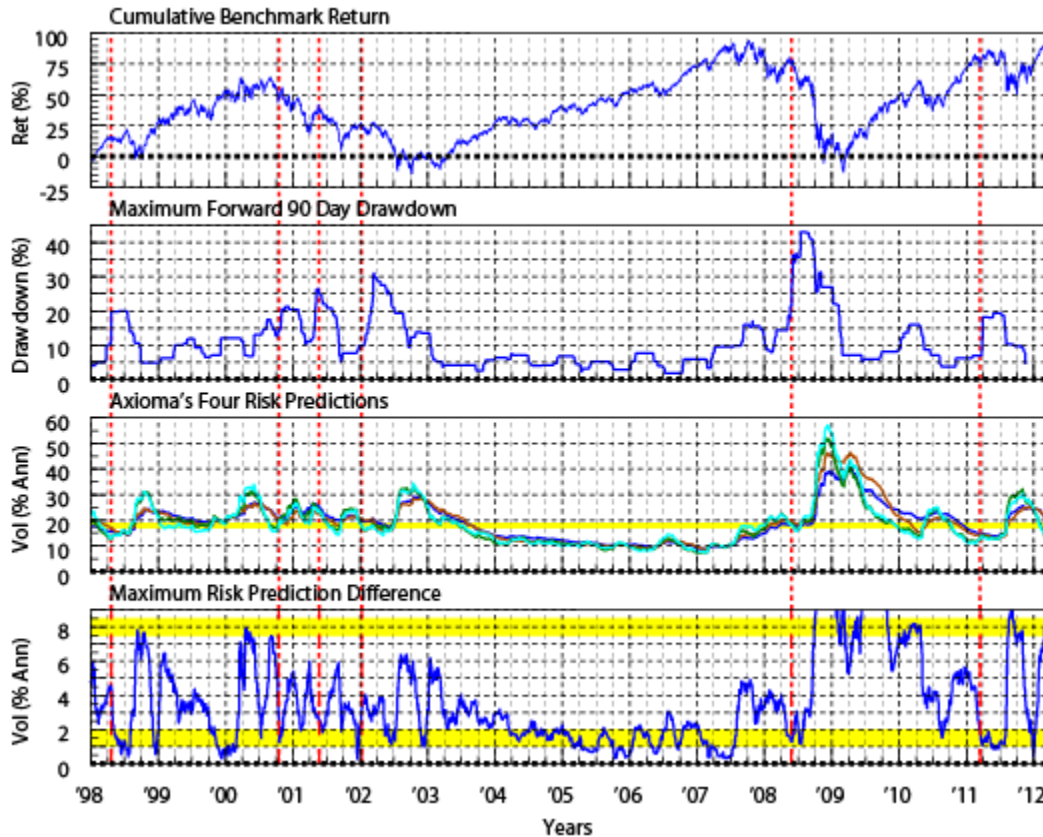

Figure 1. Historical results for the Russell 1000 Index from 1998 through 3/29/12: the cumulative benchmark return (top); the maximum, forward, 90-day drawdown (second from the top); the risk predictions of Axioma's four risk models (AXUS2-MH, AXUS2-MH-S, AXUS2-SH, and AXUS2-SH-S); and the maximum difference in those four risk predictions (bottom). The yellow bands identify two "danger zones": average risk between 17% and 19% (ann. vol.) and maximum risk differences between either 1% and 2% or 7.5% and 8.5%. The six, vertical, red, dashed lines indicate times when the danger zone was followed by a large drawdown in the Index.

The two yellow bands in Fig. 1 identify "danger zones": average risk between 17% and 19% (ann. vol.) and maximum risk differences between either 1% and 2% or 7.5% and

8.5%. The vertical, red, dashed lines indicate six times when the danger zone preceded a large drawdown. To be sure, not every trip into the danger zone resulted in a large drawdown, and not every large drawdown was preceded by a trip into the danger zone. Nevertheless, over a 14-year period, the danger zone appears to be strongly correlated with large drawdowns. The period from 2004 to 2008 was characterized by risk below the danger zone level and no large drawdowns. However, several months before the 2008 recession, risk crept into the danger zone and was soon followed by the largest drawdown in the data.

Figure 2 shows the Russell 1000 data recast into two different contour plots designed to make the danger zones easier to identify.
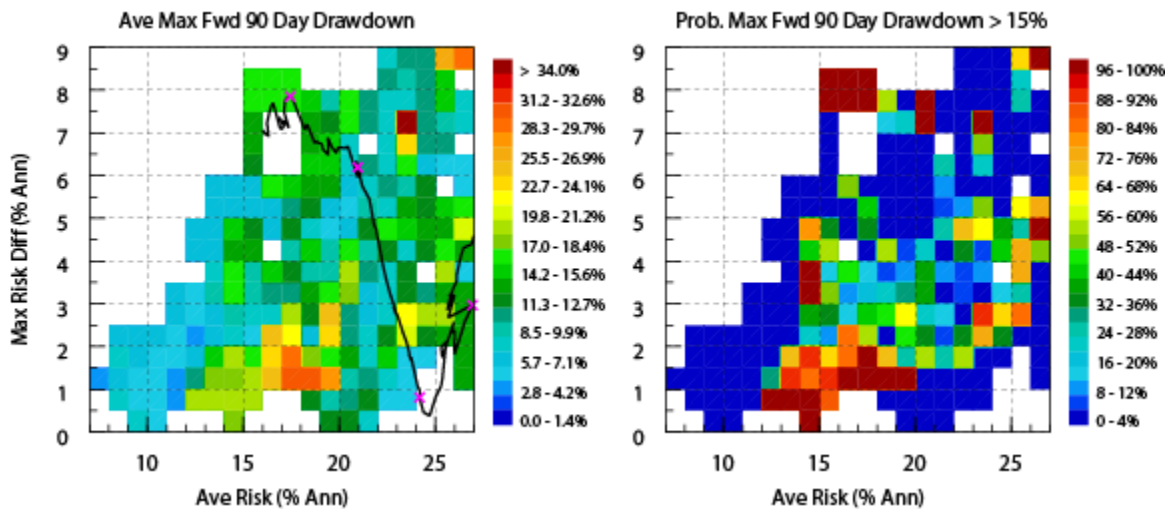

Figure 2. Danger zone plots for the Russell 1000 Index. Left: plot of the average, maximum, forward, 90-day drawdown as a function of the average risk (horizontal axis) and maximum risk difference (vertical axis). Right: the probability that the forward 90-day drawdown is more than 15%. The black line on the left is the evolution of recent risk predictions. The locations of the 11/30/11, 12/30/11, 1/31/12, and 2/29/12 predictions are indicated by the magenta X's.

Both plots show the average risk prediction on the horizontal axis and the maximum risk prediction difference on the vertical axis. The left contour plot shows the average, maximum forward 90-day drawdown for each bucket; the right contour shows the probability that the maximum drawdown was greater than 15%. The color scales for each contour plot are shown immediately to the right of each plot.

4

On the left contour plot, the black line shows the recent evolution of the risk predictions. The predictions on 11/30/11, 12/30/11, 1/31/12, and 2/29/12 are shown by the magenta X's. As of 3/29/12, the average risk was 16.0% and the risk difference was 7.1%.

For both graphs, we cut off data when the predicted risk was greater than 27%. We already know that these high risk regimes indicate market difficulties.

What do these graphs tell us? In both plots, there are two "danger zones," one at the bottom center of the plot indicated by the orange and red squares: average risk between 17% and 19%, risk difference between 1% and 2%; and a second at the top center indicated by the green drawdown colors and red probability colors: average risk between 17% and 19%, risk difference between 7.5% and 8.5%. The average drawdown in the first zone is more than 20% (orange on the left) and the likelihood of a drawdown of more than 15% is close to one (dark red on the right). The average drawdown in the second zone is closer to 15%, but the probability is almost one.

January's market surge occurred while the risk predictions skirted the first danger zone but moved towards and into the second. Average risk decreased to moderate levels, but the differences in risk predictions steadily rose.

Current market conditions are quite close to the second danger zone (average risk between 15%-17% and a risk difference of 7.5% - 8.5%). The expected drawdowns in this danger zone are 15% to 16%, which are smaller than those in the first danger zone. However, the probability of this drawdown occurring is quite high. The data from this period is dominated by results between January and June 2009, as well as October 2009 to March 2010. Other shorter time periods are included: September to October 1998, March to May 2000, September to October 2008, August to November 2011, and the current conditions (for which the maximum forward 90 day drawdown is yet unknown).

Of course, in the past week or two, current market conditions have dropped out of this second danger zone into an area on the graph for which we have little data. Consequently, it is difficult to predict whether or not the Russell 1000 universe will have a large drawdown over the next three months. However, given past data, a large drawdown would not be a surprise.

Other Universes

In this section, we examine how the analysis carries over to other benchmarks and geographies. Figure 3 shows data for the Russell 2000 Index. Fig. 4 shows the FTSE

Developed Europe Index. Fig. 5 shows the FTSE Developed Asia Pacific Index. And Fig. 6 shows the FTSE Emerging Index.
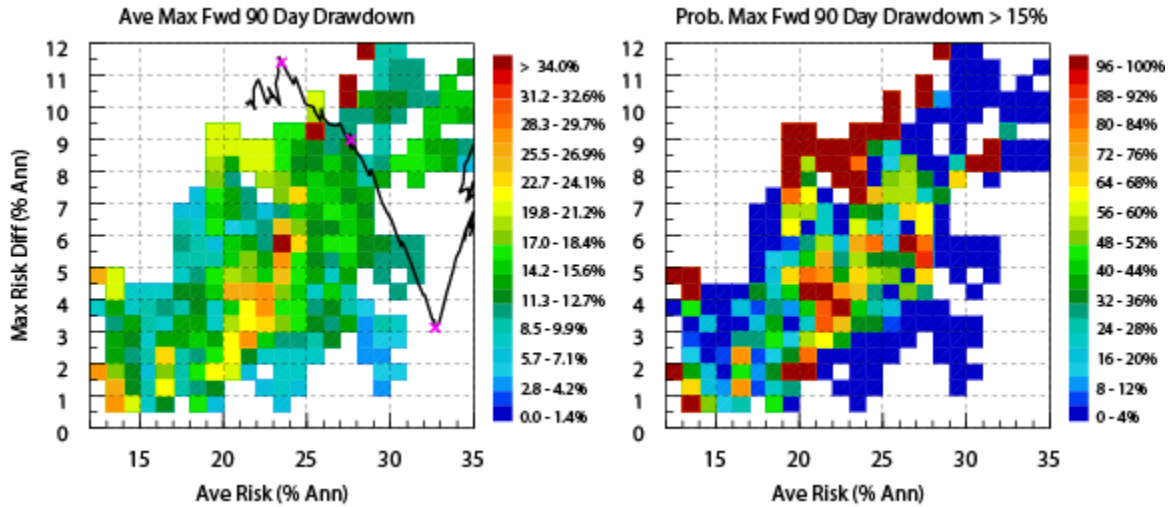

Figure 3. Danger zones for the Russell 2000 Index using Axioma's four US risk models.
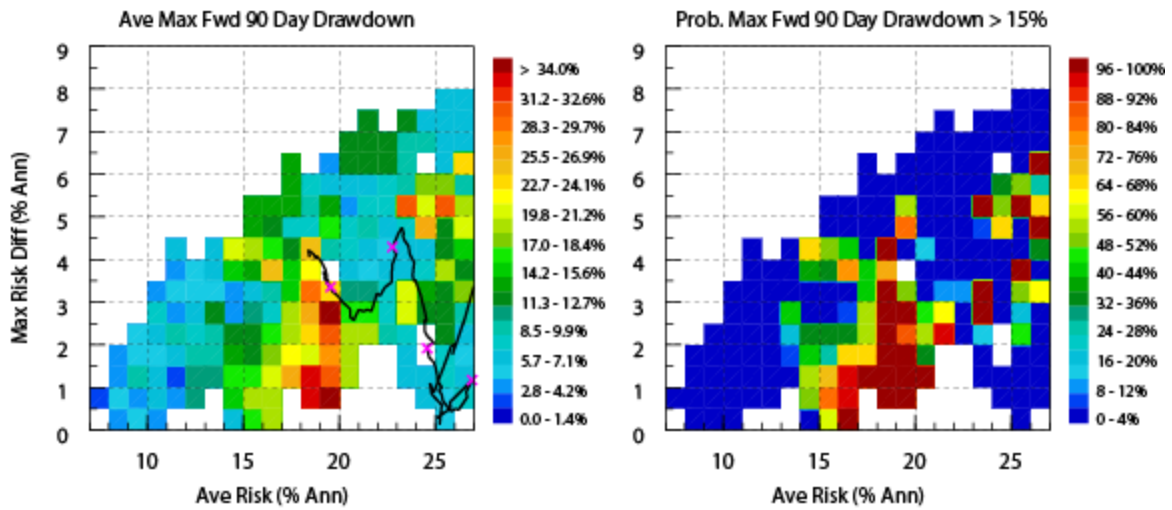

Figure 4. Danger zones for the FTSE Developed Europe Index using Axioma's four European risk models (returns in EUR).
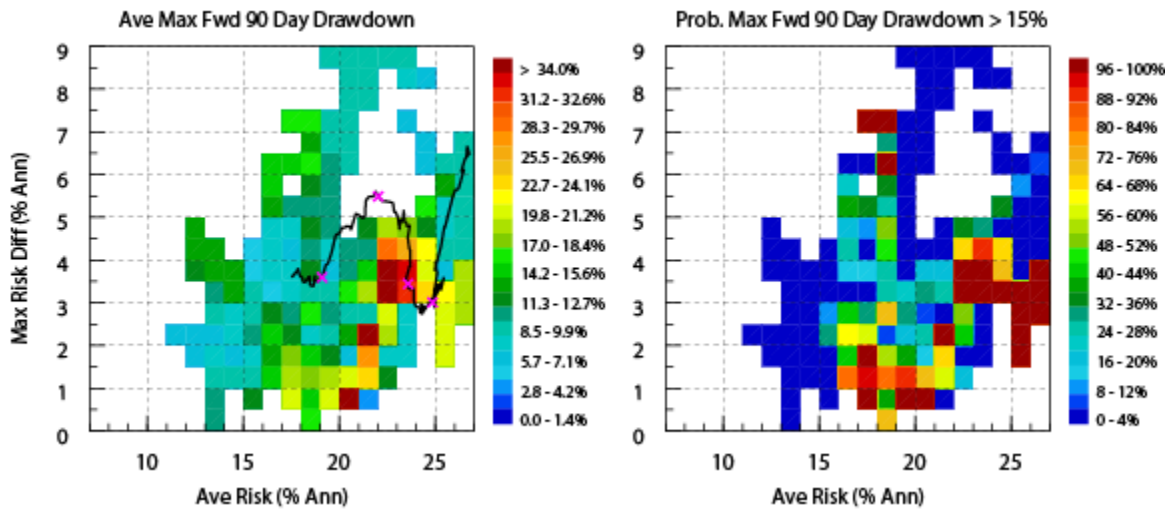
Figure 5. Danger zones for the FTSE Developed Asia Pacific Index using Axioma's four Asia Pacific risk models (returns in USD).
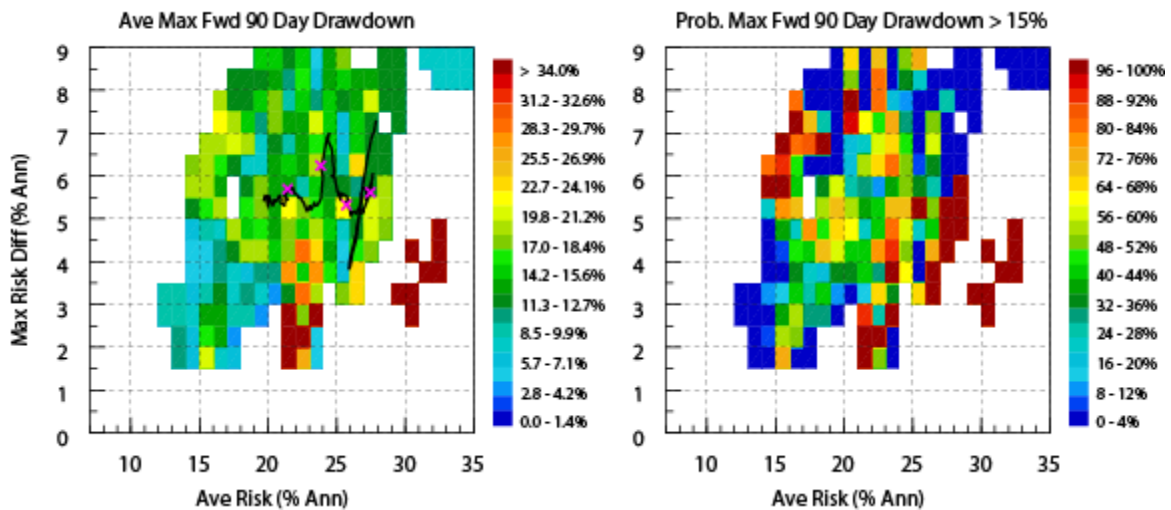

Figure 6. Danger zones for the FTSE Emerging Index using Axioma's four Emerging Markets risk models (returns in USD).

All of the charts exhibit danger zones, regions associated with large drawdowns and a high probability of a large drawdown. In most cases, there are two danger zones: one on the middle of the bottom edge of the color contours with both a high probability of a drawdown in excess of 15% and an average drawdown more than 30%; and a second region along the top, middle of the colored section with a high probability of a drawdown

in excess of 15% but an expected drawdown of only 15%. These two regions correspond to moderate levels of risk with either close agreement (small risk difference) in risk model predictions (the bottom edge) or relatively large disagreement (the top edge).

In terms of current market conditions, US equities appear to be poised for a moderately large drawdown (e.g. 15%) both in large cap and small cap equities. Europe appears to be lagging US market conditions in that its position on the contour charts is approximately two months behind the US: Europe is skirting the danger zone on the bottom edge of the contour plot, but headed towards a region on the upper edge. Historically, however, that region has not been troublesome for Europe. Meanwhile, both Asia and Emerging Markets seem to be well away from any danger zones.

Concluding Comments

This research has characterized market drawdowns in terms of risk danger zones and demonstrated the insights to be gleaned from differences in risk model spreads. There appear to be two important danger zones, both associated with moderate levels of risk. Historically, large drawdowns have been associated with small risk differences between risk models. Moderate drawdowns also appear to occur when there are large differences in the risk models. Based on the data presented here, when risk prediction levels are moderate, it appears that moderate differences in risk predictions between Axioma's four risk models are desirable.

These results highlight the value of using multiple methods of risk assessment. One simple approach is to use multiple risk models, such as those provided by Axioma.

Acknowledgements