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Market Aftershocks?

The Global Impact of the Japan Earthquake as Seen Through the Lens of Axioma's Daily Risk Models

Anthony Renshaw, PhD

Markets worldwide have been jolted by the effects of the devastating earthquake off the coast of Japan on Friday March 11. This article highlights the changes in Axioma's equity risk models that have occurred over the last few days (through market close 3/17) and provides some interpretation of these changes. Because Axioma's risk models are updated daily, we are able to observe market developments as they occur, in contrast to conventional risk models in which the covariance matrix is updated on a monthly basis. While markets outside of Japan flinched in response to initial reports of the disaster, the good news at this point in time is that those markets now seem to have stabilized. The situation for Japan, however, remains volatile.

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The Global Impact of the Japan Earthquake as Seen Through the Lens of Axioma's Daily Risk Models

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1. Introduction

Markets worldwide have been jolted by the effects of the devastating earthquake off the coast of Japan on Friday March 11. Markets fell sharply following a large aftershock and mounting fears of a meltdown at the Fukushima Daiichi nuclear plant, then rebounded on March 16. The VIX rose substantially during this period, from 21.13 at the close on March 14 to 24.32 on March 15 and 29.40 on March 16, before easing on March 17 to 26.37.

This article highlights the changes in Axioma's equity risk models that have occurred over the last few days (through market close 3/17) and provides some interpretation of these changes. Because Axioma's risk models are updated daily, we are able to observe market developments as they occur, in contrast to conventional risk models in which the covariance matrix is updated on a monthly basis. The returns-timing or returns-synchronization correction incorporated in Axioma's global risk models ensures that the reported country-country correlations using daily returns data are accurate. Without such a correction, correlations between Japan and the US would be seriously underestimated due to the different trading hours of these two markets[1].

While markets outside of Japan flinched in response to initial reports of the disaster, the good news at this point in time is that those markets now seem to have stabilized. The situation for Japan, however, remains volatile.

[1] For a detail description of this phenomenon and Axioma's Returns-Timing correction, see http://axioma.com/downloads/Axioma_ReturnsTiming_ShortVersion20101116.pdf.

2. The Global Perspective

Figure 1 shows the cumulative return of the market return for 10 Axioma fundamental factor risk models since the beginning of February. For the multi-country models, we report the Market Factor return, whose factor exposure for all assets is one. For the single-country models, we report the cumulative return of the average return of all industries. The seven multi-country models are North America (AXNA), Global (AXWW2), European (AXEU2), Global Ex US (AXWWxUS), Asia Pacific (AXAP), Asia Pacific Ex Japan (AXAPxJP), and Emerging Markets (AXEM2). The three single-country models are the US (AXUS2), Great Britain (AXGB), and Japan (AXJP2)[2].

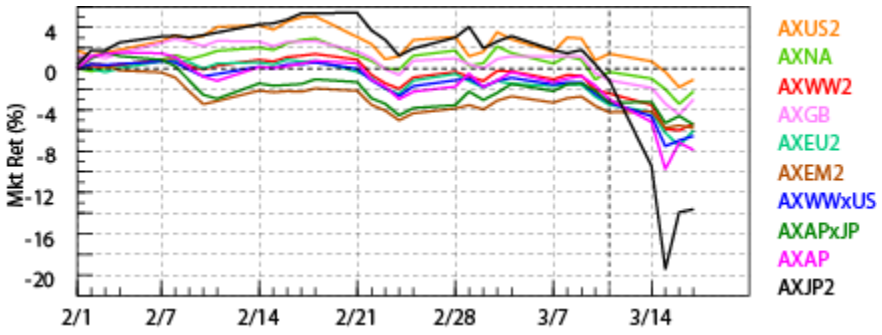

Figure 1. The cumulative return of the market for 10 Axioma fundamental factor risk models since the beginning of February. AXUS2 = US; AXNA = North America; AXWW2 = Global; AXGB = Great Britain; AXEU2 = European; AXEM2 = Emerging Markets; AXWWxUS = Global Ex US; AXAPxJP = Asia Pacific Ex Japan; AXAP = Asia Pacific; AXJP2 = Japan. Colors for each model are shown at right. The earthquake occurred on 3/11, which is indicated by the heavy dashed line. All dates indicate market close.

The Japanese equity market experienced sharp declines starting 3/11 and continuing through 3/15. On 3/16, the market finally rebounded. Other markets exhibited similar patterns, albeit of significantly smaller magnitudes. So far, non-Japanese markets – US, North America, Europe – have been the least affected by events. Nevertheless, the one-percent-plus drops experienced by US markets on 3/15 were unnerving.

[2] The factor returns are the same for the short and medium horizon models.

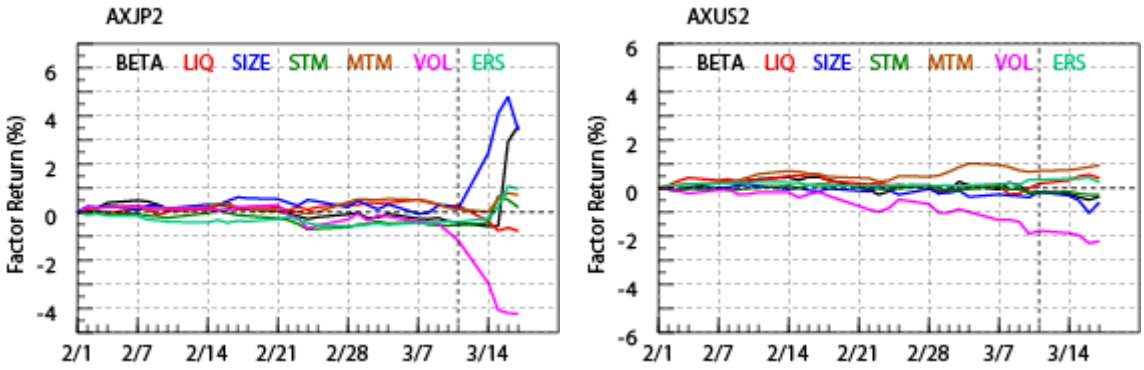

Figure 2. The cumulative return of the technical style risk factors for the Japanese (AXJP2) and US (AXUS2) fundamental factor risk models. The technical factors are market sensitivity (BETA, black), liquidity (LIQ, red), size (SIZE, blue), short-term momentum (STM, dark green), medium-term momentum (MTM, brown), volatility (VOL, pink), and exchange-rate sensitivity (ERS, aquamarine). Corresponding colors are shown on the graph.

In Fig.2, we compare the cumulative factor returns of the seven technical factors in the Japanese (AXJP2) and US (AXUS2) fundamental factor risk models over the same time frame. The seven factors are market sensitivity (BETA, black), liquidity (LIQ, red), market capitalization (SIZE, blue), short-term momentum (STM, green), medium-term momentum (MTM, brown), volatility (VOL, pink), and exchange-rate sensitivity (ERS, aquamarine).

In Table 1, we show the daily factor returns for the seven technical factors over the last four days for the Japanese risk model.

Date	SIZE	LIQ	STM	MTM	VOL	BETA	ERS
3/14	2.3%	-0.7%	0.1%	-0.1%	-1.8%	-0.2%	0.2%
3/15	1.6%	-0.4%	1.1%	0.5%	-1.2%	0.0%	0.5%
3/16	0.7%	0.1%	-0.1%	0.3%	-0.1%	3.5%	0.9%
3/17	-1.3%	-0.1%	-0.3%	-0.1%	0.0%	0.6%	-0.1%

Table 1. The daily factor returns from the technical style risk factors for the Japanese fundamental factor risk model (AXJP2). Returns in excess of +/-1% are highlighted in yellow.

In Japan, the largest initial movements since the earthquake were the size factor, which surged, and volatility, which plummeted. These returns indicate that large caps performed considerably better than small caps on 3/14, and low volatility stocks out-performed high volatility stocks. Of course, this is relative performance. Given the large decline in the Japanese market, large cap and low volatility stocks undoubtedly declined, but their declines were significantly less than those of small cap and high volatility stocks.

Other factors started to move on 3/15, including market sensitivity (which recorded the largest single day movement of +3.5% on 3/16), short-term momentum, and exchange-rate sensitivity.

Interestingly, the liquidity factor has not moved significantly even though Japanese ETFs in the US have reported record sales volumes over the last few days[3]. Evidently, the performance of liquid and illiquid Japanese stocks has been comparable.

The US factor returns have been relatively unaffected compared with the Japanese factor returns. The largest single day US factor returns were size (-0.5% on 3/16, +0.4% on 3/17) and volatility (-0.3% on 3/16).

Tables 2 and 3 report the changes in country volatility and country correlations to Japan using the country-focused[4] global risk model (AXWW2-MH) on the day before the earthquake, 3/10, and on 3/15. Figures 3 and 4 show times series of this same data for a small sub-set of countries.

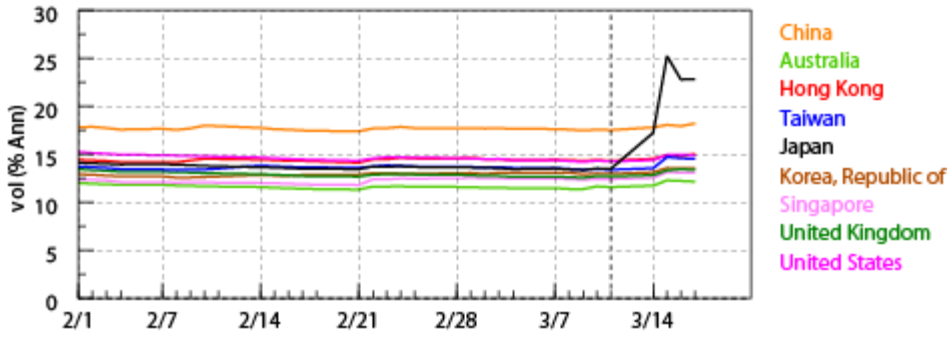

Fig. 3. Country volatilities for selected countries using Axioma's global fundamental factor risk model AXWW2 (country-focused).

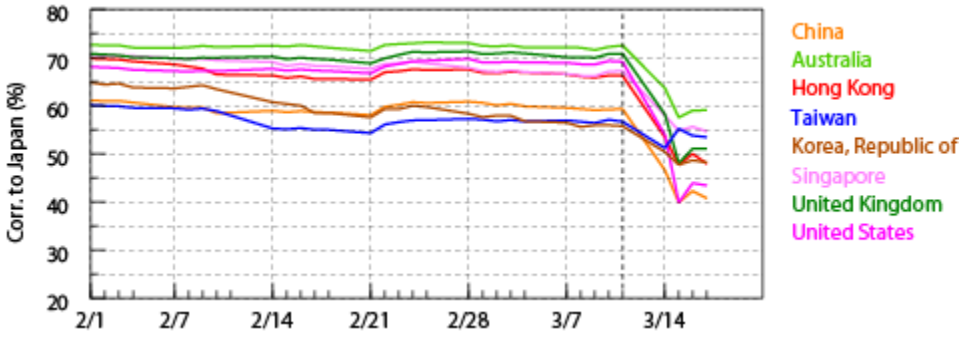

Fig. 4. Correlations of selected countries to Japan using Axioma's global fundamental factor risk model AXWW2 (country-focused).

[3] "Panic Selling Causes Record Spike in Volumes in Japan ETFs," by V. Vaghela, on Risk.net.

[4] Axioma's risk models can report risk in three distinct ways: country-focused, in which the market return is included in the country factor returns, risks, and correlations; industry-focused, in which the market return is included in the industry factor returns, risks, and correlations; and market-focused, in which the market return is reported separately from the industry and country factors.

	Country	Country Volatility on 3/10 (% Ann)	Country Volatility on 3/15 (% Ann)	Volatility Change (% Ann)		Country	Country Volatility on 3/10 (% Ann)	Country Volatility on 3/15 (% Ann)	Volatility Change (% Ann)
1	Japan	13.5%	25.2%	11.7%	35	Israel	12.6%	13.2%	0.5%
2	Lithuania	14.1%	16.7%	2.6%	36	Slovakia	10.2%	10.7%	0.5%
3	Estonia	18.0%	19.8%	1.8%	37	Botswana	11.3%	11.8%	0.5%
4	Cyprus	18.8%	20.4%	1.6%	38	Russian Federation	13.2%	13.7%	0.5%
5	Greece	21.8%	23.3%	1.5%	39	New Zealand	11.9%	12.4%	0.5%
6	Taiwan	13.5%	14.7%	1.3%	40	China	17.6%	18.1%	0.5%
7	Germany	12.0%	13.0%	1.0%	41	Hong Kong	14.4%	14.9%	0.5%
8	Switzerland	11.8%	12.6%	0.8%	42	South Africa	11.5%	12.0%	0.5%
9	Brazil	12.1%	12.9%	0.8%	43	Malaysia	10.9%	11.4%	0.5%
10	Norway	13.5%	14.3%	0.7%	44	Jordan	9.6%	10.1%	0.5%
11	France	13.3%	14.0%	0.7%	45	Croatia	12.9%	13.4%	0.5%
12	Singapore	12.4%	13.2%	0.7%	46	Slovenia	12.4%	12.8%	0.5%
13	Austria	13.7%	14.5%	0.7%	47	Hungary	15.4%	15.9%	0.4%
14	Netherlands	12.8%	13.5%	0.7%	48	Thailand	13.9%	14.3%	0.4%
15	Turkey	17.9%	18.7%	0.7%	49	Mauritius	12.4%	12.8%	0.4%
16	Czech Republic	12.4%	13.1%	0.7%	50	Canada	10.4%	10.9%	0.4%
17	Finland	14.0%	14.7%	0.7%	51	Argentina	17.3%	17.7%	0.4%
18	Sweden	14.9%	15.5%	0.7%	52	Oman	11.6%	12.0%	0.4%
19	Belgium	13.3%	14.0%	0.7%	53	Ireland	14.7%	15.1%	0.4%
20	Iceland	10.7%	11.3%	0.6%	54	Peru	13.5%	13.9%	0.4%
21	Luxembourg	10.1%	10.7%	0.6%	55	Bahrain	9.0%	9.4%	0.4%
22	Latvia	11.6%	12.2%	0.6%	56	Spain	15.9%	16.2%	0.4%
23	Mexico	11.8%	12.4%	0.6%	57	Pakistan	16.2%	16.6%	0.4%
24	Australia	11.7%	12.3%	0.6%	58	Morocco	10.2%	10.5%	0.3%
25	United States	14.3%	15.0%	0.6%	59	Romania	16.9%	17.3%	0.3%
26	Denmark	12.8%	13.5%	0.6%	60	India	18.9%	19.2%	0.3%
27	Philippines	15.0%	15.6%	0.6%	61	United Arab Emirates	14.9%	15.1%	0.3%
28	United Kingdom	12.7%	13.3%	0.6%	62	Qatar	15.4%	15.6%	0.3%
29	Poland	11.6%	12.2%	0.6%	63	Indonesia	16.0%	16.2%	0.3%
30	Korea Republic of	13.0%	13.6%	0.6%	64	Egypt	22.9%	23.2%	0.2%
31	Italy	14.8%	15.4%	0.6%	65	Portugal	17.1%	17.3%	0.2%
32	Chile	12.6%	13.2%	0.6%	66	Bulgaria	15.9%	16.1%	0.2%
33	Venezuela	10.9%	11.4%	0.6%	67	Kuwait	12.5%	12.7%	0.2%
34	Colombia	13.5%	14.1%	0.5%	68	Sri Lanka	15.1%	15.3%	0.2%

Table 2. The country volatilities on 3/10 and 3/15 using Axioma's global fundamental factor risk model AXWW2 (country-focused).

	Country	Country Correl. To Japan on 3/10	Country Correl. To Japan on 3/15	Correlation Change		Country	Country Correl. To Japan on 3/10	Country Correl. To Japan on 3/15	Correlation Change
1	Estonia	38.0%	42.9%	4.9%	35	Portugal	44.6%	27.1%	-17.5%
2	Lithuania	50.3%	54.2%	3.9%	36	Finland	63.0%	45.3%	-17.7%
3	Sri Lanka	25.3%	27.1%	1.8%	37	France	73.0%	55.0%	-18.0%
4	Japan	100.0%	100.0%	0.0%	38	Luxembourg	72.4%	54.4%	-18.0%
5	Kuwait	19.5%	19.2%	-0.3%	39	South Africa	64.1%	45.8%	-18.3%
6	Taiwan	57.1%	55.2%	-1.9%	40	Belgium	69.6%	51.2%	-18.4%
7	Bulgaria	30.2%	28.1%	-2.1%	41	Mauritius	53.2%	34.8%	-18.4%
8	Egypt	32.6%	28.6%	-4.0%	42	Italy	63.7%	45.2%	-18.4%
9	Pakistan	24.9%	19.3%	-5.6%	43	Hong Kong	66.3%	47.7%	-18.6%
10	Latvia	54.7%	48.2%	-6.5%	44	Croatia	55.1%	36.4%	-18.7%
11	Argentina	46.6%	39.7%	-6.9%	45	Netherlands	73.1%	54.3%	-18.8%
12	Qatar	38.6%	30.4%	-8.2%	46	Iceland	75.2%	56.1%	-19.2%
13	Korea Republic of	56.0%	47.7%	-8.2%	47	China	59.2%	39.9%	-19.3%
14	Peru	47.1%	37.5%	-9.5%	48	Spain	57.0%	36.8%	-20.2%
15	United Arab Emirates	38.7%	28.6%	-10.0%	49	Venezuela	69.9%	49.3%	-20.5%
16	Morocco	39.3%	28.4%	-10.9%	50	New Zealand	70.4%	49.0%	-21.4%
17	Jordan	50.4%	39.0%	-11.4%	51	Thailand	50.5%	29.1%	-21.4%
18	Colombia	41.8%	30.4%	-11.4%	52	Malaysia	62.9%	41.4%	-21.4%
19	Slovenia	50.8%	39.3%	-11.6%	53	Israel	55.3%	33.7%	-21.7%
20	India	31.0%	18.9%	-12.1%	54	Slovakia	78.0%	55.5%	-22.5%
21	Singapore	67.1%	54.8%	-12.4%	55	United Kingdom	70.8%	48.0%	-22.7%
22	Germany	68.9%	56.2%	-12.7%	56	Bahrain	67.5%	44.7%	-22.8%
23	Sweden	60.0%	46.9%	-13.1%	57	Chile	55.2%	32.3%	-22.9%
24	Russian Federation	58.4%	44.9%	-13.5%	58	Poland	61.9%	38.7%	-23.2%
25	Romania	52.6%	38.9%	-13.7%	59	Philippines	47.7%	24.5%	-23.3%
26	Norway	64.5%	50.1%	-14.4%	60	Cyprus	38.7%	13.5%	-25.2%
27	Australia	72.2%	57.5%	-14.7%	61	Botswana	67.6%	41.9%	-25.6%
28	Austria	66.5%	51.7%	-14.8%	62	Canada	66.7%	40.9%	-25.8%
29	Oman	60.7%	45.6%	-15.1%	63	Turkey	48.5%	22.3%	-26.1%
30	Ireland	60.2%	45.1%	-15.1%	64	Greece	36.3%	9.4%	-26.9%
31	Switzerland	71.7%	55.7%	-16.1%	65	Czech Republic	76.1%	48.1%	-28.0%
32	Indonesia	42.5%	26.2%	-16.3%	66	United States	69.3%	39.9%	-29.4%
33	Hungary	61.2%	44.3%	-16.9%	67	Mexico	69.5%	38.4%	-31.1%
34	Denmark	66.7%	49.4%	-17.3%	68	Brazil	52.9%	19.4%	-33.5%

Table 3. The correlations of different countries to Japan on 3/10 and 3/15 using Axioma's global fundamental factor risk model AXWW2 (country-focused).

The changes in country volatility are, of course, largest for Japan. While most of the other countries also experienced increases in country volatility, these increases have been modest in comparison.

Almost all countries have shown a substantial de-correlation with Japan over the last few days. The one exception to this is Taiwan, whose correlation to Japan went down on 3/14 (to 51.2%) but then jumped back up on 3/15 (to 55.2%), the day that all the other countries experienced their

largest de-correlation. This suggests that the events in Japan have been largely contained within Japan, with perhaps some spill over to Taiwan.

3. The Perspective from Japan

Table 4 shows the changes in industry volatilities reported by the Japanese fundamental factor risk model (AXJP2-MH) between 3/10 to 3/15. Table 5 shows the change in correlation of each industry to the market sensitivity factor, which we use as a proxy for the Japanese market.

	Industry	Industry Volatility on 3/10 (% Ann)	Industry Volatility on 3/15 (% Ann)	Volatility Change (% Ann)
1	Containers & Packaging	14.8%	35.5%	20.7%
2	Electric Utilities	14.4%	34.9%	20.5%
3	Media	15.2%	35.6%	20.4%
4	Hotels Rest. & Leisure	12.7%	31.3%	18.5%
5	Computers & Peripherals	15.6%	33.5%	17.9%
6	Food & Staples Retailing	13.0%	30.9%	17.8%
7	Distributors	14.2%	31.7%	17.5%
8	Health Care Prov. & Serv.	14.1%	31.4%	17.3%
9	Specialty Retail	13.9%	31.2%	17.2%
10	Multiline Retail	16.1%	33.1%	17.0%
11	Road & Rail	13.2%	30.1%	17.0%
12	Pharmaceuticals	13.6%	30.6%	17.0%
13	Real Estate Mgt. & Dev.	17.5%	34.3%	16.7%
14	Diversified Cons. Serv.	12.3%	28.9%	16.7%
15	Chemicals	16.2%	32.9%	16.6%
16	Leisure Eqt. & Products	14.5%	31.1%	16.6%
17	Beverages & Tobacco	13.7%	30.2%	16.5%
18	Comm. Serv. & Sup.	13.8%	30.2%	16.4%
19	Food Products	12.8%	29.2%	16.4%
20	Metals & Mining	17.6%	34.0%	16.3%
21	Gas Utilities	13.4%	29.6%	16.3%
22	Biotech. & Life Sciences	14.2%	30.4%	16.3%
23	Software	14.8%	30.9%	16.1%
24	Internet & Catalog Retail	13.9%	29.8%	15.9%
25	Electrical Equipment	16.0%	31.9%	15.9%
26	Telecommunication Services	14.4%	30.2%	15.8%
27	Transportation Infrastructure	15.2%	30.9%	15.7%
28	Industrial Conglomerates	13.6%	28.9%	15.3%
29	Elect. Eqpt. Inst. & Comp.	16.1%	31.4%	15.3%
30	Airlines	13.8%	29.0%	15.2%
31	Trading Comp.s & Distr.	16.8%	31.9%	15.2%
32	Household Durables	14.2%	29.2%	15.1%
33	IT Services	16.5%	31.4%	14.9%
34	Professional Services	15.2%	29.9%	14.7%
35	Text. Appar. & Lux. Goods	14.6%	28.8%	14.2%
36	House. & Pers. Products	13.1%	27.2%	14.1%
37	Internet Software & Services	17.9%	31.9%	14.1%
38	Auto Components	17.9%	31.6%	13.7%
39	Machinery	16.4%	29.8%	13.3%
40	Banks	17.6%	30.9%	13.2%
41	Office Electronics	15.7%	29.0%	13.2%
42	Diversified Financial Services	20.1%	33.3%	13.1%
43	Air Freight & Logistics	14.8%	27.7%	12.9%
44	Paper & Forest Products	15.5%	28.2%	12.7%
45	Automobiles	17.4%	29.8%	12.4%
46	Energy	16.5%	28.8%	12.2%
47	Health Care Equipment & Tec.	13.6%	25.4%	11.8%
48	Real Est. Invest. Trst. (REITs)	16.8%	28.5%	11.7%
49	Communications Equipment	15.9%	27.2%	11.4%
50	Capital Markets	22.6%	33.5%	10.9%
51	Building Products	15.1%	25.4%	10.2%
52	Marine	20.2%	30.0%	9.8%
53	Semicon. & Semicon. Eqt.	19.4%	29.1%	9.7%
54	Insurance	23.3%	32.4%	9.1%
55	Consumer Finance	26.2%	33.0%	6.8%
56	Construction Materials	19.4%	26.1%	6.7%
57	Construction & Engineering	14.6%	18.2%	3.6%

Table 4. The industry volatilities in the Japanese fundamental factor risk model (AXJP2-MH) on 3/10 and 3/15.

	Industry	Industry Correl. To MktSens on 3/10	Industry Correl. To MktSens on 3/15	Correlation Change
1	Consumer Finance	40.7%	40.5%	-0.2%
2	Insurance	38.2%	37.6%	-0.6%
3	Construction & Engineering	57.0%	55.2%	-1.8%
4	Real Est. Invest. Trst. (REITs)	39.0%	37.1%	-1.9%
5	Construction Materials	51.6%	49.4%	-2.1%
6	Marine	47.1%	44.6%	-2.4%
7	Paper & Forest Products	39.6%	36.8%	-2.8%
8	Capital Markets	49.9%	47.0%	-2.9%
9	Diversified Financial Services	48.1%	44.2%	-4.0%
10	Semicon. & Semicon. Eqt.	56.5%	52.3%	-4.2%
11	Internet Software & Services	42.2%	37.9%	-4.3%
12	Electric Utilities	32.2%	27.3%	-4.9%
13	Building Products	54.0%	49.1%	-5.0%
14	Banks	48.7%	43.6%	-5.1%
15	Energy	51.5%	46.1%	-5.4%
16	Automobiles	55.7%	50.1%	-5.5%
17	Communications Equipment	52.7%	46.9%	-5.7%
18	Software	45.8%	39.8%	-6.0%
19	Auto Components	54.9%	48.6%	-6.4%
20	IT Services	49.7%	43.3%	-6.5%
21	Professional Services	50.0%	43.4%	-6.6%
22	Health Care Equipment & Tec.	53.0%	46.3%	-6.7%
23	Real Estate Mgt. & Dev.	52.1%	45.0%	-7.0%
24	Internet & Catalog Retail	47.6%	40.4%	-7.2%
25	Health Care Prov. & Serv.	45.8%	38.6%	-7.2%
26	Air Freight & Logistics	54.7%	47.4%	-7.3%
27	Office Electronics	55.0%	47.6%	-7.4%
28	Transportation Infrastructure	50.0%	42.5%	-7.5%
29	Machinery	59.8%	52.0%	-7.8%
30	Text. Appar. & Lux. Goods	54.2%	46.2%	-8.0%
31	Beverages & Tobacco	48.7%	40.4%	-8.3%
32	House. & Pers. Products	49.3%	41.0%	-8.3%
33	Household Durables	55.8%	47.5%	-8.3%
34	Gas Utilities	47.7%	39.1%	-8.5%
35	Trading Comp.s & Distr.	58.4%	49.8%	-8.6%
36	Specialty Retail	48.7%	40.0%	-8.7%
37	Computers & Peripherals	51.3%	42.3%	-9.0%
38	Pharmaceuticals	47.4%	38.3%	-9.1%
39	Metals & Mining	57.9%	48.9%	-9.1%
40	Food Products	50.3%	41.0%	-9.3%
41	Chemicals	56.8%	47.5%	-9.3%
42	Electrical Equipment	58.5%	49.0%	-9.5%
43	Telecommunication Services	53.4%	43.9%	-9.6%
44	Leisure Eqt. & Products	54.6%	44.9%	-9.6%
45	Biotech. & Life Sciences	55.1%	45.4%	-9.7%
46	Elect. Eqpt. Inst. & Comp.	59.3%	49.6%	-9.8%
47	Multiline Retail	52.3%	42.5%	-9.8%
48	Airlines	57.2%	47.1%	-10.1%
49	Diversified Cons. Serv.	49.5%	39.3%	-10.2%
50	Media	50.9%	40.6%	-10.3%
51	Distributors	55.5%	45.2%	-10.3%
52	Comm. Serv. & Sup.	55.9%	45.4%	-10.5%
53	Road & Rail	50.9%	40.4%	-10.5%
54	Industrial Conglomerates	58.0%	47.2%	-10.8%
55	Food & Staples Retailing	52.9%	42.0%	-10.9%
56	Containers & Packaging	53.4%	41.3%	-12.1%
57	Hotels Rest. & Leisure	55.5%	43.4%	-12.1%

Table 5. The correlations of different industries to the market sensitivity factor in the Japanese fundamental factor risk model (AXJP2-MH) on 3/10 and 3/15. The market sensitivity factor is used as a proxy for the Japanese market.

Virtually all of Japan's industries have been hit hard by the effects of the earthquake, as evidenced by sharply higher industry volatility and sharply reduced correlation to the Japanese market. Only two industries appear to have weathered the storm: Construction Materials and Construction & Engineering.

It makes intuitive sense that Japanese service industries heavily dependent on tourism, such Hotels, Restaurants & Leisure, would suffer. One would also expect supply-chain dependent industries, such as Containers & Packaging and Distributors, to be disrupted. And, of course, Food & Staples Retailing and Electric Utilities would be directly affected by events.

Perhaps the most interesting industry to ponder is Insurance. The volatility of Insurance increased a not-inconsiderable 9.1%, but this was only the 54th largest increase out of 57 industries[5]. The correlation on Insurance to Market Sensitivity was essentially unchanged. On the one hand, the impact of the quake on the Insurance industry is direct: insurance losses will be substantial. On the other hand, a large fraction of those loses may be paid by the Japanese government and non-Japanese insurers.

4. Concluding Comments

These are challenging times for portfolio managers in general and for those with exposure to Japan in particular. The immediate post-crisis market decline has partially rebounded, so the initial "panic" sell-off appears to be behind us. However, Axioma's risk models indicate that virtually all of Japan's industries have been substantially affected, and it is unclear how long it will take for business in Japan to return to normal.

From a global perspective, the damage so far seems to have been largely contained within the Japanese economy, despite the market gyrations of earlier this week. And the rapid de-correlation of most country returns from those of Japan suggests that this containment will persist.

[5] As of market close 3/17, Insurance volatility had fallen to 30.6%, the 50th largest change since 3/10.