Stock Volatility during the Recent Financial Crisis

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http://schwert.ssb.rochester.edu/efma_2010.htm

What is market volatility?

- Standard deviation of rates of return to broad market indexes
 - Following plots show:
 - Changes in FTSE All Shares from 1968-2010
 - Affected by growth in the level of the index
 - Percent changes in FTSE (rates of return, ignoring dividends) from 1968-2010
 - Rolling annualized standard deviations of rates of return to FTSE from 1968-2010

Looking at the absolute scale of stock indexes is very misleading . . .

- The sixty largest changes in the FTSE have been within the last 11 years
 - The only exceptions among these sixty days are Oct 19-20, 1987, and 10/12/1998

Ret FTSE Chg Ret Std **FTSE** Chg Std 10/6/2008 2329.30 -192.82 -7.6% 53.4% 9/19/2008 2708.98 212.45 8.5% 43.2% 1 2 -8.3% 58.8% 10/10/2008 2012.97 -183.19 58.8% 11/24/2008 2064.68 174.13 9.2% 3 1/21/2008 2845.11 -158.41 -5.3% 23.8% 10/13/2008 2164.63 151.66 7.5% 65.7% 4 10/15/2008 2075.41 -152.95 -6.9% 2113.04 149.08 74.7% 69.1% 10/29/2008 7.6% 5 2444.58 -137.39 46.4% 5/10/2010 2776.32 136.09 27.3% 9/29/2008 -5.3% 5.2% 6 8/16/2007 3031.91 -127.33 -4.0% 30.0% 1/24/2008 2997.75 130.74 4.6% 31.5% 7 9/11/2001 2311.48 -127.11 -5.2% 23.3% 12/8/2008 2133.24 119.50 53.1% 5.9% 50.5% 8 10/20/1987 951.95 -122.63 -11.4% 2782.38 101.47 25.3% 9/8/2008 3.8% 37.5% 9 11/6/2008 2147.84 -122.20 -5.4% 73.1% 2/12/2008 3020.79 100.34 3.4% 10 8/10/2007 3129.62 24.3% 2150.06 99.22 68.2% -115.00 -3.5% 10/20/2008 4.8% 11 2219.84 -113.44 -4.9% 53.0% 2318.16 98.58 72.2% 10/8/2008 11/4/2008 4.4% 12 10/16/2008 1964.71 -110.70 -5.3% 70.7% 3/25/2008 2911.86 97.85 3.5% 24.1% 13 10/19/1987 1074.58 -107.77 -9.1% 33.4% 2/27/2008 3110.28 97.37 27.8% 3.2% 3128.97 14 97.06 32.2% 12/1/2008 2027.19 -106.80 -5.0% 54.8% 8/17/2007 3.2% 15 7/26/2007 3228.93 -104.08 -3.1% 17.0% 3053.21 90.97 3.1% 37.8% 2/19/2008 16 10/24/2008 1950.15 -103.58 -5.0% 69.9% 9/19/2007 3319.35 90.58 2.8% 22.2% 17 2653.58 -103.45 -3.8% 3219.05 89.43 26.7% 9/15/2008 28.6% 8/13/2007 2.9% 18 7/15/2002 1955.80 -103.31 -5.0% 34.7% 10/15/2002 1969.00 89.28 4.7% 38.8% 19 3/22/2001 2573.07 -103.24 -3.9% 21.9% 12/5/2007 3296.03 86.89 2.7% 25.0% 20 -4.7% 73.2% 1/14/2009 2098.99 -102.87 27.3% 10/17/2008 2050.84 86.13 4.4% 21 1/4/2000 3141.25 -100.81 -3.1% 15.2% 4/2/2009 2088.69 85.43 4.3% 33.8% 22 3/2/2009 1832.45 -97.30 -5.0% 28.7% 10/12/1998 2311.66 85.21 3.8% 33.5% 23 12/13/2007 3231.66 -97.29 -2.9% 3219.53 83.82 23.1% 26.3% 11/28/2007 2.7% 24 11/19/2008 1998.02 -97.21 -4.6% 52.6% 1/22/2008 2928.60 83.49 2.9% 26.6% 25 4/17/2000 2852.60 -94.74 -3.2% 21.4% 3/13/2003 1676.62 83.28 5.2% 30.7% 26 1/15/2008 3060.86 -93.00 -2.9% 19.6% 3/10/2009 1874.62 82.95 4.6% 36.1% 27 5/20/2008 3151.36 -92.12 -2.8% 15.1% 7/29/2002 2030.48 82.85 4.3% 47.1% 28 2038.43 2210.25 82.10 35.2% 10/22/2008 -91.03 -4.3% 69.1% 9/24/2001 3.9% 29 9/16/2008 2562.89 -90.69 -3.4% 30.6% 7/25/2002 1928.28 81.90 4.4% 44.9% 30 11/19/2007 3135.95 -89.76 -2.8% 18.1% 5/23/2006 2893.41 81.72 2.9% 20.2%

The Thirty Largest Daily Increases and Decreases in the FTSE All Shares Index, 1968-2010 (T=10,469)

Daily Changes in the FTSE All Shares Index, 1968-2010



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Looking at the percent change of stock indexes is relevant . . .

- This measures the rate of return on the investment
 - i.e., how many more dollars you would have at the end of the day if you invested \$100 at the beginning of the day
- The twenty-two of the sixty largest percent changes in the FTSE (or the DJIA or S&P 500) have occurred between 2008-2010 – nine were positive

	• 0	<u>FTSE</u>	<u>Chg</u>	<u>Ret</u>	<u>Std</u>		FTSE	Chg	Ret	Std
1	10/20/1987	951.95	-122.63	-11.4%	50.5%	1/24/1975	91.29	7.81	9.4%	51.8%
2	10/19/1987	1074.58	-107.77	-9.1%	33.4%	11/24/2008	2064.68	174.13	9.2%	<mark>58.8%</mark>
3	10/10/2008	2012.97	-183.19	-8.3%	<mark>58.8%</mark>	2/10/1975	117.53	9.31	8.6%	62.4%
4	10/6/2008	2329.30	-192.82	-7.6%	53.4%	9/19/2008	2708.98	212.45	8.5%	43.2%
5	3/1/1974	138.40	-10.87	-7.3%	31.0%	10/29/2008	2113.04	149.08	7.6%	74.7%
6	10/26/1987	863.73	-66.60	-7.2%	60.9%	10/13/2008	2164.63	151.66	7.5%	65.7%
7	10/15/2008	2075.41	-152.95	-6.9%	69.1%	1/30/1975	106.22	7.13	7.2%	59.7%
8	1/2/1975	62.60	-4.29	-6.4%	31.2%	2/7/1975	108.22	6.36	6.2%	58.8%
9	3/11/1975	126.55	-8.18	-6.1%	46.9%	1/27/1975	96.88	5.59	6.1%	53.4%
10	12/6/1973	142.86	-8.30	-5.5%	28.0%	12/8/2008	2133.24	119.50	5.9%	53.1%
11	12/14/1973	134.36	-7.66	-5.4%	36.8%	4/10/1992	1232.15	68.24	5.9%	23.7%
12	11/6/2008	2147.84	-122.20	-5.4%	73.1%	4/17/1975	137.81	7.60	5.8%	40.0%
13	10/22/1987	953.46	-53.94	-5.4%	57.7%	10/21/1987	1007.40	55.45	5.8%	55.7%
14	10/16/2008	1964.71	-110.70	-5.3%	70.7%	1/29/1975	99.09	5.19	5.5%	57.2%
15	9/29/2008	2444.58	-137.39	-5.3%	46.4%	4/22/1975	146.94	7.63	5.5%	40.9%
16	1/21/2008	2845.11	-158.41	-5.3%	23.8%	4/16/1975	130.21	6.65	5.4%	36.0%
17	9/11/2001	2311.48	-127.11	-5.2%	23.3%	6/19/1970	127.10	6.47	5.4%	34.1%
18	10/24/2008	1950.15	-103.58	-5.0%	<mark>69.9%</mark>	1/13/1975	69.44	3.48	5.3%	39.6%
19	3/2/2009	1832.45	-97.30	-5.0%	28.7%	3/13/2003	1676.62	83.28	5.2%	30.7%
20	2/17/1975	111.88	-5.93	-5.0%	71.9%	5/10/2010	2776.32	136.09	5.2%	27.3%
21	7/15/2002	1955.80	-103.31	-5.0%	34.7%	1/23/1975	83.48	4.03	5.1%	44.7%
22	12/1/2008	2027.19	-106.80	-5.0%	<mark>54.8%</mark>	12/7/1973	150.03	7.17	5.0%	34.5%
23	10/8/2008	2219.84	-113.44	-4.9%	<mark>53.0%</mark>	2/26/1975	118.60	5.66	5.0%	62.4%
24	1/14/2009	2098.99	-102.87	-4.7%	27.3%	7/1/1975	134.60	6.39	5.0%	30.8%
25	9/28/1981	265.85	-13.02	-4.7%	23.0%	10/20/2008	2150.06	99.22	4.8%	68.2%
26	11/19/2008	1998.02	-97.21	-4.6%	52.6%	9/29/1981	278.69	12.84	4.8%	29.8%
27	8/14/1974	90.41	-4.23	-4.5%	25.3%	10/15/2002	1969.00	89.28	4.7%	38.8%
28	7/22/2002	1906.67	-88.80	-4.5%	41.9%	3/10/2009	1874.62	82.95	4.6%	36.1%
29	9/30/2002	1801.48	-83.52	-4.4%	34.1%	1/24/2008	2997.75	130.74	4.6%	31.5%
30	6/2/1969	143.36	-6.55	-4.4%	21.4%	1/22/1975	79.45	3.43	4.5%	42.3%

The Thirty Largest Daily Percent Increases and Decreases in the FTSE All Shares Index, 1968-2010 (T=10,469)

Daily Returns to the FTSE All Shares Index, 1968-2010



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How to lie with statistics . . . - focus on very recent history

- Newspapers often focus on the last few years in discussing current conditions
 - On this basis, people would think stock volatility is unbelievably high in the past year or so . . .
 - This is misleading when viewed from the perspective on the longer history we have available to us
 - Compare the plots of rolling standard deviations from 2004-2010 versus the plot from 1968-2010 . . .
 - Good news is that things seem to have settled down a bit now (compared to 12 months ago)
 - Although the recent events in Greece and in the Gulf of Mexico have created some renewed volatility

Volatility of FTSE All Shares Index, 2004-2010



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Volatility of FTSE All Shares Index, 1968-2010



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Stylized Facts/Questions: A very long-term view!

- Market-level volatility has been remarkably stable over time
 - Data back to 1802, covers many wars, financial crises, depressions/recessions
 - Also, major changes in the composition of the US and UK economies
 - Mainly banks, insurance companies, canals in early 1800s
 - Railroads started being important after 1834
 - Great Depression is the most notable period of prolonged high volatility
 - OPEC I, 1973-75 was worse in UK than US

Volatility of FTSE All Shares Index and US Stock Index, 1802-2010



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Forecasting volatility: Important because of recent high volatility

Derivatives give us tools

 CBOE reports implied volatility for S&P 500 options (VIX) for several maturities

 They have also started trading futures contracts on implied volatility

Term structure of implied volatility: Things will settle down . . .

- Looking at the term structures from 2000-2010, they were pretty flat (i.e., similar forecasts for all horizons) until October 2008
- The big spikes in volatility in Fall 2008 led to a sharply declining forecast of future volatility
- Things are now back to more normal patterns

70 -- 15-Jul-08 Implied Annual Standard Deviation of the S&P 500 Index -15-Jul-09 -+ -15-Oct-09 60 → 15-Jan-10 -15-Apr-10 -0-50 40 30 20 10 0 365 730 0 1095

Forward Structure of Implied S&P Volatility, 2008-2010

Calendar Days into the Future

The CBOE now trades a futures contract on VIX

- Looking at the longest future maturity (typically about 9-10 months)
 - Futures value of VIX peaks at 43% in mid-December 2008, and now has returned to around 30%
 - Even at the worst of the liquidity crisis, traders were not expecting the spike in volatility to last long or be as bad as it was briefly in the Fall of 2008



Sometimes Sectors Drive Market Volatility: Technology in 2000-2002

 Next figure shows the implied volatility series published by CBOE with ticker symbols VIX (S&P) and VXN (Nasdaq)

 VXN is much higher, especially in 1998-2002; similar since mid-2007

Implied Volatility for S&P 500 (VIX) and Nasdaq 100 Portfolio (VXN), Annualized Standard Deviation of Returns, 1986-2010



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Implied Volatility for Nasdaq 100 Portfolio (VXN) Relative to S&P 500 (VIX), Annualized Standard Deviation of Returns, 1995-2010



Was the 2008 Credit Crisis a Finance "Bubble"?

- Next figure shows historical volatility for:
 - Nasdaq Financial portfolio, the S&P 1200 Financial portfolio, and the Datastream US Financial portfolio, since 1973
 - They all move together, increasing modestly during the Technology "bubble" from 1998-2002
 - Increased substantially in 2008-2009 during the liquidity crisis

Volatility for Several Indexes of Financial Stocks, Annualized Standard Deviation of Returns, 1973-2010



Summary

- Market-level volatility often rises after prices fall
 - Recent poor performance of the market is consistent with the higher levels of volatility [counter-cyclical]
 - Inflation of index levels exaggerate perceptions of increased volatility

Should Someone Try to Lower Volatility? If So, How?

Margin requirements?

Regulation of trading?

Taxes on Trading?