Stock Volatility: Past, Present & Future

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http://schwert.ssb.rochester.edu/volatility2008.htm

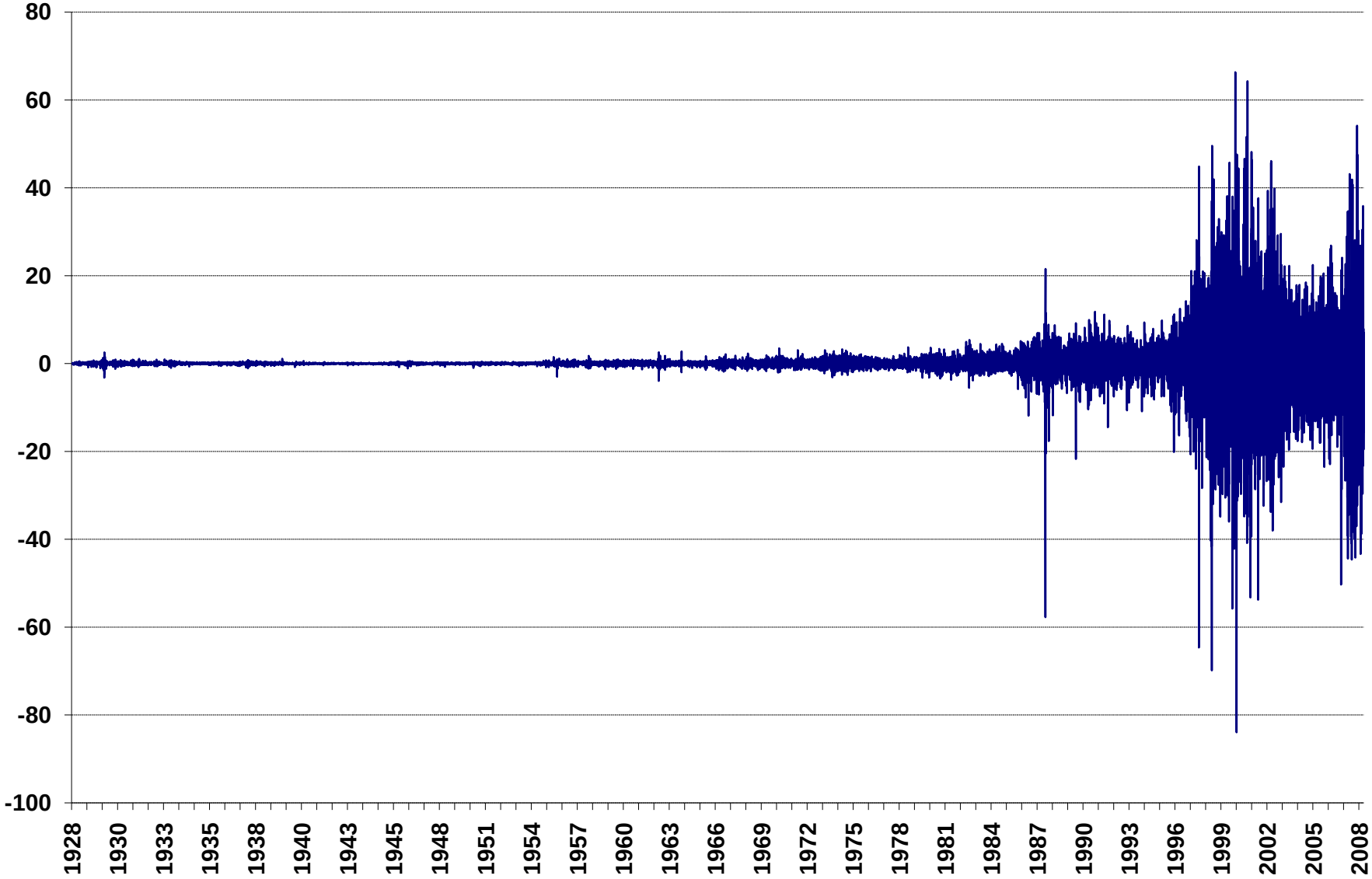
What is market volatility?

- Standard deviation of rates of return to broad market indexes
  - Following plots show:
    - Changes in S&P Composite from 1928-2008
      - Affected by growth in the level of the index
    - Percent changes in S&P Composite (rates of return, ignoring dividends) from 1928-2008
    - Rolling annualized standard deviations of rates of return to S&P Composite from 1928-2008

Looking at the Absolute Scale of Stock Indexes is Very Misleading . . .

- The sixty largest changes in the S&P 500 (or in the DJIA) have been within the last 10 years
  - The only exception among these sixty days is Oct 19, 1987

Daily Changes in the Standard & Poor's Composite Index, 1928-2008



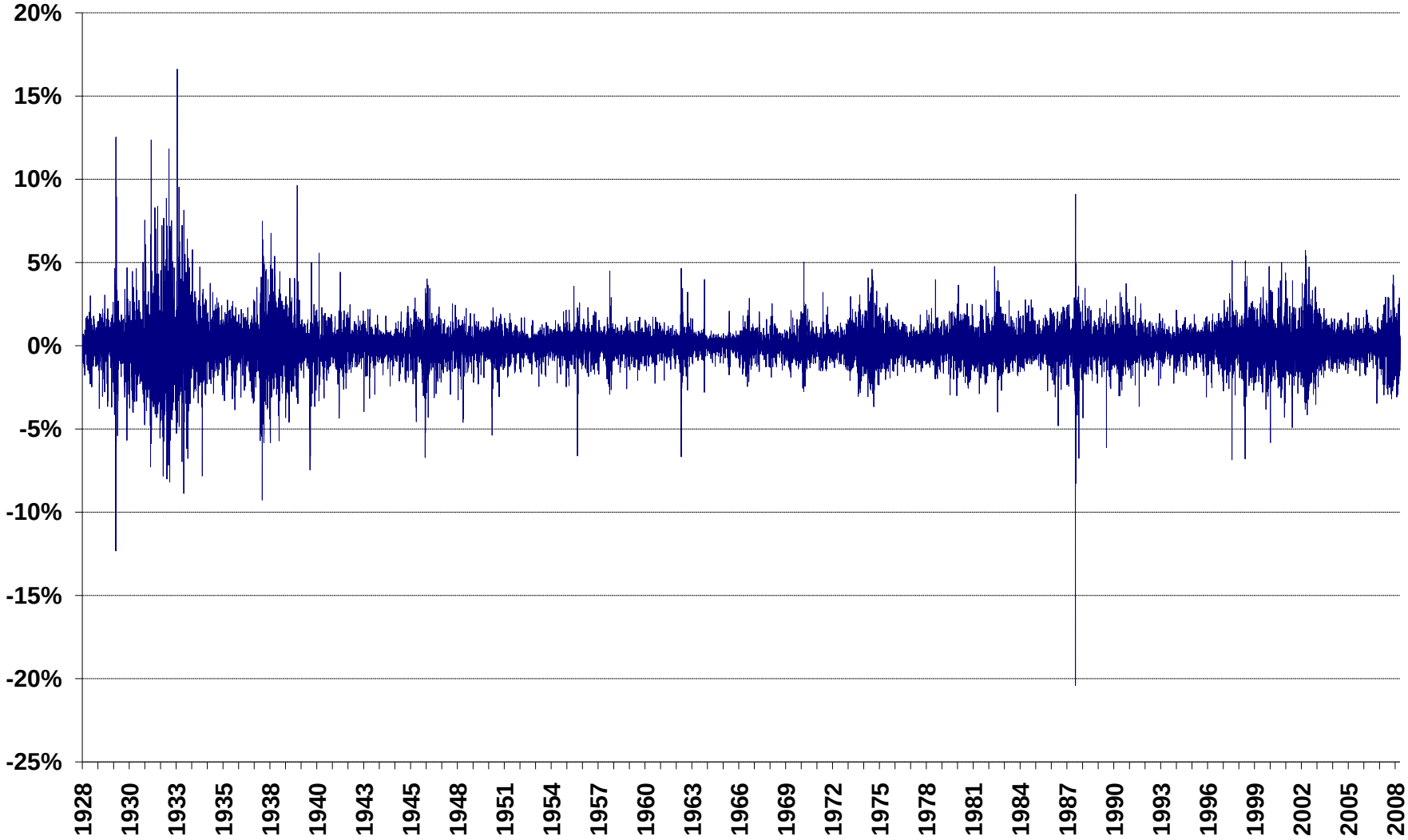
The Thirty Largest Daily Increases and Decreases in the S&P Composite Index, 1928-2008 (T=21,331)

	Date	SP	Chg	Ret	Std	Date	SP	Chg	Ret	Std
1	4/14/2000	1356.56	-83.95	-5.8%	31.5%	3/16/2000	1458.47	66.32	4.8%	28.8%
2	8/31/1998	957.28	-69.86	-6.8%	31.7%	1/3/2001	1347.56	64.29	5.0%	32.1%
3	10/27/1997	876.99	-64.65	-6.9%	27.5%	3/18/2008	1330.74	54.14	4.2%	26.8%
4	**10/19/1987**	**224.97**	**-57.73**	**-20.4%**	**73.0%**	12/5/2000	1376.54	51.57	3.9%	23.9%
5	1/4/2000	1399.42	-55.80	-3.8%	17.7%	9/8/1998	1023.46	49.57	5.1%	37.9%
6	9/17/2001	1038.77	-53.77	-4.9%	22.7%	4/5/2001	1151.44	48.19	4.4%	34.6%
7	3/12/2001	1180.16	-53.26	-4.3%	22.2%	4/25/2000	1477.44	47.58	3.3%	31.2%
8	2/27/2007	1399.04	-50.33	-3.5%	13.5%	4/1/2008	1370.18	47.48	3.6%	31.7%
9	11/7/2007	1475.62	-44.65	-2.9%	19.0%	3/11/2008	1320.65	47.28	3.7%	22.0%
10	8/9/2007	1453.09	-44.40	-3.0%	23.3%	10/19/2000	1388.76	46.63	3.5%	24.4%
11	2/5/2008	1336.64	-44.18	-3.2%	26.1%	4/18/2001	1238.16	46.35	3.9%	33.2%
12	6/6/2008	1360.68	-43.37	-3.1%	20.2%	7/29/2002	898.96	46.12	5.4%	42.9%
13	2/18/2000	1346.09	-42.18	-3.0%	23.0%	10/28/1999	1342.44	45.74	3.5%	24.0%
14	8/27/1998	1042.59	-41.60	-3.8%	24.2%	7/24/2002	843.42	45.72	5.7%	37.3%
15	11/1/2007	1508.44	-40.94	-2.6%	16.2%	4/17/2000	1401.44	44.88	3.3%	29.1%
16	12/20/2000	1264.74	-40.86	-3.1%	25.9%	10/28/1997	921.85	44.86	5.1%	33.0%
17	8/4/1998	1072.12	-40.32	-3.6%	19.7%	5/30/2000	1422.45	44.44	3.2%	25.1%
18	1/17/2008	1333.25	-39.95	-2.9%	21.1%	10/13/2000	1374.17	44.39	3.3%	21.0%
19	1/24/2000	1401.53	-39.83	-2.8%	21.9%	9/18/2007	1519.78	43.13	2.9%	20.7%
20	10/19/2007	1500.63	-39.45	-2.6%	12.6%	10/15/1998	1047.49	41.96	4.2%	30.8%
21	4/3/2001	1106.47	-39.40	-3.4%	30.9%	11/13/2007	1481.05	41.87	2.9%	22.0%
22	8/3/2007	1433.06	-39.14	-2.7%	18.7%	11/28/2007	1469.02	40.79	2.9%	26.2%
23	6/26/2008	1283.15	-38.82	-2.9%	19.6%	4/18/2000	1441.61	40.17	2.9%	30.8%
24	1/28/2000	1360.16	-38.41	-2.7%	23.0%	10/15/2002	881.27	39.83	4.7%	39.9%
25	12/11/2007	1477.65	-38.31	-2.5%	24.9%	5/8/2002	1088.84	39.35	3.7%	22.1%
26	9/3/2002	878.02	-38.05	-4.2%	35.2%	9/3/1999	1357.24	38.13	2.9%	20.7%
27	2/29/2008	1330.63	-37.05	-2.7%	20.6%	1/7/2000	1441.47	38.02	2.7%	18.6%
28	1/2/2001	1283.27	-37.01	-2.8%	27.8%	9/24/2001	1003.45	37.65	3.9%	28.8%
29	10/15/1999	1247.41	-36.02	-2.8%	21.0%	3/21/2000	1493.88	37.25	2.6%	29.6%
30	3/7/2000	1355.63	-35.66	-2.6%	21.8%	9/1/1998	994.26	36.98	3.9%	35.1%

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 sixty largest percent changes in the S&P 500 (or in the DJIA) have been before the last 10 years
  - The only exceptions among these sixty days are in 1997 and 1998

Daily Percent Changes in the Standard & Poor's Index, 1928-2008



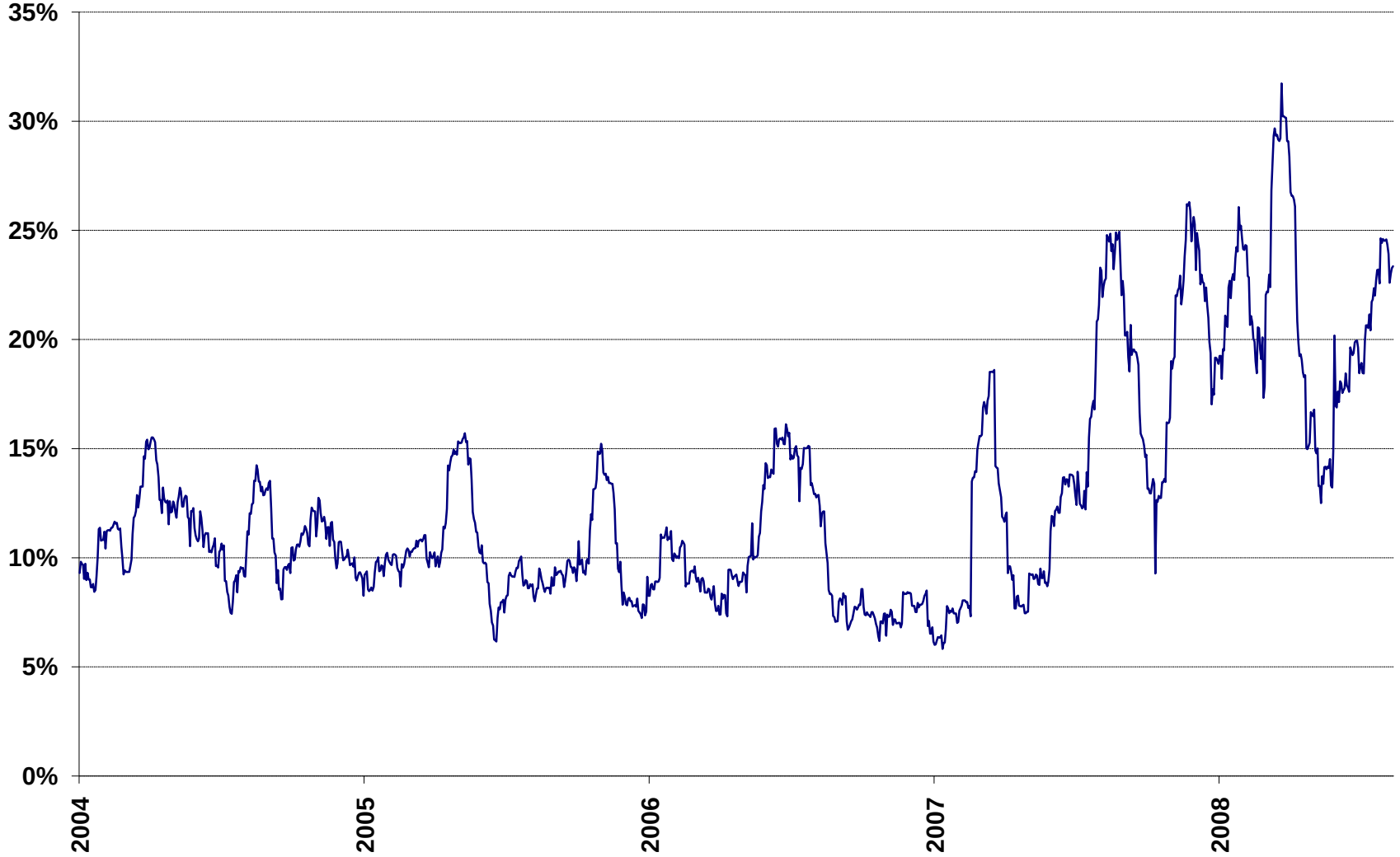
The Thirty Largest Daily Percent Increases and Decreases in the S&P Composite Index, 1928-2008 (T=21,331)

		SP	Chg	Ret	Std		SP	Chg	Ret	Std
1	10/19/1987	224.97	-57.73	-20.4%	73.0%	3/15/1933	6.81	0.97	16.6%	71.1%
2	10/28/1929	22.74	-3.20	-12.3%	55.1%	10/30/1929	22.99	2.56	12.5%	78.1%
3	10/29/1929	20.43	-2.31	-10.2%	62.4%	10/6/1931	9.91	1.09	12.4%	67.5%
4	11/6/1929	20.61	-2.27	-9.9%	84.6%	9/21/1932	8.52	0.90	11.8%	65.8%
5	10/18/1937	10.76	-1.10	-9.3%	44.8%	9/5/1939	12.64	1.11	9.6%	43.6%
6	7/20/1933	10.57	-1.03	-8.9%	43.3%	4/20/1933	7.82	0.68	9.5%	49.7%
7	7/21/1933	9.65	-0.92	-8.7%	52.5%	10/21/1987	258.38	21.55	9.1%	83.9%
8	10/26/1987	227.67	-20.55	-8.3%	87.0%	11/14/1929	19.24	1.58	8.9%	96.3%
9	10/5/1932	7.39	-0.66	-8.2%	70.0%	8/3/1932	6.39	0.52	8.9%	46.3%
10	8/12/1932	7.00	-0.61	-8.0%	57.0%	10/8/1931	10.62	0.84	8.6%	74.6%
11	5/31/1932	4.47	-0.38	-7.8%	47.9%	2/13/1932	8.80	0.68	8.4%	50.1%
12	7/26/1934	8.36	-0.71	-7.8%	32.8%	12/18/1931	8.36	0.64	8.3%	46.7%
13	5/14/1940	10.28	-0.83	-7.5%	33.5%	2/11/1932	8.12	0.62	8.3%	41.5%
14	9/24/1931	10.68	-0.84	-7.3%	42.5%	7/24/1933	10.50	0.79	8.1%	59.1%
15	9/12/1932	8.15	-0.63	-7.2%	46.3%	6/10/1932	4.92	0.35	7.7%	65.5%
16	6/15/1933	9.74	-0.73	-7.0%	42.2%	6/3/1931	13.12	0.92	7.5%	39.1%
17	**10/27/1997**	**876.99**	**-64.65**	**-6.9%**	**27.5%**	11/10/1932	7.44	0.52	7.5%	52.2%
18	**8/31/1998**	**957.28**	**-69.86**	**-6.8%**	**31.7%**	10/20/1937	11.93	0.83	7.5%	54.7%
19	10/16/1933	9.21	-0.67	-6.8%	47.1%	6/19/1933	10.68	0.72	7.2%	46.0%
20	1/8/1988	243.40	-17.67	-6.8%	36.2%	5/6/1932	6.09	0.41	7.2%	45.4%
21	9/3/1946	15.53	-1.12	-6.7%	25.6%	4/19/1933	7.14	0.48	7.2%	39.6%
22	5/28/1962	55.50	-3.97	-6.7%	26.4%	8/15/1932	7.44	0.50	7.2%	60.0%
23	5/21/1940	9.14	-0.65	-6.6%	41.5%	10/11/1932	6.88	0.46	7.2%	70.5%
24	9/26/1955	42.61	-3.02	-6.6%	24.4%	1/6/1932	8.08	0.53	7.0%	52.3%
25	11/11/1929	19.86	-1.32	-6.2%	87.0%	10/14/1932	7.13	0.46	6.9%	75.3%
26	9/21/1933	10.03	-0.66	-6.2%	36.9%	4/9/1938	10.27	0.65	6.8%	53.2%
27	10/13/1989	333.65	-21.74	-6.1%	22.7%	6/4/1932	5.22	0.33	6.7%	56.1%
28	10/23/1929	26.60	-1.67	-5.9%	37.5%	9/23/1931	11.52	0.72	6.7%	36.5%
29	10/5/1931	8.82	-0.55	-5.9%	48.0%	10/4/1933	10.29	0.62	6.4%	44.5%
30	5/13/1940	11.11	-0.69	-5.8%	23.3%	10/25/1937	12.00	0.72	6.4%	58.9%

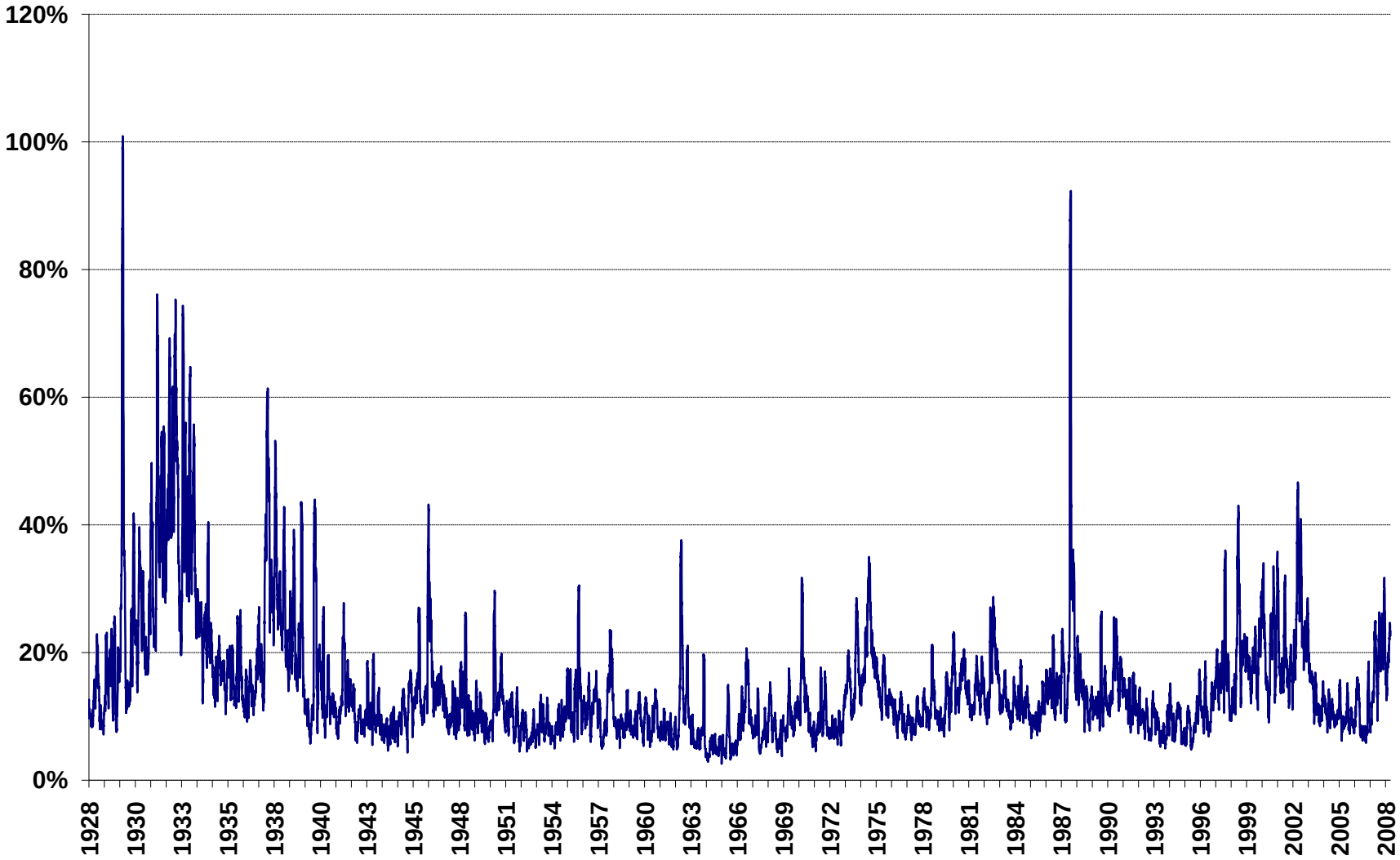
How to Lie with Statistics . . . - Focus on very recent history

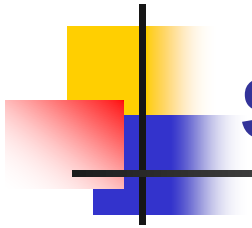
- Newspapers often focus on the last few years in discussing current conditions
  - On this basis, people would think stock volatility is very high in recent months . . .
  - This is incredibly misleading when viewed from the perspective on the longer history we have available to us
  - Compare the plots of rolling standard deviations from 2004-2008 versus the plot from 1928-2008 . . .

Rolling Annualized Standard Deviation of S&P Daily Returns, 2004-2008



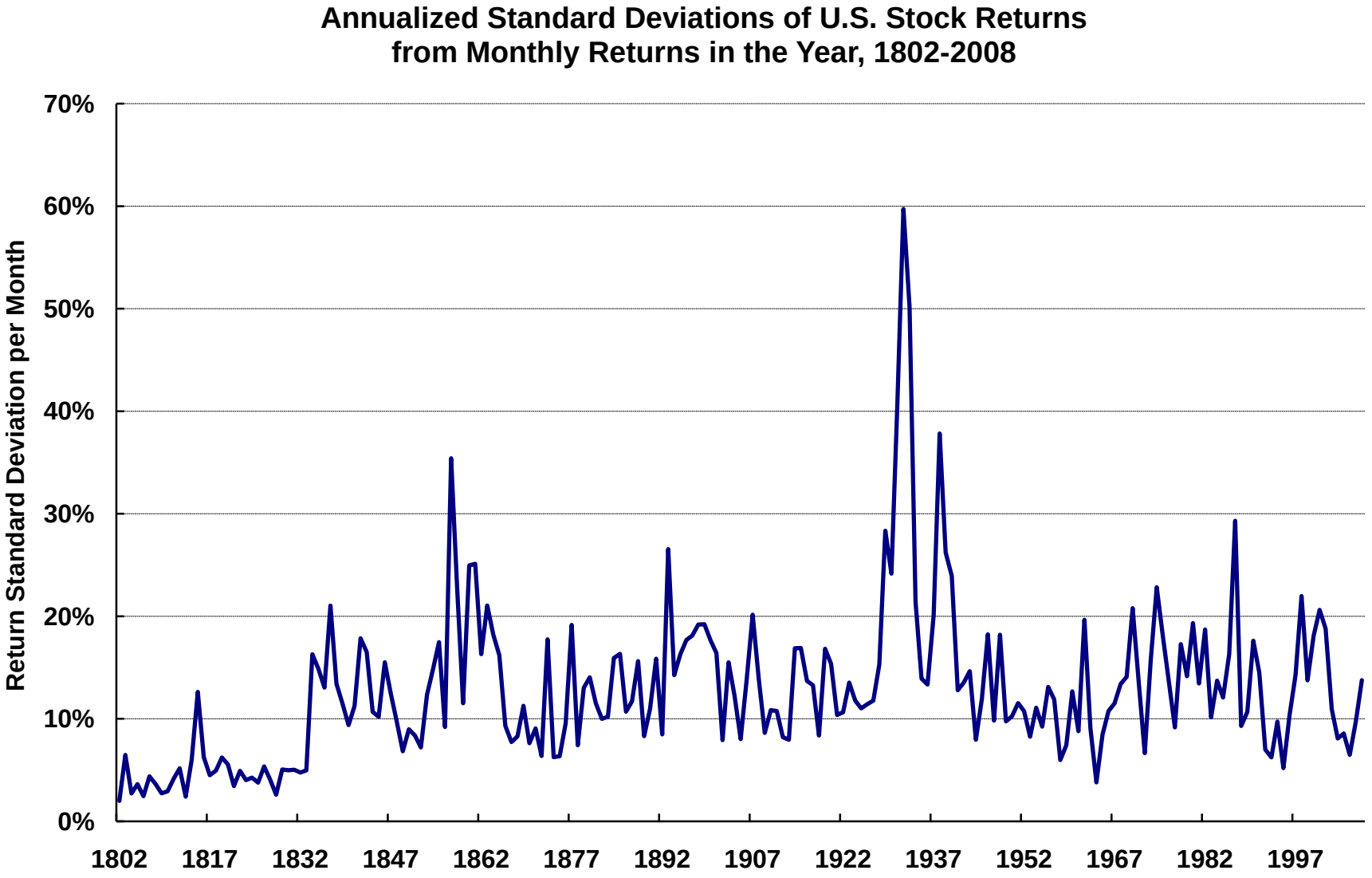
Rolling Annualized Standard Deviation of S&P Daily Returns, 1928-2008

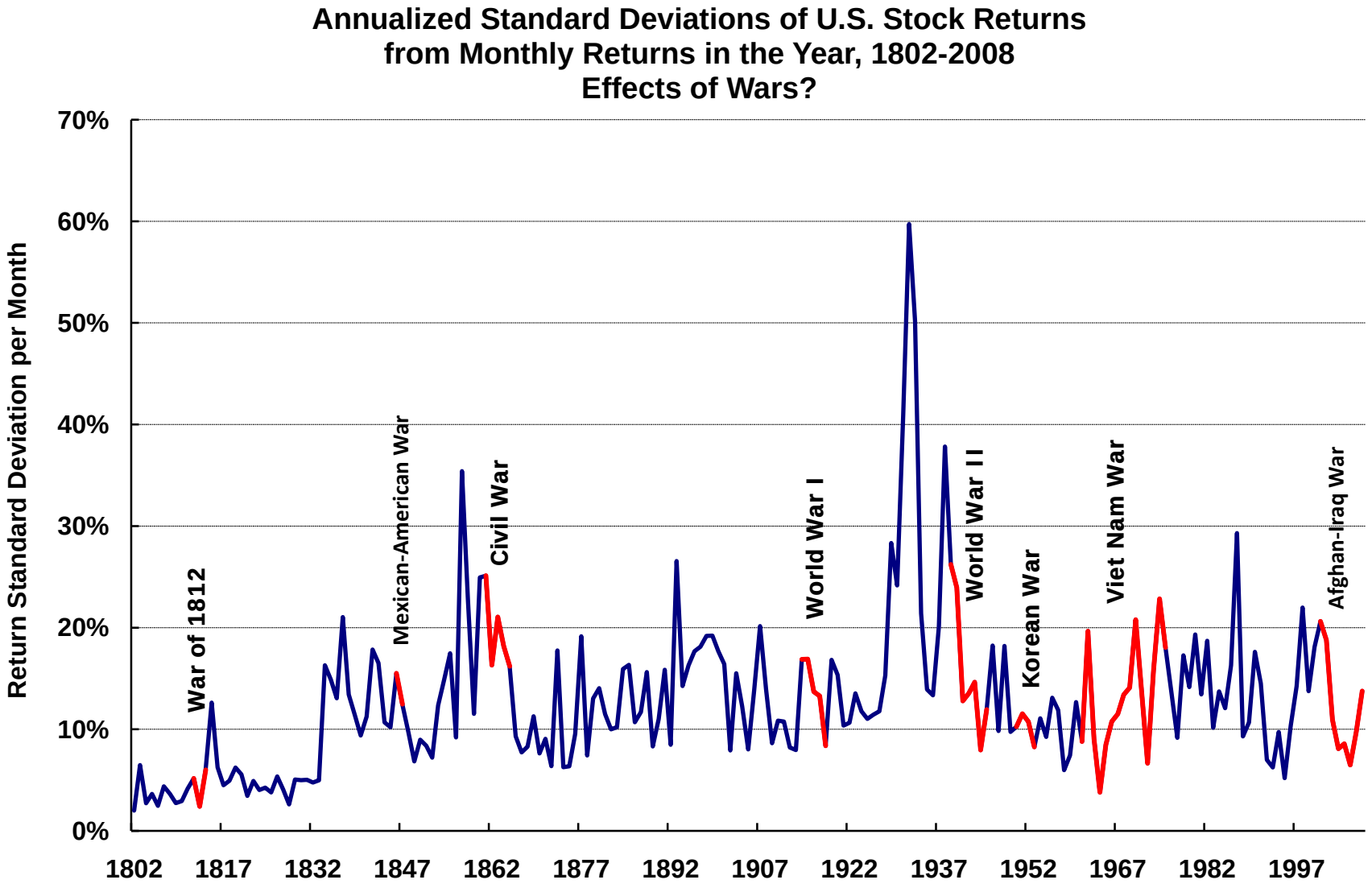


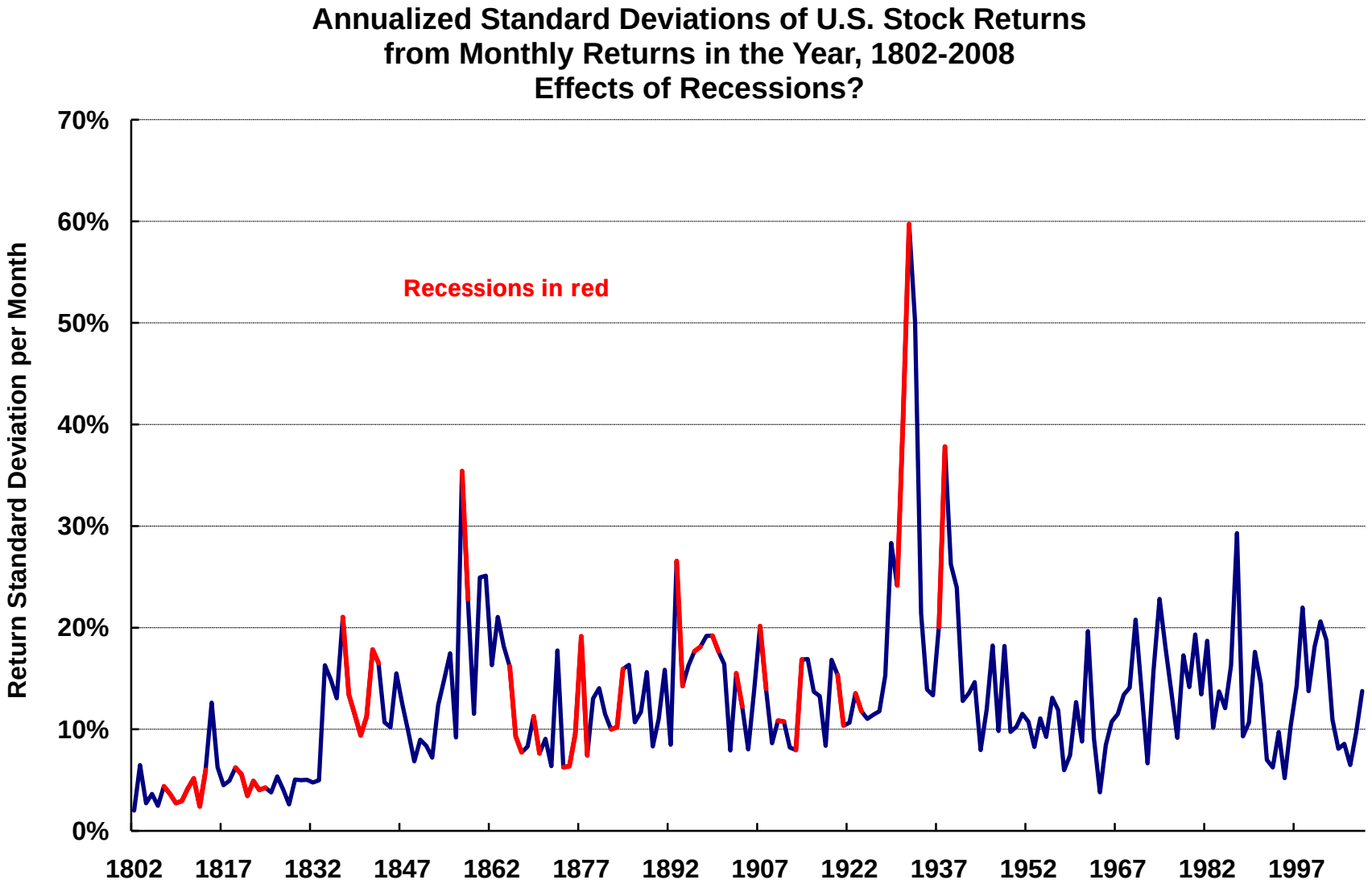


Stylized Facts/Questions

- 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 economy
    - 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


Annualized Standard Deviations of U.S. Stock Returns
from Monthly Returns in the Year, 1802-2008
Return Standard Deviation per Month
70%
60%
50%
40%
30%
20%
10%
0%
1802
1817
1832
1847
1862
1877
1892
1907
1922
1937
1952
1967
1982
1997

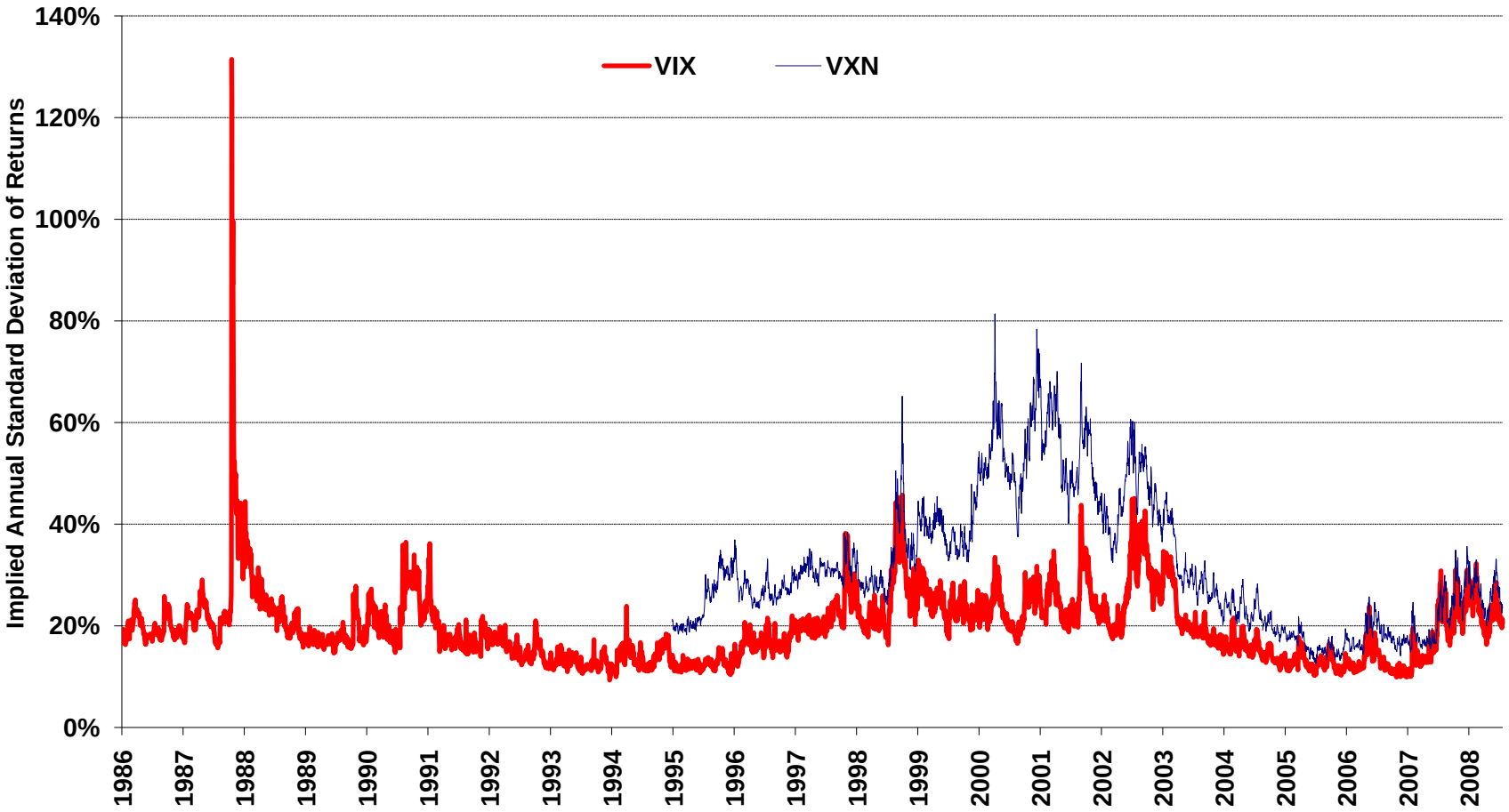

Annualized Standard Deviations of U.S. Stock Returns
from Monthly Returns in the Year, 1802-2008
Effects of Wars?
Return Standard Deviation per Month
70%
60%
50%
40%
30%
20%
10%
0%
1802
1817
1832
1847
1862
1877
1892
1907
1922
1937
1952
1967
1982
1997
War of 1812
Mexican-American War
Civil War
World War I
World War II
Korean War
Viet Nam War
Afghan-Iraq War


Annualized Standard Deviations of U.S. Stock Returns
from Monthly Returns in the Year, 1802-2008
Effects of Recessions?
Return Standard Deviation per Month
70%
60%
50%
40%
30%
20%
10%
0%
Recessions in red
1802
1817
1832
1847
1862
1877
1892
1907
1922
1937
1952
1967
1982
1997

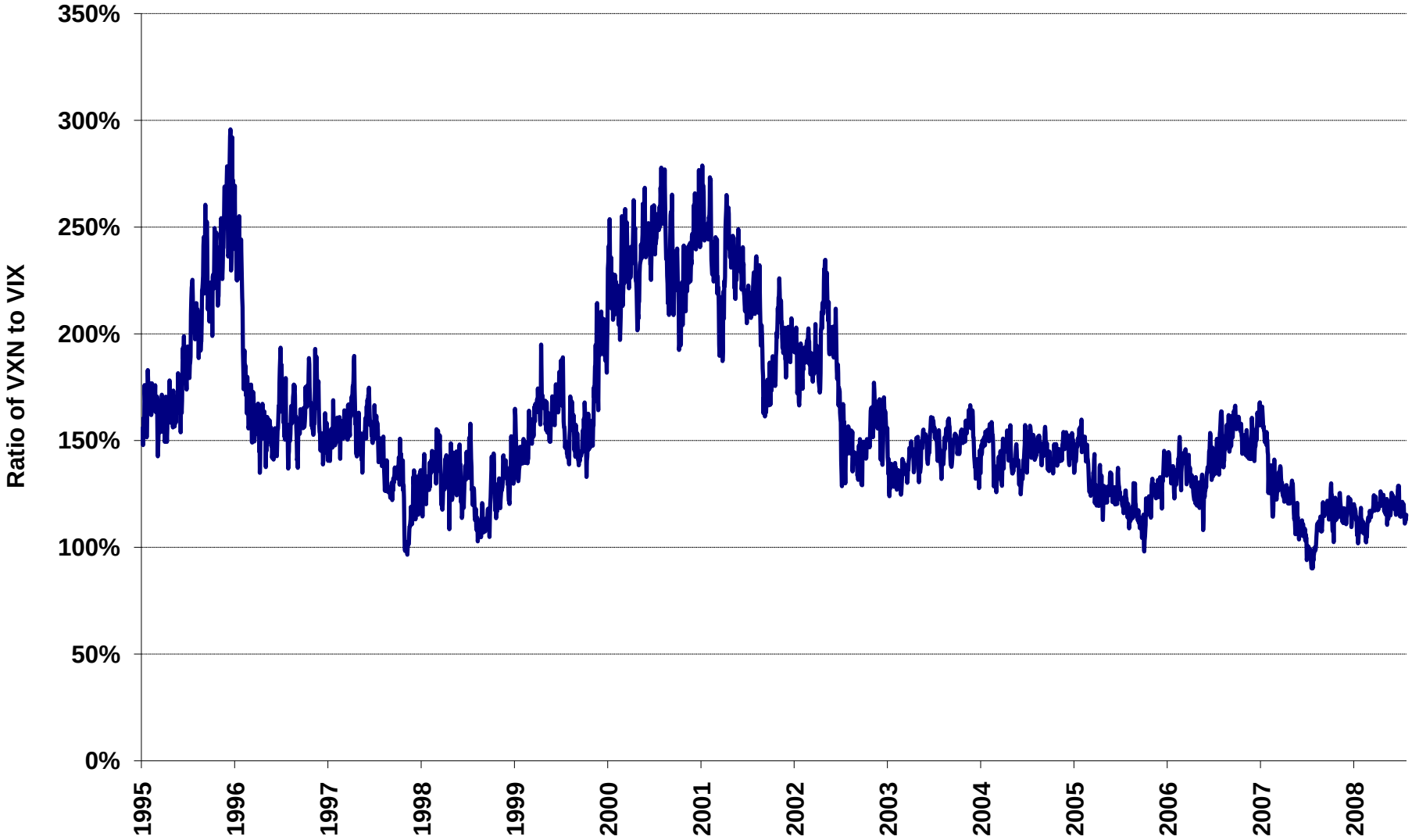
Implied Volatility: S&P vs. Nasdaq

- 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 2000-2002
  - These measures represent forecasts of future volatility (covering the span of the underlying index options, usually about a month)

Implied Volatility for S&P 500 (VIX) and Nasdaq 100 Portfolio (VXN), Annualized Standard Deviation of Returns, 1986-2008



Implied Volatility for Nasdaq 100 Portfolio (VXN) Relative to S&P 500 (VIX), Annualized Standard Deviation of Returns, 1995-2008



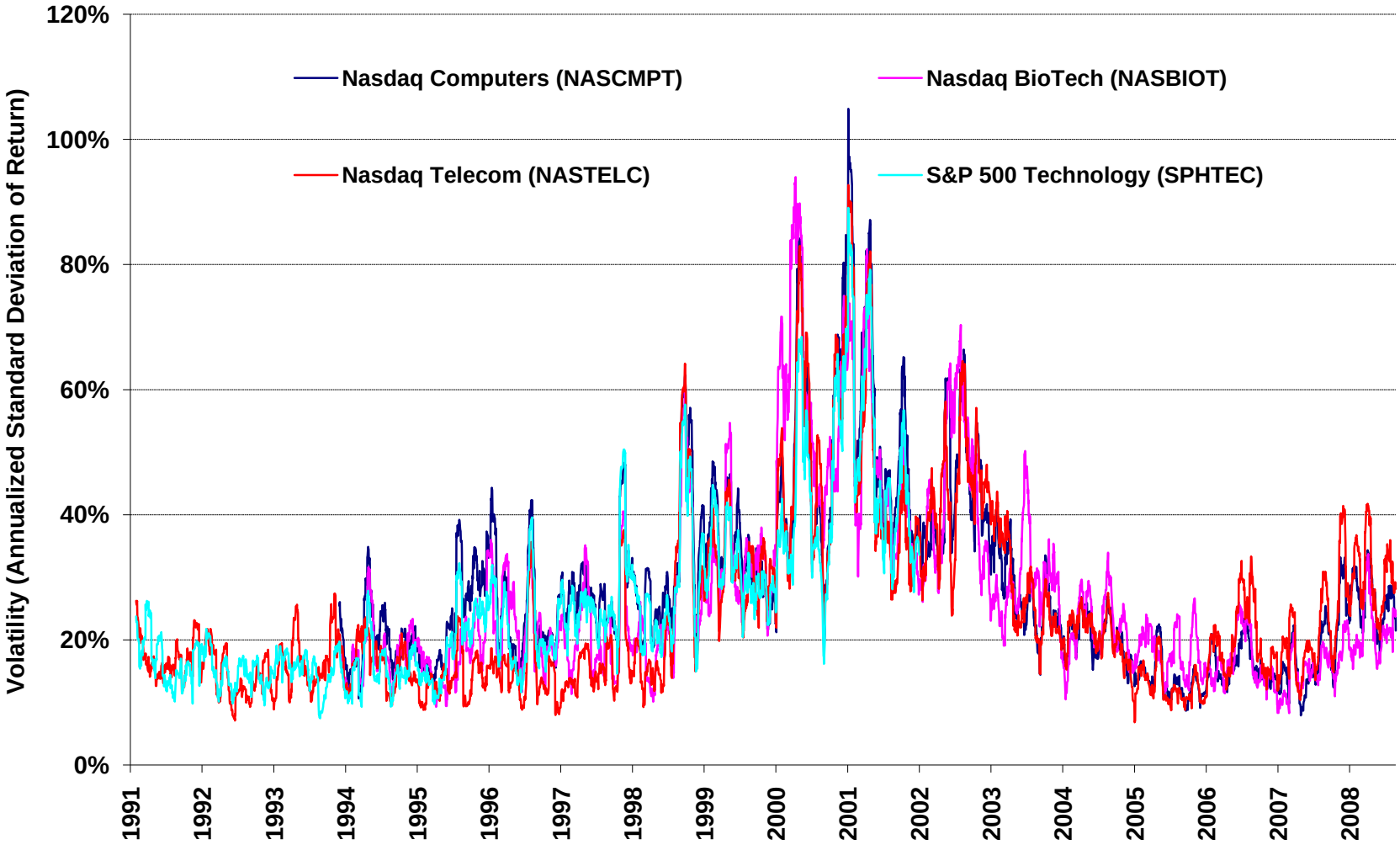
Recent Issues: Nasdaq Bubble?

- 2000-2002 was a period of high volatility for Nasdaq/technology stocks
  - This seems to have returned to more normal levels in the last couple of years
  - It turns out that the high volatility was primarily in technology stocks, independent of firm size, exchange listing, or age of the firm

Technology Portfolios

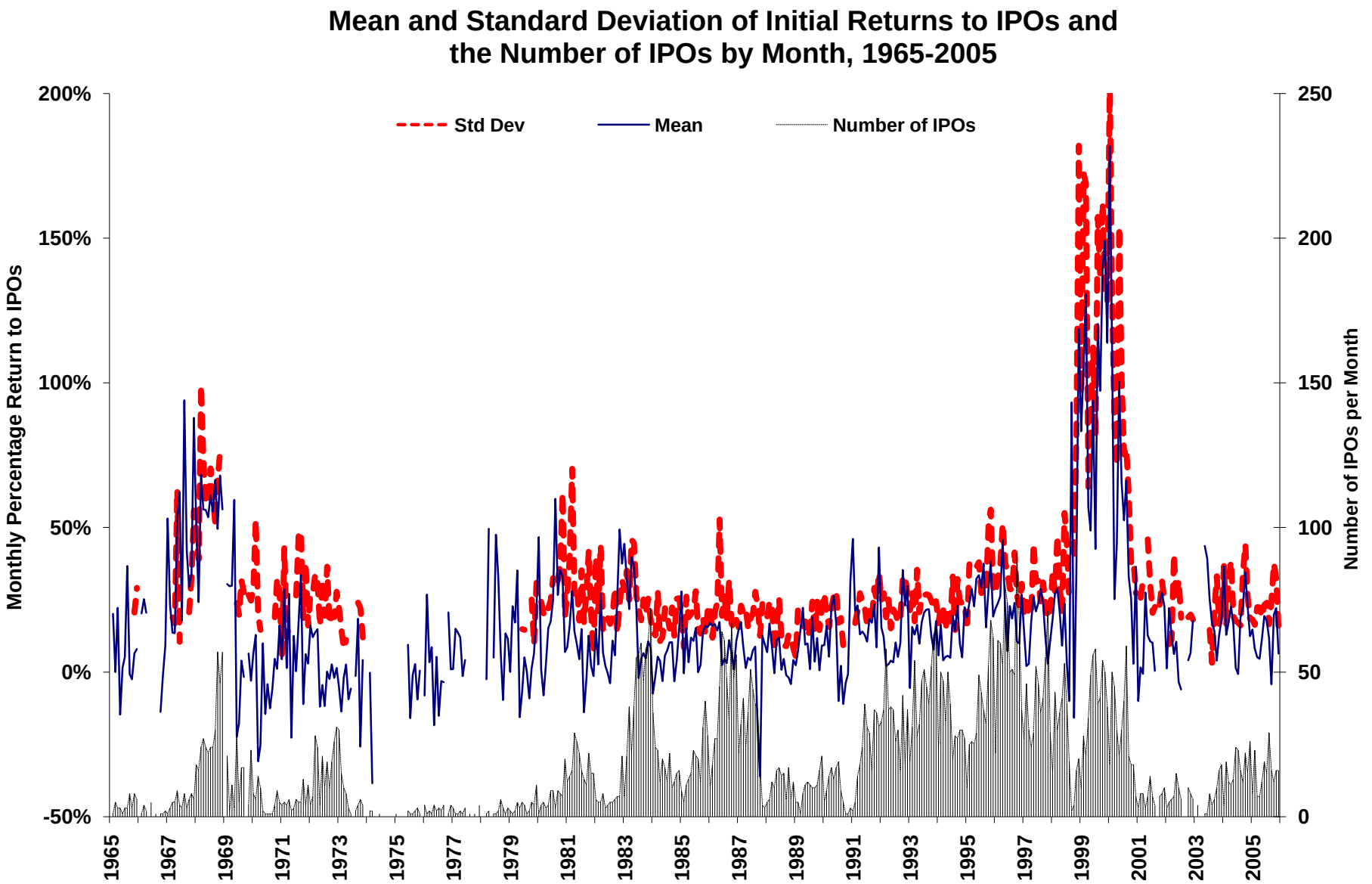
- Next figure shows historical volatility for:
  - S&P Technology portfolio, Nasdaq Computer, Biotech, and Telecom portfolios
    - They all move together, increasing substantially since mid-1998
    - Decreasing in 2003

Volatility for Several Indexes of Technology Stocks, Annualized Standard Deviation of Returns, 1991-2008



Is It the IPO Market?

- Next figure shows the number of IPO's per month and the average initial return to IPO investors
  - Initial returns (underpricing) were very high from early 1999 through mid-2000
  - Volatility of IPO returns is usually very high when average returns are also high
    - Some periods/types of deals are very hard to price accurately!


Mean and Standard Deviation of Initial Returns to IPOs and the Number of IPOs by Month, 1965-2005
Std Dev
Mean
Number of IPOs
Monthly Percentage Return to IPOs
Number of IPOs per Month
200%
150%
100%
50%
0%
-50%
250
200
150
100
50
0
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005

Summary

- Market-level volatility often rises after prices fall
  - Recent relatively good performance of the market is consistent with the lower levels of volatility [pro-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?
  - STTs

These all seem like bad ideas