

Appendix A: Big 6 Banks

Panel A1: Big 6 Volatility

Bank	Pre-crisis average	Post-crisis average	2015 average
Bank of America	19.70	39.02	23.21
Citigroup	24.51	38.06	21.75
Goldman Sachs	26.92	28.23	19.35
JP Morgan	28.01	29.57	20.17
Morgan Stanley	31.75	37.22	22.60
Wells Fargo	17.29	28.74	16.94
Mean	24.70	33.47	20.67
Weighted Mean	22.14	30.73	20.29
Median	21.09	30.24	20.87

Panel A2: Big 6 Volatility/Market Volatility¹

Bank	Pre-crisis average	Post-crisis average	2015 average
Bank of America	1.21	2.02	1.88
Citigroup	1.48	1.95	1.80
Goldman Sachs	1.81	1.60	1.62
JP Morgan	1.64	1.60	1.64
Morgan Stanley	1.99	2.07	1.89
Wells Fargo	1.18	1.46	1.44
Mean	1.55	1.78	1.71
Weighted Mean	1.50	1.70	1.67
Median	1.41	1.68	1.71

¹ For domestic volatility/market comparisons, we used the market return of the S&P 500. We used the standard deviation of the daily return over 260 trading days to best approximate an annual average.

Panel A3: Big 6 Implied Volatility

Bank	Pre-crisis average ¹	Post-crisis average	2015 average
Bank of America	18.55	35.49	25.42
Citigroup	21.00	33.42	24.68
Goldman Sachs	27.37	27.93	22.79
JP Morgan	22.53	26.99	21.47
Morgan Stanley	27.90	35.95	24.86
Wells Fargo	20.06	24.88	18.56
Mean	22.90	30.77	22.96
Weighted Mean	21.79	27.95	22.22
Median	19.89	27.31	21.36

¹ Earliest implied volatility data is available in 2005, so we begin our pre-crisis period then.

Panel A4: Big 6 Implied Volatility/Market Implied Volatility

Bank	Pre-crisis average	Post-crisis average	2015 average
Bank of America	1.56	2.47	1.78
Citigroup	1.73	2.31	1.73
Goldman Sachs	2.29	1.96	1.59
JP Morgan	1.88	1.87	1.49
Morgan Stanley	2.34	2.53	1.74
Wells Fargo	1.66	1.69	1.29
Mean	1.91	2.14	1.61
Weighted Mean	1.82	2.01	1.56
Median	1.79	1.92	1.54

Panel A5: Big 6 Option Delta¹

Bank	Pre-crisis average	Post-crisis average	2014 average ²
Bank of America	0.025	0.078	0.044
Citigroup	0.033	0.071	0.059
Goldman Sachs	0.040	0.075	0.047
JP Morgan	0.044	0.071	0.045
Morgan Stanley	0.049	0.081	0.040
Wells Fargo	0.028	0.069	0.043
Mean	0.036	0.074	0.046
Median	0.027	0.066	0.046

¹ Delta is computed on one-year, 50% out-of-the-money put options.

² Delta data only through June 2015, so we use 2014 average as our most recent measure

Panel A6: Big 6 Betas

Bank	Pre-crisis average	Post-crisis average	2015 average
Bank of America	0.88	1.79	1.22
Citigroup	1.19	1.78	1.32
Goldman Sachs	1.33	1.32	1.21
JP Morgan	1.35	1.46	1.20
Morgan Stanley	1.56	1.85	1.40
Wells Fargo	0.77	1.43	1.04
Mean	1.18	1.61	1.23
Weighted Mean	1.13	1.55	1.20
Median	1.18	1.49	1.22

Panel A7: Big 6 CDS Spread¹

Bank	Pre-crisis average ²	Post-crisis average	2015 average
Bank of America	18.99	143.15	89.64
Citigroup	22.50	134.31	90.30
Goldman Sachs	47.47	162.75	117.04
JP Morgan	21.80	104.37	80.69
Morgan Stanley	65.29	230.46	136.07
Wells Fargo	15.02	68.71	47.73
Mean	31.85	140.63	93.58
Weighted Mean	26.02	112.40	81.89
Median	24.00	116.00	89.00

¹ Price data for a five-year tenor.

² Earliest CDS data is available in February 2004, so we begin our pre-crisis period then.

³ Note that there is no S&P 500 CDS index, so median was calculated from CDS data for all companies now in the index.

Panel A8: Big 6 Price-Earnings Ratio Relative to Market¹

Bank	Pre-crisis average	Post-crisis average	2015 average
Bank of America	0.56	1.90	0.81
Citigroup	0.73	0.19	0.67
Goldman Sachs	0.57	0.71	0.59
JP Morgan	0.83	0.60	0.53
Morgan Stanley	0.63	3.22	0.85
Wells Fargo	0.69	0.70	0.63
Mean	0.67	1.22	0.68
Median	0.64	0.67	0.61

¹ We follow Rajan (2005) and examine bank PE ratio as a percentage of S&P 500 PE ratio.

Panel A9: Big 6 Preferred Stock Price¹

Bank	Pre-crisis average	Post-crisis average	2015 average
Bank of America	24.26	20.31	21.33
Citigroup	N/A	N/A	N/A
Goldman Sachs	25.12	20.59	20.21
JP Morgan	N/A	N/A	N/A
Morgan Stanley	25.36	19.85	20.68
Wells Fargo	N/A	N/A	N/A
Mean	24.97	20.25	20.74
Median	25.65	20.31	20.68

¹ Note there are only three banks in our sample (Bank of America, Goldman Sachs, and Morgan Stanley) with floating rate preferred stock dating back to the pre-crisis period, the rest are reported as N/A.

Panel A10: Big 6 Systemic Risk Percentage¹

Bank	Pre-crisis average	Post-crisis average	2014 average
Bank of America	0.02	13.69	10.95
Citigroup	1.23	12.18	11.15
Goldman Sachs	6.79	4.84	4.92
JP Morgan	6.77	12.11	12.81
Morgan Stanley	13.76	6.32	6.26
Wells Fargo	0.00	0.36	0.00
Mean	4.76	8.25	7.68
Median	0.00	8.18	7.18

¹ SRISK is defined as the capital that a firm is expected to need if we have another financial crisis. SRISK% is SRISK divided by the sum of SRISK for all firms with positive SRISK in the relevant period.

Appendix B: Midsize Domestic Financial Institutions¹

Panel B1: Midsize Domestic Volatility

Bank	Pre-crisis average	Post-crisis average	2015 average
Low MVE	26.56	30.04	22.58
Quintile 2	21.73	28.82	20.63
Quintile 3	25.86	31.18	22.64
Quintile 4	25.07	31.76	21.77
High MVE	28.50	28.77	20.30
Mean	25.54	30.11	21.61
Median	22.83	25.71	21.40

Panel B2: Midsize Domestic Volatility/Market Volatility¹

Bank	Pre-crisis average	Post-crisis average	2015 average
Low MVE	1.81	1.69	1.82
Quintile 2	1.47	1.64	1.69
Quintile 3	1.73	1.69	1.89
Quintile 4	1.64	1.70	1.80
High MVE	1.73	1.59	1.70
Mean	1.68	1.66	1.78
Median	1.53	1.57	1.68

¹ For domestic volatility/market comparisons, we used the market return of the S&P 500. We used the standard deviation of the daily return over 260 trading days to best approximate an annual average.

¹ Quintile ranking based on market capitalization in each period. In the pre-crisis period, the mean market cap in the bottom quintile was slightly over \$1B, and the mean in 2015 was around \$2.7B. For the top quintile, the pre-crisis mean was \$312B, and in 2015 it was around \$488B.

Panel B3: Midsize Domestic Implied Volatility

Bank	Pre-crisis average ¹	Post-crisis average	2015 average
Low MVE	25.34	36.73	28.62
Quintile 2	24.38	36.02	31.66
Quintile 3	28.41	30.62	26.25
Quintile 4	24.91	29.60	25.25
High MVE	24.65	26.74	21.85
Mean	25.62	32.06	26.79
Median	21.74	27.18	23.67

¹ Earliest implied volatility data is available in 2005, so we begin our pre-crisis period then.

Panel B4: Midsize Domestic Implied Volatility/Market Implied Volatility

Bank	Pre-crisis average	Post-crisis average	2015 average
Low MVE	2.03	2.70	2.06
Quintile 2	2.10	2.61	2.27
Quintile 3	2.36	2.18	1.86
Quintile 4	2.08	2.08	1.80
High MVE	2.08	1.89	1.54
Mean	2.15	2.31	1.91
Median	1.91	1.95	1.69

Panel B5: Midsize Domestic Betas

Bank	Pre-crisis average	Post-crisis average	2015 average
Low MVE	0.85	1.22	0.99
Quintile 2	0.79	1.16	0.99
Quintile 3	0.99	1.32	1.14
Quintile 4	1.10	1.40	1.04
High MVE	1.08	1.34	1.11
Mean	0.96	1.29	1.05
Median	0.93	1.23	1.07

Panel B6: Midsize Domestic CDS Spread¹

Bank	Pre-crisis average ²	Post-crisis average	2015 average
Low MVE	18.15	76.52	61.79
Quintile 2	19.31	77.08	52.14
Quintile 3	24.65	106.44	72.03
Quintile 4	24.95	97.50	80.42
High MVE	28.94	115.88	74.18
Mean	23.02	94.00	67.91
Median	18.00	76.00	59.00

¹ Price data for a five-year tenor.

² Earliest CDS data is available in February 2004, so we begin our pre-crisis period then.

Panel B7: Midsize Domestic Price–Earnings Ratio Relative to Market¹

Bank	Pre–crisis average	Post–crisis average	2015 average
Low MVE	0.89	0.96	0.78
Quintile 2	0.90	0.94	0.90
Quintile 3	0.51	0.61	0.64
Quintile 4	0.89	0.45	0.58
High MVE	0.76	0.82	0.75
Mean	0.79	0.75	0.73
Median	0.78	0.83	0.74

¹ We follow Rajan (2005) and examine bank PE ratio as a percentage of S&P 500 PE ratio.

Appendix C: International Institutions²

Panel C1: International Bank Volatility

Country	Pre-crisis average	Post-crisis average	2015 average
Australia	17.28	21.33	18.10
Brazil	43.80	35.36	51.84
Canada	17.49	16.61	14.45
Denmark	23.28	32.27	21.82
France	26.56	42.95	29.73
Germany	33.36	39.95	28.66
Italy	27.39	46.08	36.26
Japan	36.68	29.98	24.70
Netherlands	34.61	43.21	29.29
Spain	27.84	34.88	30.66
Sweden	29.67	28.54	24.90
Switzerland	29.46	32.70	27.39
UK	25.32	35.67	24.31
Mean	26.55	32.73	25.57
Median	21.80	29.88	26.06
Big 6 Mean	24.70	33.47	20.67
Big 6 Median	21.09	30.24	20.87

²Australian banks include National Australia Bank, Australia and New Zealand Banking Company, and Westpac Banking. Brazilian banks include Banco de Brazil. Canadian banks include Toronto-Dominion Group, Royal Bank of Canada, Bank of Nova Scotia, and Bank of Montreal. Danske is the Danish bank in our sample and ING is the Netherlands bank. French banks are BNP Paribas, Credit Agricole Group, Societe Generale, and Natixis. German banks are Deutsche Bank and Commerzbank. Italian banks are Unicredit and Intesa Sanpaolo. Japanese banks are Mitsubishi, Mizuho, and Sumitomo. Santander is the Spanish bank in our sample. Nordea is the Swedish bank. UBS and Credit Suisse are the Switzerland banks. The UK banks are HSBC, Barclays, Lloyds, Royal Bank of Scotland, and Standard Chartered.

Panel C2: International Volatility/Market Volatility¹

Country	Pre-crisis average	Post-crisis average	2015 average
Australia	1.60	1.43	1.31
Brazil	1.56	1.52	1.99
Canada	1.34	1.21	1.17
Denmark	1.16	1.48	1.06
France	1.40	1.98	1.52
Germany	1.48	1.98	1.43
Italy	1.58	1.73	1.44
Japan	1.86	1.36	1.26
Netherlands	1.57	1.95	1.43
Spain	1.46	1.43	1.48
Sweden	1.45	1.30	1.21
Switzerland	1.64	2.11	1.54
UK	1.59	2.22	1.73
Mean	1.52	1.72	1.43
Median	1.49	1.56	1.38
Big 6 Mean	1.55	1.78	1.71
Big 6 Median	1.41	1.68	1.71

¹ For international market comparisons, we use local indices except for banks in the Netherlands, Sweden, and Denmark. We benchmark volatility of banks in these countries against a European index. We used the standard deviation of the daily return over 260 trading days to best approximate an annual average.

Panel C3: International Implied Volatility

Country	Pre-crisis average ¹	Post-crisis average	2015 average
Australia	15.91	18.87	20.71
Brazil	66.25	37.83	39.26
Canada	17.22	18.41	16.90
Denmark	21.74	31.87	22.48
France	23.72	41.91	31.88
Germany	25.66	40.10	33.08
Italy	20.54	41.24	34.61
Japan	29.00	28.46	28.49
Netherlands	20.84	38.49	30.95
Spain	22.47	36.68	35.25
Sweden	23.05	26.15	23.52
Switzerland	21.92	30.49	27.00
UK	23.04	32.93	27.02
Mean	22.10	31.36	27.27
Median	20.36	28.27	26.54
Big 6 Mean	22.90	30.77	22.96
Big 6 Median	19.89	27.31	21.36

¹ Earliest implied volatility data is available in 2005, so we begin our pre-crisis period then.

Panel C4: International Implied Volatility/Market Implied Volatility

Country	Pre-crisis average	Post-crisis average	2015 average
Australia	1.10	1.06	1.27
Brazil	3.63	2.23	2.44
Canada	1.23	1.02	1.04
Denmark	1.32	1.36	0.95
France	1.41	1.79	1.33
Germany	1.48	1.88	1.40
Italy	1.22	1.76	1.44
Japan	1.51	1.22	1.31
Netherlands	1.23	1.62	1.29
Spain	1.34	1.56	1.46
Sweden	1.38	1.11	0.99
Switzerland	1.28	1.30	1.13
UK	1.55	1.88	1.66
Mean	1.36	1.50	1.36
Median	1.27	1.39	1.28
Big 6 Mean	1.91	2.14	1.61
Big 6 Median	1.79	1.92	1.54

Panel C5: International Betas

Country	Pre-crisis average	Post-crisis average	2015 average
Australia	0.50	0.70	0.75
Brazil	0.73	0.85	1.28
Canada	0.41	0.58	0.69
Denmark	0.58	1.00	0.82
France	0.79	1.35	1.27
Germany	1.01	1.14	1.08
Italy	0.86	1.30	1.28
Japan	1.36	1.31	1.35
Netherlands	N/A	N/A	N/A
Spain	1.03	1.07	1.12
Sweden	0.57	0.80	0.88
Switzerland	1.10	1.27	0.73
UK	0.86	1.25	0.85
Mean	0.80	1.07	0.99
Median	0.74	1.11	0.95
Big 6 Mean	1.18	1.61	1.23
Big 6 Median	1.18	1.49	1.22

Panel C6: International CDS Spread¹

Country	Pre-crisis average ²	Post-crisis average	2015 average
Australia	11.76	103.44	70.86
Brazil	N/A	321.50	422.65
Canada	N/A	56.42	59.44
Denmark	N/A	N/A	N/A
France	11.74	139.48	75.13
Germany	N/A	N/A	N/A
Italy	16.09	208.35	93.20
Japan	N/A	N/A	N/A
Netherlands	11.89	116.01	62.30
Spain	14.77	203.43	103.46
Sweden	N/A	82.99	62.66
Switzerland	19.48	99.85	71.60
UK	13.53	90.67	97.21
Mean	13.66	129.13	103.66
Median	11.50	98.52	76.84
Big 6 Mean	31.85	140.63	93.58
Big 6 Median	24.00	116.00	89.00

¹ Price data for a five-year tenor.

² Earliest CDS data is available in February 2004, so we begin our pre-crisis period then.