

Online Appendix for:
**‘THE ROLE OF JUMPS AND LEVERAGE IN FORECASTING
VOLATILITY IN INTERNATIONAL EQUITY MARKETS’**

DANIEL BUNCIC AND KATJA I. M. GISLER

July 13, 2016

This online appendix provides summary statistics as well as time series plots of the data used in the study. An exact description of how these series were computed is provided in Section 3 of the paper.

Table A.1: Summary statistics of $\log(RV)$ (realized volatility)

Equity Index	Country	Full Sample Period	T	%Miss	Mean	Med	Std.dev	Skew	Kurt	Min	Max	ACF(1 - 3)	PACF(1 - 3)
S&P 500	United States	03.01.2000 - 08.07.2016	4126	0.72	2.53	2.49	0.53	0.47	3.40	0.70	4.94	0.79 0.75 0.72	0.79 0.35 0.18
FTSE 100	United Kingdom	04.01.2000 - 08.07.2016	4147	0.65	2.41	2.37	0.50	0.47	3.18	1.13	4.68	0.84 0.80 0.78	0.84 0.34 0.21
Nikkei 225	Japan	04.01.2000 - 08.07.2016	4001	1.36	2.61	2.60	0.44	0.32	3.57	1.29	4.50	0.77 0.71 0.68	0.77 0.29 0.17
DAX 30	Germany	03.01.2000 - 08.07.2016	4179	0.48	2.78	2.76	0.51	0.36	3.17	1.27	4.80	0.83 0.79 0.77	0.83 0.33 0.20
All Ordinaries	Australia	04.01.2000 - 08.07.2016	4126	1.27	2.14	2.10	0.48	0.46	3.43	0.57	4.13	0.67 0.66 0.64	0.67 0.38 0.23
CAC 40	France	03.01.2000 - 08.07.2016	4205	0.45	2.71	2.70	0.48	0.30	3.22	1.16	4.73	0.83 0.79 0.76	0.83 0.33 0.20
Hang Seng	Hong Kong	03.01.2000 - 08.07.2016	3802	6.71	2.54	2.50	0.41	0.62	3.97	1.27	4.65	0.72 0.70 0.68	0.72 0.38 0.23
KOSPI	South Korea	04.01.2000 - 08.07.2016	4065	0.47	2.63	2.61	0.51	0.35	2.89	1.33	4.81	0.86 0.83 0.81	0.86 0.35 0.19
AEX	The Netherlands	03.01.2000 - 08.07.2016	4204	0.50	2.60	2.56	0.50	0.46	3.20	0.87	4.56	0.84 0.80 0.77	0.84 0.33 0.19
Swiss Market Index	Switzerland	04.01.2000 - 08.07.2016	4132	0.51	2.45	2.37	0.45	0.86	3.81	1.45	4.63	0.85 0.82 0.80	0.85 0.33 0.20
IBEX 35	Spain	03.01.2000 - 08.07.2016	4170	0.48	2.75	2.80	0.48	-0.05	2.95	1.17	4.77	0.84 0.79 0.77	0.84 0.32 0.21
S&P CNX Nifty	India	08.07.2002 - 08.07.2016	3443	1.29	2.71	2.65	0.47	0.77	4.08	1.53	5.38	0.76 0.71 0.68	0.76 0.32 0.19
IPC Mexico	Mexico	03.01.2000 - 08.07.2016	4130	0.72	2.42	2.36	0.48	0.62	3.62	1.07	4.74	0.67 0.63 0.60	0.67 0.33 0.20
Bovespa	Brazil	03.01.2000 - 07.07.2016	4038	1.27	3.00	2.97	0.37	0.71	4.93	1.61	4.87	0.67 0.61 0.56	0.67 0.28 0.16
S&P TSX	Canada	02.05.2002 - 08.07.2016	3541	0.70	2.16	2.10	0.52	0.81	4.02	0.75	4.56	0.79 0.75 0.73	0.79 0.34 0.20
Euro STOXX 50	Euro Area	03.01.2000 - 08.07.2016	4182	1.23	2.76	2.74	0.50	0.08	5.12	-1.07	5.11	0.76 0.71 0.69	0.76 0.32 0.22
FT Straits Times	Singapore	03.01.2000 - 18.09.2015	3879	1.71	2.33	2.30	0.38	0.60	3.70	1.45	4.29	0.81 0.77 0.75	0.81 0.33 0.22
FTSE MIB	Italy	03.01.2000 - 07.07.2016	4163	0.69	2.66	2.64	0.49	0.28	2.96	1.42	4.75	0.83 0.78 0.76	0.83 0.32 0.19

Notes: This table reports standard summary statistics of the 18 international $\log(RV)$ (realized volatility) series of the various equity markets. In the first to fifth columns of the table the equity index, the corresponding country, the full sample period and the sample size T as well as the percentage of missing trading days (%Miss) are shown. In columns six to twelve, we show common sample statistics such as the mean, median (Med), standard deviation (Std.dev), skewness (Skew), kurtosis (Kurt), as well as the minimum (Min) and the maximum (Max) of the series. In the last six columns (grouped into blocks of three), the first to third order autocorrelation function (ACF) and partial ACF (PACF) are given. The full available sample is from January 3, 2000, to July 8, 2016.

Table A.2: Summary statistics of $\log(C)$ (continuous component)

Equity Index	Country	Full Sample Period	T	%Miss	Mean	Med	Std.dev	Skew	Kurt	Min	Max	ACF(1 - 3)	PACF(1 - 3)
S&P 500	United States	03.01.2000 - 08.07.2016	4126	0.72	2.40	2.37	0.53	0.52	3.51	0.49	4.81	0.84 0.79 0.76	0.84 0.29 0.16
FTSE 100	United Kingdom	04.01.2000 - 08.07.2016	4147	0.65	2.35	2.31	0.50	0.47	3.29	0.59	4.68	0.84 0.80 0.79	0.84 0.32 0.23
Nikkei 225	Japan	04.01.2000 - 08.07.2016	4001	1.36	2.52	2.51	0.44	0.36	3.71	1.10	4.50	0.78 0.72 0.69	0.78 0.29 0.18
DAX 30	Germany	03.01.2000 - 08.07.2016	4179	0.48	2.71	2.69	0.51	0.35	3.17	1.12	4.72	0.84 0.80 0.78	0.84 0.31 0.19
All Ordinaries	Australia	04.01.2000 - 08.07.2016	4126	1.27	2.08	2.04	0.48	0.45	3.40	0.57	4.06	0.71 0.69 0.67	0.71 0.38 0.22
CAC 40	France	03.01.2000 - 08.07.2016	4205	0.45	2.66	2.65	0.48	0.28	3.18	1.12	4.65	0.83 0.79 0.77	0.83 0.32 0.20
Hang Seng	Hong Kong	03.01.2000 - 08.07.2016	3802	6.71	2.46	2.43	0.41	0.60	3.96	1.18	4.65	0.73 0.69 0.67	0.73 0.35 0.22
KOSPI	South Korea	04.01.2000 - 08.07.2016	4065	0.47	2.56	2.53	0.53	0.36	2.85	1.20	4.81	0.86 0.84 0.82	0.86 0.35 0.20
AEX	The Netherlands	03.01.2000 - 08.07.2016	4204	0.50	2.55	2.51	0.50	0.45	3.19	0.84	4.46	0.84 0.80 0.78	0.84 0.33 0.19
Swiss Market Index	Switzerland	04.01.2000 - 08.07.2016	4132	0.51	2.40	2.32	0.46	0.86	3.79	1.43	4.57	0.86 0.82 0.80	0.86 0.33 0.19
IBEX 35	Spain	03.01.2000 - 08.07.2016	4170	0.48	2.70	2.73	0.49	-0.04	2.91	1.17	4.56	0.85 0.80 0.78	0.85 0.31 0.21
S&P CNX Nifty	India	08.07.2002 - 08.07.2016	3443	1.29	2.60	2.54	0.46	0.75	3.98	1.37	4.90	0.78 0.73 0.70	0.78 0.30 0.18
IPC Mexico	Mexico	03.01.2000 - 08.07.2016	4130	0.72	2.31	2.26	0.45	0.47	3.43	0.68	4.32	0.71 0.65 0.62	0.71 0.30 0.19
Bovespa	Brazil	03.01.2000 - 07.07.2016	4038	1.27	2.91	2.88	0.37	0.64	4.60	1.56	4.83	0.70 0.62 0.57	0.70 0.24 0.15
S&P TSX	Canada	02.05.2002 - 08.07.2016	3541	0.70	2.08	2.01	0.51	0.86	4.28	0.74	4.56	0.82 0.77 0.75	0.82 0.32 0.20
Euro STOXX 50	Euro Area	03.01.2000 - 08.07.2016	4182	1.23	2.67	2.65	0.51	-0.14	6.64	-2.39	4.73	0.77 0.73 0.71	0.77 0.33 0.21
FT Straits Times	Singapore	03.01.2000 - 18.09.2015	3879	1.71	2.26	2.22	0.37	0.68	3.83	1.34	4.29	0.79 0.75 0.73	0.79 0.32 0.22
FTSE MIB	Italy	03.01.2000 - 07.07.2016	4163	0.69	2.60	2.59	0.49	0.26	2.89	1.37	4.57	0.83 0.79 0.76	0.83 0.32 0.18

Notes: This table reports standard summary statistics of the 18 international $\log(C)$ (continuous component) series of the various equity markets. In the first to fifth columns of the table the equity index, the corresponding country, the full sample period and the sample size T as well as the percentage of missing trading days (%Miss) are shown. In columns six to twelve, we show common sample statistics such as the mean, median (Med), standard deviation (Std.dev), skewness (Skew), kurtosis (Kurt), as well as the minimum (Min) and the maximum (Max) of the series. In the last six columns (grouped into blocks of three), the first to third order autocorrelation function (ACF) and partial ACF (PACF) are given. The full available sample is from January 3, 2000, to July 8, 2016.

Table A.3: Summary statistics of $\log(1 + J)$ (jump component)

Equity Index	Country	Full Sample Period	T	%Miss	Mean	Med	Std.dev	Skew	Kurt	Min	Max	ACF(1 - 3)	PACF(1 - 3)
S&P 500	United States	03.01.2000 - 08.07.2016	4126	0.72	0.76	0.64	0.66	0.90	3.42	0.00	3.52	0.07 0.13 0.11	0.07 0.13 0.09
FTSE 100	United Kingdom	04.01.2000 - 08.07.2016	4147	0.65	0.44	0.31	0.50	1.60	6.25	0.00	3.68	0.25 0.24 0.22	0.25 0.19 0.14
Nikkei 225	Japan	04.01.2000 - 08.07.2016	4001	1.36	0.66	0.62	0.52	0.58	2.92	0.00	3.30	0.05 0.04 0.04	0.05 0.04 0.03
DAX 30	Germany	03.01.2000 - 08.07.2016	4179	0.48	0.64	0.53	0.59	1.13	4.33	0.00	3.59	0.15 0.14 0.14	0.15 0.12 0.10
All Ordinaries	Australia	04.01.2000 - 08.07.2016	4126	1.27	0.36	0.27	0.39	1.25	4.57	0.00	2.71	0.02 0.04 0.06	0.02 0.04 0.06
CAC 40	France	03.01.2000 - 08.07.2016	4205	0.45	0.44	0.36	0.45	1.05	4.16	0.00	3.26	0.06 0.06 0.05	0.06 0.06 0.05
Hang Seng	Hong Kong	03.01.2000 - 08.07.2016	3802	6.71	0.57	0.51	0.51	0.88	3.74	0.00	3.02	0.12 0.10 0.13	0.12 0.09 0.11
KOSPI	South Korea	04.01.2000 - 08.07.2016	4065	0.47	0.55	0.49	0.49	0.84	3.75	0.00	3.54	0.04 0.03 0.07	0.04 0.02 0.06
AEX	The Netherlands	03.01.2000 - 08.07.2016	4204	0.50	0.40	0.30	0.43	1.38	5.69	0.00	3.09	0.06 0.06 0.08	0.06 0.06 0.08
Swiss Market Index	Switzerland	04.01.2000 - 08.07.2016	4132	0.51	0.39	0.32	0.40	1.29	5.50	0.00	3.02	0.10 0.07 0.08	0.10 0.06 0.07
IBEX 35	Spain	03.01.2000 - 08.07.2016	4170	0.48	0.51	0.42	0.50	1.01	4.08	0.00	3.95	0.08 0.04 0.03	0.08 0.03 0.03
S&P CNX Nifty	India	08.07.2002 - 08.07.2016	3443	1.29	0.76	0.64	0.72	0.99	3.75	0.00	4.44	0.09 0.14 0.11	0.09 0.13 0.09
IPC Mexico	Mexico	03.01.2000 - 08.07.2016	4130	0.72	0.62	0.44	0.68	1.39	4.90	0.00	4.18	0.12 0.18 0.17	0.12 0.17 0.14
Bovespa	Brazil	03.01.2000 - 07.07.2016	4038	1.27	0.79	0.71	0.68	0.73	3.18	0.00	3.93	0.11 0.09 0.15	0.11 0.08 0.13
S&P TSX	Canada	02.05.2002 - 08.07.2016	3541	0.70	0.42	0.29	0.49	1.80	7.10	0.00	3.46	0.12 0.15 0.11	0.12 0.13 0.08
Euro STOXX 50	Euro Area	03.01.2000 - 08.07.2016	4182	1.23	0.71	0.61	0.63	1.04	4.16	0.00	4.03	0.13 0.12 0.13	0.13 0.10 0.10
FT Straits Times	Singapore	03.01.2000 - 18.09.2015	3879	1.71	0.49	0.41	0.46	1.02	4.44	0.00	3.51	0.33 0.32 0.29	0.33 0.23 0.15
FTSE MIB	Italy	03.01.2000 - 07.07.2016	4163	0.69	0.50	0.41	0.49	1.21	5.26	0.00	3.70	0.08 0.09 0.14	0.08 0.09 0.12

Notes: This table reports standard summary statistics of the 18 international $\log(1 + J)$ (jump component) series of the various equity markets. In the first to fifth columns of the table the equity index, the corresponding country, the full sample period and the sample size T as well as the percentage of missing trading days (%Miss) are shown. In columns six to twelve, we show common sample statistics such as the mean, median (Med), standard deviation (Std.dev), skewness (Skew), kurtosis (Kurt), as well as the minimum (Min) and the maximum (Max) of the series. In the last six columns (grouped into blocks of three), the first to third order autocorrelation function (ACF) and partial ACF (PACF) are given. The full available sample is from January 3, 2000, to July 8, 2016.

Table A.4: Summary statistics of $\min\{r, 0\}$ (leverage effect)

Equity Index	Country	Full Sample Period	T	%Miss	Mean	Med	Std.dev	Skew	Kurt	Min	Max	ACF(1 - 3)	PACF(1 - 3)
S&P 500	United States	04.01.2000 - 08.07.2016	4126	0.72	-0.38	0.00	0.77	-3.75	25.54	-9.69	0.00	0.10 0.13 0.12	0.10 0.12 0.10
FTSE 100	United Kingdom	05.01.2000 - 08.07.2016	4147	0.65	-0.38	0.00	0.72	-3.37	20.94	-8.93	0.00	0.13 0.11 0.09	0.13 0.10 0.06
Nikkei 225	Japan	05.01.2000 - 08.07.2016	4001	1.36	-0.49	0.00	0.95	-3.79	27.08	-12.11	0.00	0.08 0.11 0.05	0.08 0.10 0.04
DAX 30	Germany	04.01.2000 - 08.07.2016	4179	0.48	-0.50	0.00	0.93	-2.90	14.28	-7.92	0.00	0.14 0.12 0.10	0.14 0.10 0.07
All Ordinaries	Australia	05.01.2000 - 08.07.2016	4126	1.27	-0.31	0.00	0.60	-3.66	24.94	-7.26	0.00	0.12 0.13 0.12	0.12 0.12 0.09
CAC 40	France	04.01.2000 - 08.07.2016	4205	0.45	-0.50	0.00	0.91	-2.88	14.55	-8.52	0.00	0.10 0.10 0.08	0.10 0.09 0.07
Hang Seng	Hong Kong	04.01.2000 - 08.07.2016	3802	6.71	-0.39	0.00	0.77	-3.50	22.93	-9.29	0.00	0.09 0.06 0.10	0.09 0.05 0.09
KOSPI	South Korea	05.01.2000 - 08.07.2016	4065	0.47	-0.47	0.00	0.99	-4.01	29.23	-12.83	0.00	0.10 0.09 0.07	0.10 0.08 0.06
AEX	The Netherlands	04.01.2000 - 08.07.2016	4204	0.50	-0.48	0.00	0.91	-3.35	19.07	-9.12	0.00	0.15 0.13 0.10	0.15 0.11 0.07
Swiss Market Index	Switzerland	05.01.2000 - 08.07.2016	4132	0.51	-0.38	0.00	0.74	-3.47	21.38	-9.07	0.00	0.19 0.11 0.11	0.19 0.07 0.08
IBEX 35	Spain	04.01.2000 - 08.07.2016	4170	0.48	-0.51	0.00	0.93	-3.09	19.34	-12.72	0.00	0.12 0.07 0.09	0.12 0.05 0.07
S&P CNX Nifty	India	09.07.2002 - 08.07.2016	3443	1.29	-0.37	0.00	0.85	-4.67	41.91	-13.79	0.00	0.22 0.14 0.13	0.22 0.10 0.08
IPC Mexico	Mexico	04.01.2000 - 08.07.2016	4130	0.72	-0.40	0.00	0.79	-3.21	17.33	-8.27	0.00	0.17 0.07 0.06	0.17 0.04 0.05
Bovespa	Brazil	04.01.2000 - 07.07.2016	4038	1.27	-0.58	0.00	1.07	-3.17	20.89	-15.40	0.00	0.08 0.07 0.05	0.08 0.07 0.04
S&P TSX	Canada	03.05.2002 - 08.07.2016	3541	0.70	-0.28	0.00	0.65	-4.44	34.36	-9.06	0.00	0.16 0.13 0.20	0.16 0.11 0.17
Euro STOXX 50	Euro Area	04.01.2000 - 08.07.2016	4182	1.23	-0.50	0.00	0.92	-2.95	15.09	-8.77	0.00	0.11 0.10 0.09	0.11 0.09 0.07
FT Straits Times	Singapore	04.01.2000 - 18.09.2015	3879	1.71	-0.34	0.00	0.70	-4.16	32.91	-9.63	0.00	0.13 0.14 0.15	0.13 0.13 0.12
FTSE MIB	Italy	04.01.2000 - 07.07.2016	4163	0.69	-0.53	0.00	0.97	-3.10	18.77	-13.33	0.00	0.10 0.10 0.08	0.10 0.09 0.07

Notes: This table reports standard summary statistics of the 18 international $\min\{r, 0\}$ (leverage effect) series of the various equity markets. In the first to fifth columns of the table the equity index, the corresponding country, the full sample period and the sample size T as well as the percentage of missing trading days (%Miss) are shown. In columns six to twelve, we show common sample statistics such as the mean, median (Med), standard deviation (Std.dev), skewness (Skew), kurtosis (Kurt), as well as the minimum (Min) and the maximum (Max) of the series. In the last six columns (grouped into blocks of three), the first to third order autocorrelation function (ACF) and partial ACF (PACF) are given. The full available sample is from January 3, 2000, to July 8, 2016.

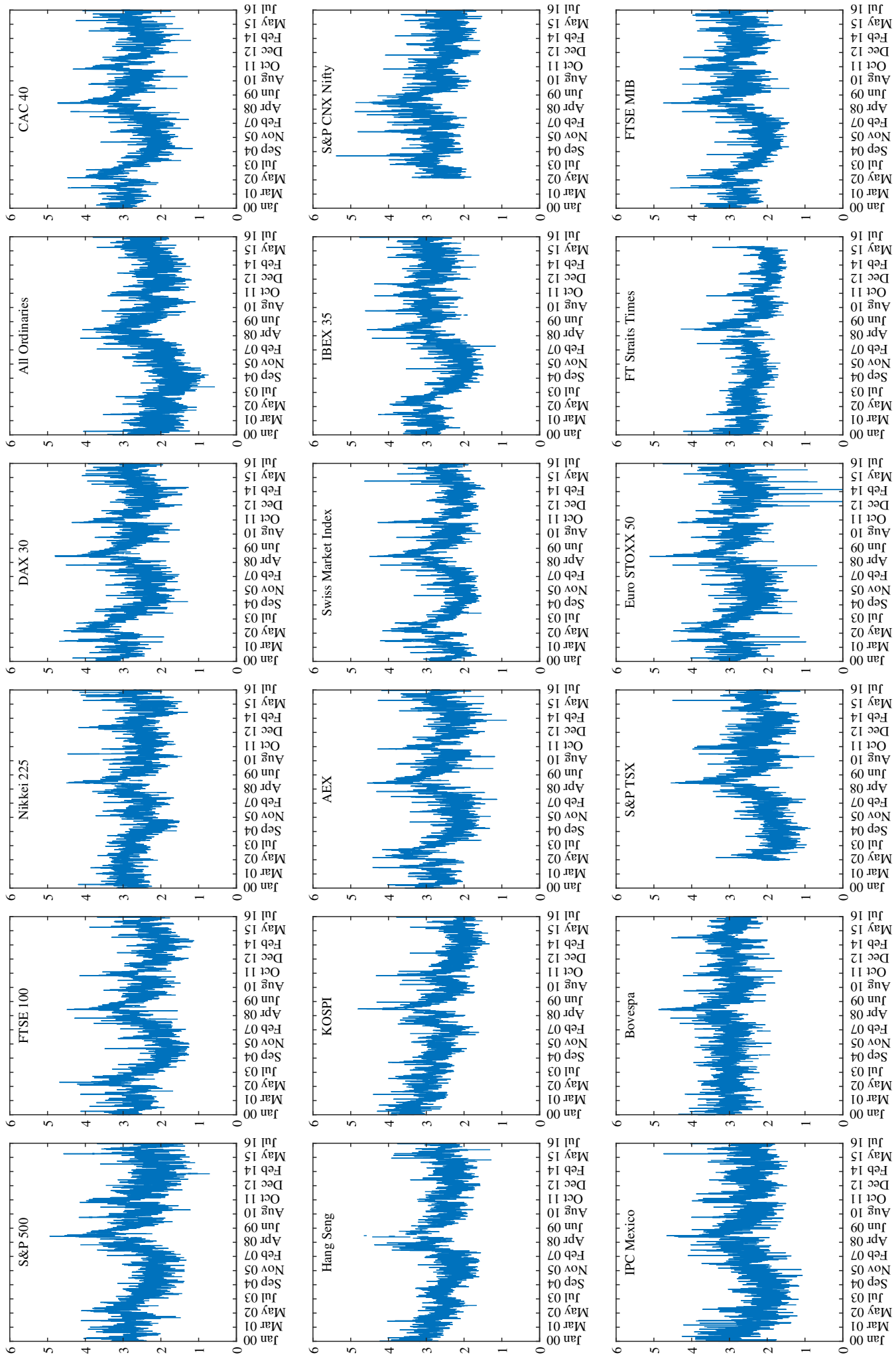


Figure A.1: Time series plot of the $\log(RV_t)$ data.

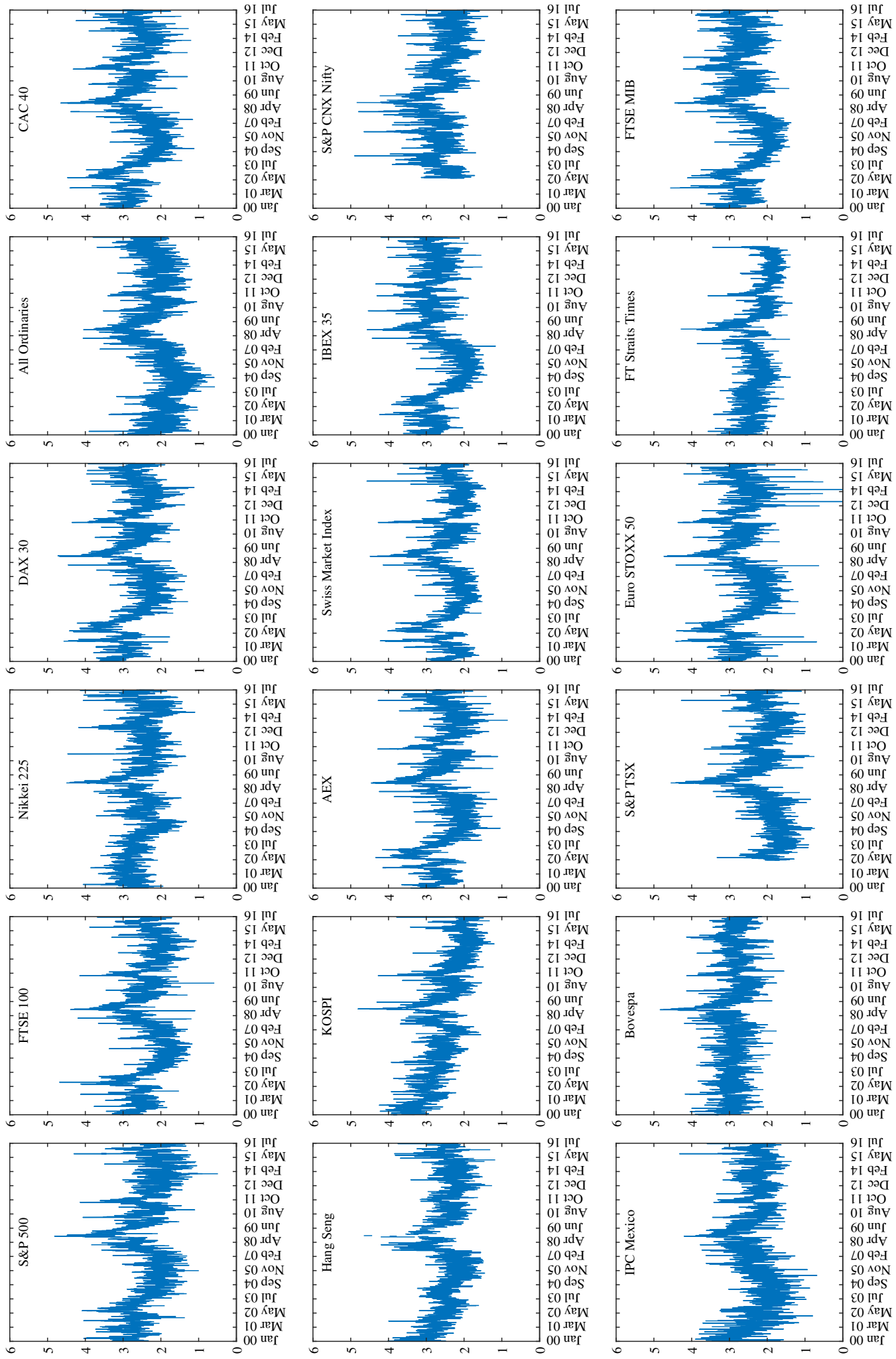


Figure A.2: Time series plot of the continuous component $\log(C_t)$.

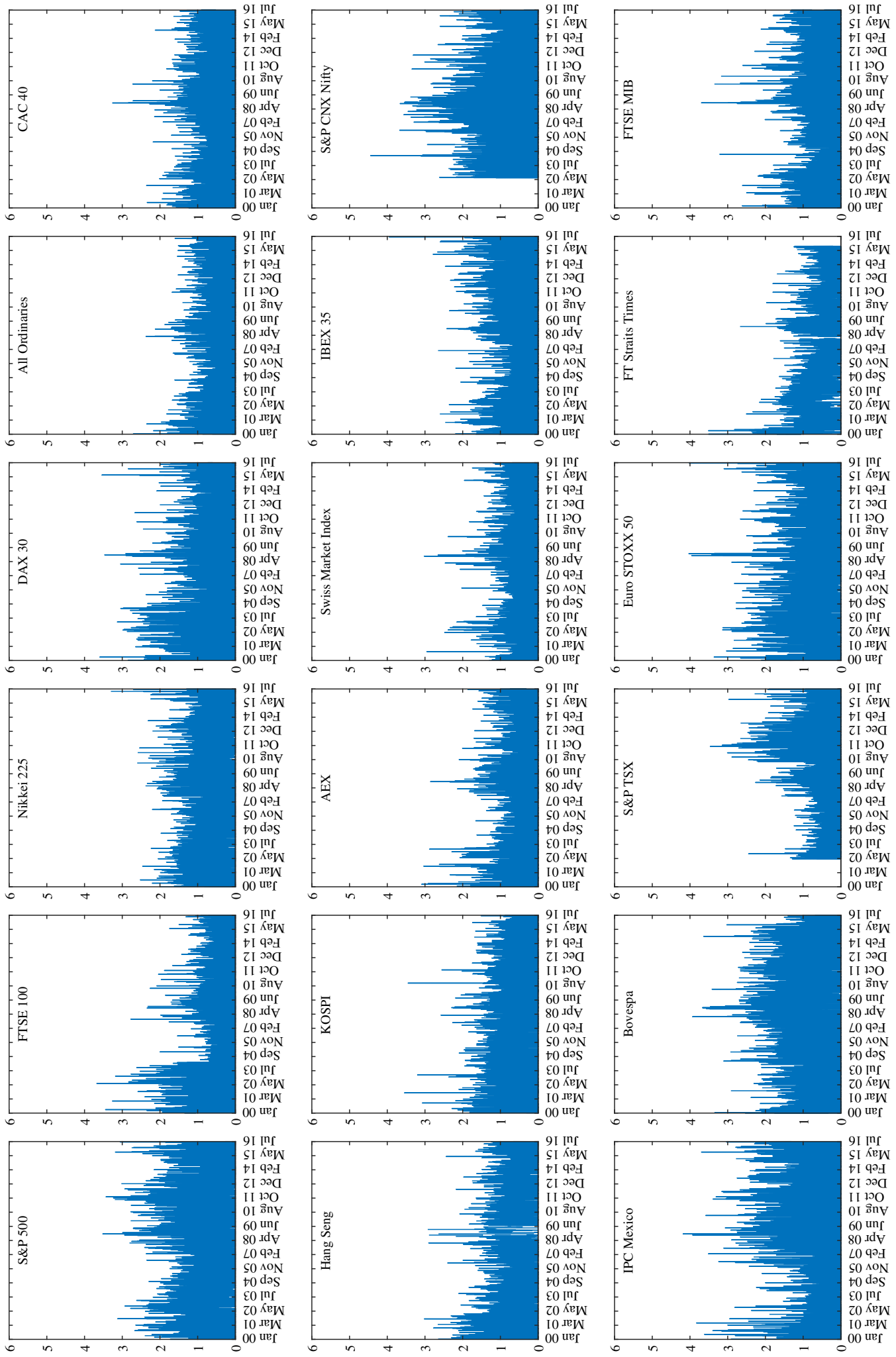


Figure A.3: Time series plot of the jump component $\log(1 + J_t)$.

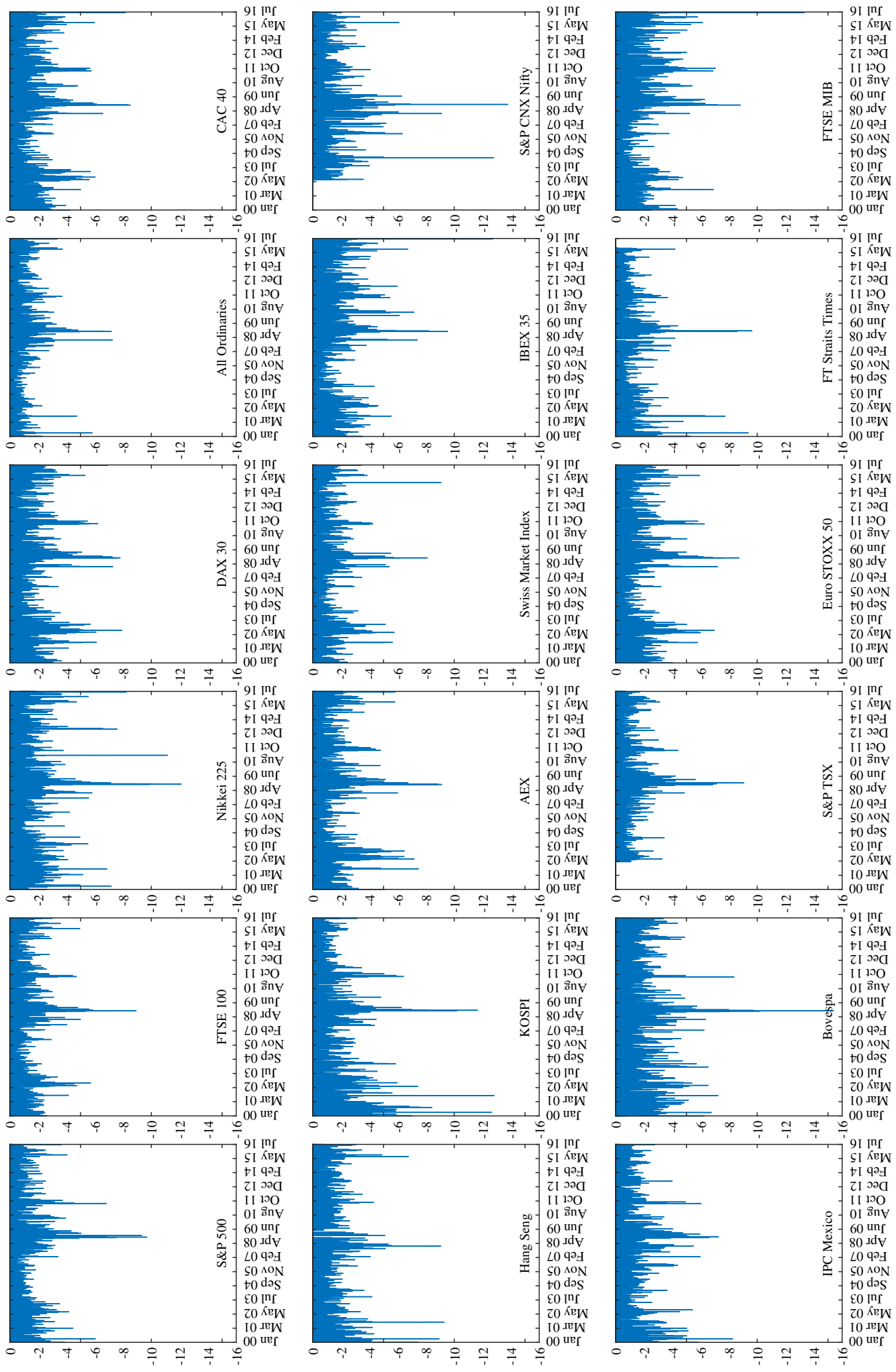


Figure A.4: Time series plot of the leverage effect $\min\{0, r_t\}$.