Online-Appendix zu

„Variance Risk Premia"

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Appendix

Table A 1 – Summary statistics of variance risk premia for the subsample from January 1996 to December 2007

| | | Descriptive statistics of variance risk premia | | | | | | | | | | | | | | | | | |
| | | VRP as (RV-EV)·100 | | | | | LVRP as ln(RV/EV) | | | | | | RVRP as RV/EV-1 | | | | | | |
Ticker	Realized volatility	Mean	t-stat	Sample std.	Skew	Kurt	Mean	t-stat	Sample std.	Skew	Kurt	Sharpe Ratio	Mean	t-stat	Sample std.	Skew	Kurt	Sharpe Ratio	N
DAX	15.16%	-0.75	-2.29	1.93	2.21	14.00	-0.41	-3.33	0.62	0.50	3.16	0.64	-0.18	-1.61	0.64	2.67	12.95	0.16	309
DJX	12.01%	-0.95	-5.55	1.37	-1.95	11.68	-0.50	-9.05	0.48	0.58	3.20	1.03	-0.31	-6.91	0.40	2.29	10.27	0.58	898
NDX	29.47%	-1.25	-2.26	7.31	2.14	15.47	-0.28	-8.78	0.43	0.46	3.37	0.66	-0.16	-5.24	0.42	2.06	9.14	0.28	2035
SPX	16.29%	-1.46	-7.93	2.45	0.42	8.39	-0.53	-13.40	0.51	0.51	3.22	0.98	-0.32	-10.04	0.42	2.29	10.17	0.49	2174
AA	33.03%	-2.71	-2.93	7.27	1.34	5.76	-0.29	-4.27	0.49	-0.10	4.26	0.74	-0.15	-2.70	0.46	2.20	10.89	0.41	387
MO	28.78%	-1.69	-1.89	10.80	2.64	23.08	-0.40	-6.09	0.76	0.49	4.59	0.57	-0.04	-0.31	1.50	7.93	75.85	0.01	1336
AMZN	61.52%	6.33	2.19	31.61	2.15	8.82	-0.12	-1.86	0.69	0.35	3.74	0.19	0.15	1.49	1.08	3.63	20.32	-0.05	1105
AXP	30.27%	1.05	0.86	11.81	2.85	14.92	-0.08	-1.45	0.54	0.78	4.42	0.17	0.09	1.06	0.84	3.32	16.45	-0.05	882
AMGN	35.25%	-1.65	-1.47	12.08	0.91	8.42	-0.21	-4.59	0.50	0.10	2.68	0.45	-0.08	-1.86	0.49	1.36	5.00	0.12	1202
ADI	51.39%	2.47	0.48	30.30	1.49	6.03	-0.09	-1.06	0.50	0.37	3.07	0.18	0.04	0.40	0.60	1.96	7.59	-0.03	389
AAPL	50.20%	0.26	0.06	56.10	10.81	124.62	-0.20	-5.19	0.51	1.45	11.08	0.53	0.00	-0.01	1.54	12.38	177.76	0.00	1132
BAC	26.44%	-0.96	-1.02	8.09	1.67	10.56	-0.26	-4.09	0.54	-0.13	2.94	0.52	-0.11	-1.99	0.50	1.97	11.47	0.17	705
BA	29.98%	-1.43	-2.12	7.40	2.80	26.78	-0.23	-4.56	0.50	0.30	4.30	0.53	-0.09	-1.79	0.59	4.53	39.59	0.13	855
CSCO	42.36%	0.10	0.05	17.34	1.68	8.07	-0.17	-3.32	0.50	0.03	2.73	0.37	-0.04	-0.83	0.50	1.43	5.92	0.06	909
XOM	23.34%	-0.92	-2.44	3.93	2.28	16.29	-0.21	-4.27	0.48	0.16	2.89	0.60	-0.09	-1.94	0.48	2.44	15.84	0.24	582
FB	0.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
GE	25.30%	-1.40	-2.22	7.03	1.58	10.10	-0.19	-4.39	0.46	0.48	3.76	0.49	-0.07	-1.51	0.53	3.15	19.38	0.12	911
HD	32.08%	1.22	0.72	17.65	6.35	51.76	-0.15	-2.55	0.54	0.90	6.63	0.33	0.04	0.40	1.08	6.82	57.02	-0.02	692
IBM	28.91%	-1.14	-1.76	7.98	1.58	9.53	-0.29	-6.01	0.58	0.04	2.94	0.50	-0.12	-2.62	0.56	1.91	8.83	0.12	1691
JNJ	21.41%	-2.32	-2.52	7.03	2.65	16.09	-0.39	-4.80	0.56	0.25	3.44	0.83	-0.20	-2.78	0.56	3.71	27.73	0.34	387
MCD	26.34%	-1.61	-2.07	5.40	1.43	7.23	-0.31	-3.63	0.52	0.31	3.28	0.77	-0.15	-2.03	0.52	2.02	7.91	0.36	258
MRK	27.48%	-0.98	-1.68	5.96	1.39	5.97	-0.22	-4.40	0.56	0.14	3.09	0.49	-0.06	-1.19	0.58	1.55	5.26	0.08	945
MET	27.60%	-0.94	-0.87	4.22	1.59	5.60	-0.12	-1.61	0.30	0.95	3.53	1.03	-0.07	-0.84	0.33	1.74	5.96	1.27	28
MSFT	31.02%	-1.41	-1.41	10.94	2.29	12.77	-0.21	-4.75	0.50	0.12	3.04	0.46	-0.08	-1.82	0.50	1.86	8.22	0.11	1251
MON	38.89%	0.62	0.44	7.47	1.16	7.78	-0.09	-0.94	0.45	-0.24	3.38	0.22	0.01	0.08	0.46	1.23	4.73	-0.01	207
NKE	31.67%	-1.79	-1.66	10.80	1.51	7.54	-0.31	-4.82	0.57	0.07	2.77	0.74	-0.14	-2.41	0.52	1.63	6.22	0.29	488
PFE	28.14%	-1.25	-1.58	7.55	2.04	9.52	-0.22	-3.73	0.54	0.22	4.04	0.47	-0.06	-0.92	0.62	2.69	13.08	0.07	738
PG	22.87%	5.06	0.95	32.26	4.74	24.90	-0.22	-1.65	0.82	1.31	5.63	0.25	0.33	0.85	2.35	4.61	24.24	-0.01	511
SBUX	39.40%	0.93	0.44	18.12	4.20	26.80	-0.21	-2.82	0.56	0.57	3.28	0.43	-0.04	-0.44	0.70	3.15	17.62	0.04	497
TSLA	0.00%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
VLO	35.62%	-1.80	-2.37	6.22	0.70	5.37	-0.20	-3.84	0.43	0.44	3.44	0.51	-0.10	-1.87	0.46	2.30	11.87	0.18	664
VZ	26.45%	-3.33	-4.42	6.30	0.45	8.08	-0.32	-7.39	0.38	0.31	3.42	1.63	-0.22	-5.61	0.32	1.46	5.04	2.02	239
WMT	27.82%	-0.71	-0.75	7.36	1.15	5.42	-0.19	-3.25	0.50	0.05	2.44	0.40	-0.07	-1.17	0.48	1.14	4.14	0.09	754

Note: Entries refer to the time period from January 4th 1996 to December 31st 2007. RV and EV denote the realized and risk-neutral expected variance, respectively. Realized volatility is calculated from daily returns and annualized by $\sqrt{255/22}$. t-stat denotes the relevant t-statistics adjusted for serial correlation according to the method by Newey and West (1987) with a lag length of 22 days. Sample std., Skew, and Kurt denotes the sample standard deviation, skewness and kurtosis. Sharpe ratio is the annualized Sharpe ratio calculated as the annualized mean LVRP or RVRP divided by the corresponding sample standard deviation adjusted for serial dependence according to Newey and West (1987) with 22 lags and annualized by $\sqrt{255/22}$.

Table A 2 – Summary statistics for variance risk premia based on linear interpolation

| | | Descriptive statistics of variance risk premia | | | | | | | | | | | | | | | | | | | |
| | | VRP as (RV-EV)·100 | | | | | LVRP as ln(RV/EV) | | | | | | RVRP as RV/EV-1 | | | | | | |
Ticker	Realized volatility	Mean	t-stat	Sample std.	Skew	Kurt	Mean	t-stat	Sample std.	Skew	Kurt	Sharpe Ratio	Mean	t-stat	Sample std.	Skew	Kurt	Sharpe Ratio	N
AEX	16.12%	-0.69	-3.02	2.17	1.22	8.54	-0.32	-4.64	0.59	0.44	3.28	0.58	-0.13	-1.73	0.64	2.57	11.25	0.11	736
CAC	19.88%	-0.62	-1.93	3.38	2.30	12.57	-0.27	-4.62	0.57	0.45	3.39	0.51	-0.09	-1.36	0.66	3.00	16.72	0.07	967
DAX	20.21%	-0.84	-1.65	5.78	4.01	37.84	-0.34	-6.46	0.61	0.49	3.85	0.54	-0.12	-1.91	0.74	3.51	19.48	0.06	1660
DJX	15.17%	-0.85	-2.01	4.95	4.92	51.02	-0.50	-10.76	0.58	0.74	5.04	0.81	-0.26	-4.65	0.67	4.46	28.23	0.14	2061
ESX	19.60%	-0.95	-3.02	2.88	1.30	7.73	-0.33	-5.06	0.55	0.27	2.95	0.60	-0.16	-2.61	0.53	1.92	7.71	0.18	813
NDX	26.05%	-1.17	-2.53	7.38	3.17	24.11	-0.34	-10.72	0.51	0.59	4.66	0.64	-0.17	-4.58	0.60	4.50	33.36	0.13	3278
SMI	14.05%	-0.24	-0.67	3.06	3.16	16.46	-0.34	-4.30	0.64	0.91	4.36	0.55	-0.08	-0.70	0.92	3.62	17.80	0.03	717
SPX	17.10%	-1.26	-3.66	5.15	5.72	60.03	-0.54	-15.08	0.57	0.79	5.07	0.86	-0.29	-6.63	0.67	5.61	46.12	0.14	3598
AA	40.18%	-0.48	-0.23	21.06	6.70	58.75	-0.22	-4.10	0.55	0.67	4.80	0.49	-0.05	-0.60	0.76	3.92	22.67	0.03	803
MO	25.68%	-1.26	-1.94	9.55	2.94	26.89	-0.38	-7.53	0.71	0.42	4.45	0.55	-0.08	-0.91	1.24	8.62	96.79	0.02	2163
AMZN	47.01%	1.58	0.96	24.58	2.74	14.02	-0.23	-5.38	0.62	0.45	3.91	0.38	-0.02	-0.29	0.86	4.10	27.71	0.01	2315
AXP	35.11%	1.08	0.87	15.47	4.26	26.88	-0.19	-4.44	0.57	0.65	4.43	0.34	0.00	-0.06	0.80	3.53	18.76	0.00	1949
AMGN	32.06%	-1.62	-2.23	10.52	1.41	12.34	-0.31	-7.20	0.59	0.10	2.94	0.51	-0.12	-3.00	0.58	2.18	10.62	0.11	2328
ADI	51.22%	0.42	0.14	23.08	2.16	10.87	-0.19	-3.23	0.50	0.20	3.35	0.42	-0.07	-0.98	0.53	2.12	9.30	0.07	685
AAPL	39.31%	-1.38	-0.66	39.51	14.80	241.88	-0.31	-8.72	0.54	0.80	7.12	0.61	-0.11	-1.81	1.15	14.53	274.82	0.04	2392
BAC	39.00%	7.21	1.51	46.17	5.20	31.83	-0.20	-3.53	0.61	0.78	4.64	0.31	0.03	0.30	0.98	4.51	32.25	-0.01	1467
BA	28.94%	-1.44	-2.60	7.92	2.92	27.12	-0.27	-7.40	0.51	0.25	3.98	0.56	-0.13	-3.40	0.56	3.78	29.33	0.15	2032
CSCO	39.36%	-0.21	-0.20	14.35	1.91	10.53	-0.25	-5.51	0.62	0.29	3.22	0.43	-0.04	-0.84	0.72	2.55	11.87	0.03	1932
XOM	22.53%	-0.38	-0.38	12.02	9.04	98.63	-0.32	-6.91	0.57	0.73	5.27	0.56	-0.11	-1.56	0.90	7.57	84.47	0.04	1738
FB	43.97%	-2.23	-0.69	19.40	1.89	8.68	-0.25	-2.62	0.60	0.88	4.22	0.40	-0.03	-0.24	0.85	3.19	13.75	0.01	501
GE	30.84%	-0.90	-1.13	10.47	2.37	17.41	-0.24	-6.04	0.54	0.59	4.45	0.48	-0.07	-1.28	0.72	4.27	30.13	0.04	1860
HD	30.48%	-0.91	-1.16	12.17	7.80	93.81	-0.33	-7.83	0.55	0.50	4.79	0.63	-0.14	-2.72	0.77	7.69	87.11	0.10	1789
IBM	26.61%	-1.37	-3.25	6.86	1.20	12.64	-0.34	-9.22	0.58	0.22	3.20	0.58	-0.15	-4.23	0.58	2.49	12.72	0.14	2920
JNJ	19.07%	-1.32	-2.74	5.82	2.77	22.95	-0.45	-7.97	0.64	0.20	3.96	0.77	-0.20	-3.60	0.71	5.18	43.54	0.17	1238
MCD	18.85%	-1.34	-3.40	4.69	1.66	25.99	-0.42	-9.44	0.50	0.70	3.82	0.86	-0.24	-5.62	0.50	3.09	17.52	0.31	1406
MRK	26.06%	-0.87	-1.58	8.06	2.69	22.61	-0.30	-6.73	0.63	0.32	2.98	0.51	-0.08	-1.83	0.69	2.36	10.92	0.07	2038
MET	34.99%	0.98	0.33	30.18	10.84	140.27	-0.23	-4.19	0.53	1.35	9.33	0.46	-0.02	-0.19	1.27	9.26	104.47	0.01	945
MSFT	32.20%	-0.89	-1.32	9.94	3.08	20.25	-0.25	-6.69	0.55	0.34	3.40	0.46	-0.09	-2.00	0.61	2.72	14.70	0.07	2441
MON	32.56%	-1.09	-0.84	13.47	5.18	42.88	-0.29	-6.34	0.50	0.53	4.08	0.60	-0.14	-2.77	0.55	2.84	13.45	0.14	1295
NKE	29.08%	-1.07	-1.34	9.93	2.59	16.35	-0.32	-6.33	0.61	0.41	3.37	0.57	-0.11	-1.90	0.70	2.87	13.94	0.08	1448
PFE	27.28%	-1.41	-3.25	6.10	1.89	12.99	-0.31	-6.69	0.56	-0.01	3.77	0.60	-0.14	-3.17	0.56	2.56	13.24	0.17	1442
PG	21.38%	0.83	0.47	18.83	8.20	75.15	-0.40	-6.45	0.69	1.04	5.99	0.55	-0.07	-0.50	1.44	7.25	62.90	0.01	1609
SBUX	33.55%	-0.47	-0.51	12.87	4.38	37.62	-0.27	-5.71	0.56	0.51	3.29	0.50	-0.09	-1.79	0.64	2.78	14.60	0.08	1530
TSLA	54.35%	-5.77	-2.20	22.92	1.65	6.88	-0.32	-4.62	0.60	0.30	2.72	0.58	-0.12	-1.77	0.60	1.82	6.38	0.12	732
VLO	38.84%	0.07	0.04	17.11	5.40	44.21	-0.18	-4.25	0.52	0.48	3.68	0.35	-0.04	-0.69	0.62	2.68	13.13	0.03	1747
VZ	22.19%	-1.36	-2.19	6.85	3.73	40.62	-0.34	-8.43	0.49	0.42	3.72	0.77	-0.19	-4.50	0.49	3.38	22.43	0.26	1399
WMT	24.47%	-1.18	-2.46	6.03	1.08	12.25	-0.36	-8.41	0.55	0.31	3.27	0.66	-0.18	-4.45	0.53	2.53	12.68	0.20	1882

Note: Entries refer to the time period from January 4th 1996 until July 29th 2015. RV and EV denote the realized and risk-neutral expected variance, respectively. EV is calculated based on linearly interpolated implied volatilities. Realized volatility is calculated from daily returns and annualized by $\sqrt{255/22}$. t-stat denotes the relevant t-statistics adjusted for serial correlation according to the method by Newey and West (1987) with a lag length of 22 days. Sample std., Skew, and Kurt denotes the sample standard deviation, skewness and kurtosis. Sharpe ratio is the annualized Sharpe ratio calculated as the annualized mean LVRP or RVRP divided by the corresponding sample standard deviation adjusted for serial dependence according to Newey and West (1987) with 22 lags and annualized by $\sqrt{255/22}$.

Table A 3 - Robustness regressions of raw variance swap returns on Fama-French and JUMP and VOL factors over the entire sample period

Ticker	LVRP as ln(RV/EV) alpha		RVRP as RV/EV-1 alpha		market		SMB		HML		JUMP		VOL		R²	N
SPX	-0.434	(-16.118)	-0.165	(-3.601)	-4.474	(-5.052)	0.559	(0.322)	0.119	(0.082)	2.553	(2.909)	2.800	(4.797)	61.07%	174
DJX	-0.383	(-11.902)	-0.126	(-2.569)	-7.386	(-4.721)	4.367	(2.244)	4.242	(2.084)	1.952	(3.400)	2.801	(3.670)	67.83%	125
NDX	-0.287	(-9.556)	-0.090	(-2.135)	-4.377	(-5.108)	0.222	(0.143)	0.748	(0.570)	2.033	(2.950)	2.112	(3.558)	54.76%	172
AA	-0.249	(-3.873)	-0.076	(-1.142)	-8.182	(-3.160)	-2.620	(-1.359)	3.126	(1.329)	0.664	(1.266)	0.281	(0.293)	55.22%	45
MO	-0.349	(-5.636)	-0.026	(-0.208)	-0.659	(-0.271)	-3.390	(-0.870)	-5.132	(-1.831)	0.283	(0.502)	2.595	(2.275)	4.93%	124
AMZN	-0.182	(-3.297)	0.099	(1.059)	0.509	(0.242)	-5.636	(-1.417)	-5.216	(-1.640)	1.245	(1.851)	2.339	(1.673)	12.34%	138
AXP	-0.103	(-2.354)	0.122	(1.665)	-3.336	(-2.310)	1.393	(0.473)	0.886	(0.441)	2.723	(2.681)	2.950	(2.633)	42.42%	110
AMGN	-0.281	(-6.494)	-0.093	(-2.025)	-3.172	(-2.683)	-0.047	(-0.025)	-1.038	(-0.625)	1.264	(4.350)	0.766	(1.220)	29.42%	129
ADI	-0.091	(-1.105)	0.015	(0.178)	-1.013	(-0.797)	-6.622	(-2.849)	-1.247	(-0.574)	0.833	(1.653)	0.021	(0.021)	39.33%	33
AAPL	-0.287	(-6.729)	-0.110	(-2.019)	-3.757	(-3.108)	0.728	(0.293)	1.703	(0.847)	1.856	(1.636)	0.781	(1.297)	33.07%	126
BAC	-0.074	(-1.288)	0.216	(2.108)	-8.062	(-3.855)	1.181	(0.343)	-4.798	(-1.418)	3.231	(2.218)	-1.578	(-0.979)	48.86%	76
BA	-0.167	(-4.057)	-0.020	(-0.394)	-3.212	(-2.982)	-1.993	(-0.949)	-0.925	(-0.651)	0.777	(3.030)	0.707	(0.675)	24.28%	119
CSCO	-0.204	(-3.662)	0.055	(0.722)	-3.949	(-3.672)	3.039	(1.232)	0.940	(0.621)	1.860	(2.536)	1.873	(2.466)	31.66%	97
XOM	-0.260	(-5.986)	-0.013	(-0.144)	-6.571	(-1.918)	2.457	(1.145)	-1.139	(-0.477)	1.631	(2.577)	3.479	(3.150)	43.25%	105
FB	-0.367	(-4.911)	-0.304	(-3.445)	1.150	(0.206)	7.012	(1.244)	5.216	(1.527)	1.088	(1.739)	-7.691	(-2.118)	26.23%	23
GE	-0.174	(-3.739)	0.034	(0.475)	-3.272	(-2.434)	0.227	(0.073)	1.190	(0.558)	3.064	(2.167)	1.698	(1.896)	41.36%	96
HD	-0.233	(-5.041)	-0.051	(-0.944)	-1.996	(-2.159)	-2.587	(-1.419)	0.684	(0.785)	1.162	(3.178)	2.235	(3.065)	38.19%	99
IBM	-0.291	(-7.851)	-0.108	(-2.815)	-2.129	(-3.062)	-0.956	(-0.677)	0.004	(0.003)	1.348	(4.329)	2.075	(3.478)	38.02%	155
JNJ	-0.364	(-5.664)	-0.160	(-2.764)	-1.081	(-1.145)	-2.993	(-1.878)	-0.105	(-0.071)	1.054	(2.611)	2.365	(2.513)	41.04%	70
MCD	-0.388	(-8.120)	-0.196	(-3.485)	-3.778	(-1.944)	1.743	(0.848)	1.569	(0.621)	0.408	(1.731)	2.638	(3.057)	39.54%	80
MRK	-0.240	(-4.024)	-0.003	(-0.042)	-1.250	(-1.145)	-0.600	(-0.352)	2.015	(1.252)	1.554	(3.122)	1.547	(1.497)	22.02%	110
MET	-0.102	(-2.208)	0.317	(1.539)	-15.178	(-2.248)	17.978	(1.591)	16.453	(1.607)	6.221	(2.157)	1.261	(0.575)	57.41%	60
MSFT	-0.180	(-4.252)	-0.003	(-0.057)	-3.797	(-3.333)	-1.564	(-1.062)	-0.323	(-0.229)	1.064	(1.860)	0.330	(0.428)	24.40%	126
MON	-0.214	(-4.818)	-0.055	(-1.043)	-2.943	(-2.152)	0.875	(0.430)	-0.326	(-0.198)	1.071	(3.237)	2.283	(2.783)	39.74%	84
NKE	-0.193	(-2.601)	0.082	(0.764)	-4.042	(-1.719)	0.269	(0.104)	-2.670	(-1.007)	1.079	(1.763)	3.408	(3.120)	30.42%	74
PFE	-0.186	(-3.579)	-0.024	(-0.421)	-1.257	(-1.377)	0.105	(0.054)	-1.323	(-0.988)	1.478	(4.156)	1.938	(2.646)	24.77%	77
PG	-0.356	(-6.208)	-0.016	(-0.124)	1.644	(0.332)	-24.948	(-1.632)	6.460	(1.389)	0.996	(1.885)	2.895	(1.852)	38.85%	87
SBUX	-0.232	(-3.849)	-0.026	(-0.323)	-3.953	(-2.921)	-0.389	(-0.177)	-1.995	(-1.061)	0.455	(1.349)	1.095	(0.586)	19.33%	88
TSLA	-0.337	(-3.351)	-0.141	(-1.621)	-1.026	(-0.468)	8.101	(1.554)	-1.058	(-0.168)	-0.105	(-0.237)	1.193	(0.849)	8.81%	43
VLO	-0.151	(-2.968)	0.025	(0.404)	-5.340	(-3.349)	4.189	(1.661)	2.114	(0.965)	1.097	(1.919)	0.537	(0.506)	25.86%	112
VZ	-0.225	(-4.053)	-0.039	(-0.628)	-4.014	(-2.237)	1.070	(0.512)	1.517	(0.924)	1.062	(2.661)	2.693	(3.172)	49.81%	79
WMT	-0.320	(-6.407)	-0.120	(-2.279)	-3.048	(-2.913)	-2.965	(-1.707)	0.076	(0.058)	0.716	(2.142)	0.986	(1.203)	27.46%	106
AEX	-0.311	-5.383	-0.155	(-2.239)	5.126	(1.489)	-0.036	(-0.895)	-0.094	(-2.020)	3.275	(2.506)	7.806	(2.752)	72.45%	21
CAC	0.000	0.000	-	-	-	-	-	-	-	-	-	-	-	-	-	0
DAX	-0.257	-5.038	-0.043	(-0.612)	-7.133	(-3.350)	-0.035	(-0.883)	0.015	(0.453)	1.924	(3.271)	3.194	(3.014)	71.80%	40
ESX	-0.212	-2.876	-0.019	(-0.245)	-2.940	(-0.786)	0.008	(0.149)	-0.074	(-2.372)	1.599	(1.382)	3.985	(1.865)	74.93%	21
SMI	0.000	0.000	-	-	-	-	-	-	-	-	-	-	-	-	-	0

Note: Entries refer to data over the entire time horizon from January 4th 1996 to July 29th 2015 and report the OLS-estimates and t-statistics (in parentheses) of non-overlapping regressions of 22-day raw variance swap returns, defined as $RV_{0,T}/E_t^{\mathbb{Q}}[RV_{0,T}] - 1$, on the corresponding excess return on the market portfolio and the two additional factors, SMB and HML, identified by Fama and French (1993), as well as on the jump-risk mimicking portfolio JUMP and the VOL factor. For the US, the market portfolio is proxied by the 22-day return on the value-weighted portfolio of all stocks traded at the NYSE, NASDAQ, and AMEX. For the European indices, the market excess return refers to the excess return on a proxy for a European market portfolio taken from Kenneth French's website. t-statistics are not adjusted for serial correlation. N denotes the total number of observations. In order to allow direct comparisons, the second and third column show the regression intercepts and corresponding t-statistics for the same regression specification with LVRP as dependent variable.

Table A 4 - Robustness regressions of raw variance swap returns on Fama-French and JUMP and VOL factors over the period from January 1996 until December 2007

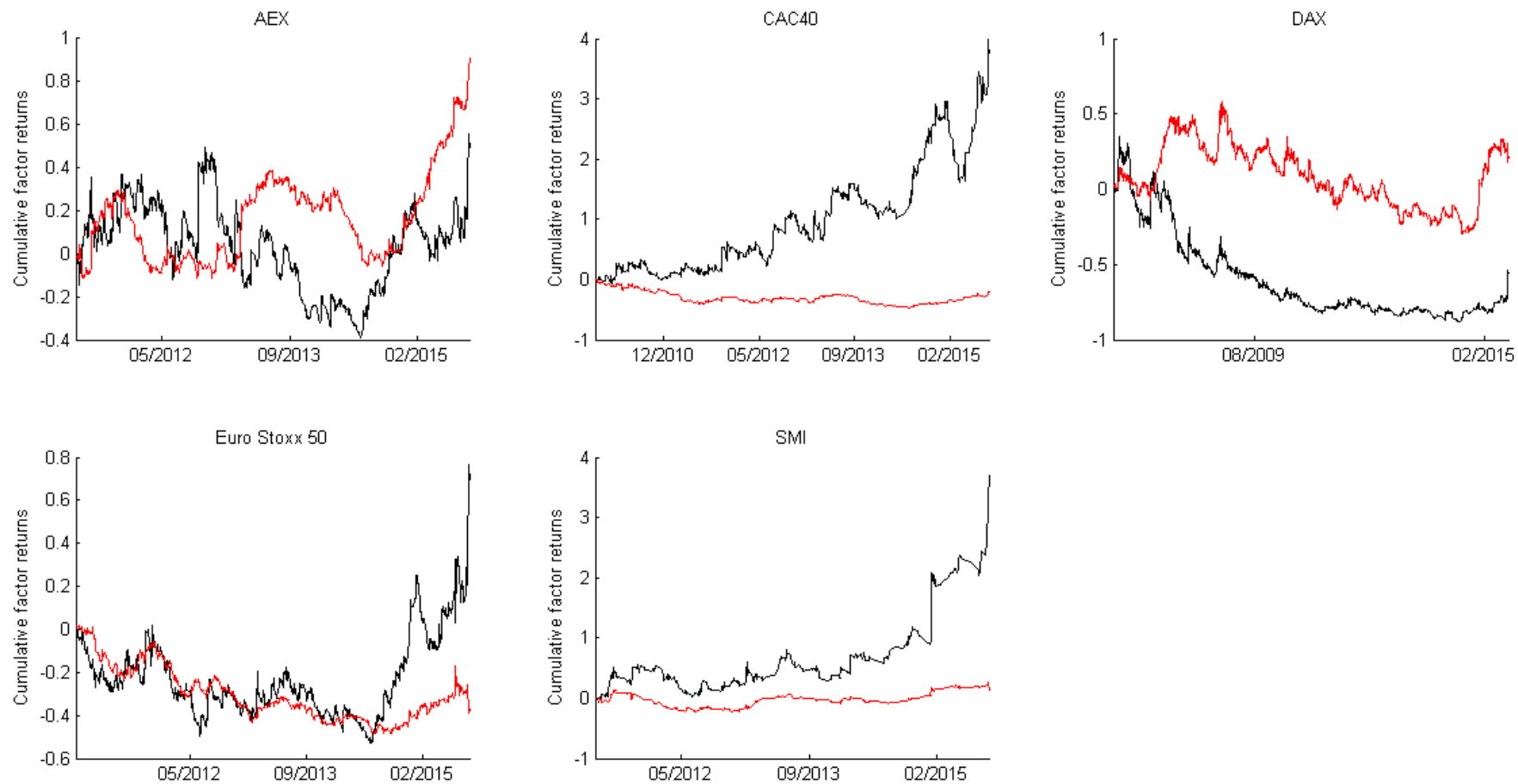| Ticker	LVRP as ln(RV/EV) alpha		RVRP as RV/EV-1 alpha		market		SMB		HML		JUMP		VOL		R^2	N
SPX	-0.421	(-11.771)	-0.227	(-8.194)	-4.106	(-5.709)	-2.667	(-2.230)	-2.280	(-1.970)	1.525	(6.069)	1.925	(4.323)	70.54%	101
DJX	-0.409	(-7.471)	-0.250	(-6.924)	-4.163	(-2.684)	0.665	(0.401)	-1.425	(-0.832)	1.324	(6.377)	1.222	(3.635)	67.13%	52
NDX	-0.239	(-5.374)	-0.119	(-2.628)	-3.504	(-2.782)	-1.865	(-1.577)	-0.619	(-0.557)	1.072	(3.048)	1.319	(1.937)	43.15%	100
AA	-0.446	(-2.550)	-0.411	(-2.699)	-12.787	(-3.175)	-17.150	(-3.630)	-8.955	(-1.527)	-2.371	(-1.465)	-1.096	(-0.448)	68.85%	15
MO	-0.414	(-3.915)	-0.007	(-0.033)	1.447	(0.630)	-6.640	(-1.136)	-6.585	(-1.260)	-0.779	(-0.830)	2.538	(1.800)	4.28%	64
AMZN	-0.115	(-1.345)	0.251	(1.726)	1.214	(0.311)	-8.909	(-1.295)	-10.194	(-1.672)	0.010	(0.009)	2.295	(1.008)	7.63%	65
AXP	0.019	(0.249)	0.205	(1.603)	-4.256	(-0.934)	-3.808	(-0.621)	-5.075	(-1.050)	2.230	(1.234)	2.528	(1.687)	28.81%	41
AMGN	-0.200	(-2.856)	-0.063	(-0.830)	-3.768	(-1.891)	-1.928	(-1.172)	-3.536	(-1.401)	1.256	(2.492)	-0.929	(-0.700)	26.23%	58
ADI	-0.021	(-0.245)	0.096	(1.179)	-2.205	(-0.717)	-10.374	(-2.195)	-4.929	(-0.968)	-0.735	(-0.559)	0.276	(0.148)	43.24%	15
AAPL	-0.151	(-2.174)	-0.040	(-0.550)	-5.632	(-2.718)	-3.978	(-2.137)	-4.365	(-1.786)	0.313	(0.930)	-0.241	(-0.253)	23.17%	53
BAC	-0.155	(-1.408)	-0.013	(-0.120)	-3.373	(-2.021)	-2.916	(-1.535)	-5.116	(-2.916)	0.722	(0.800)	-0.852	(-0.491)	22.97%	33
BA	-0.115	(-1.942)	-0.008	(-0.111)	-1.959	(-1.302)	-5.904	(-1.484)	-3.935	(-1.270)	1.266	(3.242)	-1.856	(-1.550)	28.06%	46
CSCO	-0.102	(-1.334)	0.014	(0.198)	-1.913	(-0.672)	-0.356	(-0.154)	-0.283	(-0.117)	0.828	(1.750)	0.033	(0.046)	9.33%	31
XOM	-0.175	(-4.184)	-0.093	(-2.800)	-2.115	(-0.890)	-1.003	(-0.349)	-1.520	(-0.488)	0.586	(1.600)	0.919	(0.643)	20.88%	33
FB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
GE	-0.124	(-2.660)	-0.014	(-0.227)	-5.514	(-1.659)	-7.287	(-1.396)	-5.267	(-1.180)	0.044	(0.038)	-0.055	(-0.053)	32.21%	37
HD	-0.027	(-0.517)	0.097	(1.368)	-5.141	(-1.384)	-8.920	(-1.614)	-5.154	(-1.106)	-0.952	(-0.568)	0.011	(0.009)	34.44%	30
IBM	-0.237	(-3.353)	-0.065	(-0.935)	-1.526	(-1.407)	-0.613	(-0.431)	-0.063	(-0.040)	1.560	(2.899)	2.118	(3.170)	28.71%	82
JNJ	-0.281	(-3.116)	-0.125	(-1.255)	-2.921	(-2.386)	-5.774	(-4.258)	-3.207	(-2.749)	1.273	(2.241)	-0.827	(-0.323)	39.93%	19
MCD	-0.721	(-9.451)	-0.473	(-9.419)	-66.992	(-2.847)	97.753	(2.432)	-45.191	(-2.915)	-3.570	(-2.311)	-5.931	(-4.417)	83.60%	7
MRK	-0.032	(-0.376)	0.162	(1.676)	-2.239	(-1.411)	-0.678	(-0.274)	-0.182	(-0.077)	2.435	(4.274)	0.416	(0.242)	25.56%	41
MET	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
MSFT	-0.168	(-3.323)	-0.067	(-1.385)	-2.385	(-1.942)	-3.797	(-2.810)	-0.346	(-0.259)	0.568	(1.514)	-0.349	(-0.560)	31.26%	53
MON	0.061	(0.939)	0.183	(1.775)	-24.978	(-2.436)	1.780	(0.365)	-9.218	(-3.831)	-0.941	(-1.224)	-6.684	(-2.863)	67.07%	11
NKE	-0.316	(-3.366)	-0.179	(-2.527)	0.833	(0.439)	-3.483	(-1.255)	-5.504	(-2.329)	0.296	(0.418)	0.824	(0.694)	24.86%	20
PFE	0.002	(0.025)	0.163	(1.562)	-0.223	(-0.075)	1.543	(0.466)	-0.386	(-0.114)	1.722	(3.584)	1.688	(1.369)	9.91%	32
PG	-0.302	(-1.065)	0.304	(0.583)	8.140	(1.108)	-32.591	(-2.919)	8.282	(1.377)	2.730	(1.322)	3.347	(1.018)	54.78%	20
SBUX	-0.315	(-1.669)	-0.126	(-0.963)	-2.519	(-0.695)	-2.659	(-0.583)	-4.030	(-1.093)	0.234	(0.619)	-3.251	(-2.948)	24.33%	20
TSLA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
VLO	-0.281	(-3.524)	-0.164	(-2.202)	0.922	(0.322)	-8.001	(-2.600)	-3.877	(-1.358)	0.539	(1.451)	-2.590	(-5.741)	17.02%	42
VZ	-0.026	(-0.124)	0.094	(0.527)	-0.822	(-0.666)	-3.531	(-3.452)	-0.612	(-0.645)	0.749	(0.796)	9.434	(5.062)	66.93%	9
WMT	-0.107	(-1.141)	0.031	(0.295)	-3.107	(-1.466)	-2.817	(-1.510)	-1.094	(-0.531)	1.546	(1.969)	-0.450	(-0.259)	30.31%	36
AEX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
CAC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
DAX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ESX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
SMI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0

Note: Entries refer to data over the time horizon from January 4th 1996 to December 31st 2007 and report the OLS-estimates and t-statistics (in parentheses) of non-overlapping regressions of 22-day raw variance swap returns, defined as $RV_{0,T}/E_t^{\mathbb{Q}}[RV_{0,T}] - 1$, on the corresponding excess return on the market portfolio and the two additional factors, SMB and HML, identified by Fama and French (1993), as well as on the jump-risk mimicking portfolio JUMP and the VOL factor. For the US, the market excess return is proxied by the 22-day excess return on the value-weighted portfolio of all stocks traded at the NYSE, NASDAQ, and AMEX. t-statistics are not adjusted for serial correlation. N denotes the total number of observations. In order to allow direct comparisons, the second and third column show the regression intercepts and corresponding t-statistics for the same regression specification with LVRP as dependent variable.

Table A 5 - Robustness regressions of raw variance swap returns on Fama-French and JUMP and VOL over the period after January 2008

	LVRP as ln(RV/EV)		RVRP as RV/EV-1												
Ticker	alpha		alpha		market		SMB		HML		JUMP		VOL		R²	N
SPX	-0.434	(-10.219)	-0.068	(-0.876)	-8.012	(-3.492)	5.358	(1.669)	6.519	(2.223)	3.053	(2.954)	3.252	(2.398)	68.68%	73
DJX	-0.367	(-9.030)	-0.059	(-0.981)	-7.844	(-4.011)	5.284	(2.056)	5.472	(2.351)	2.265	(3.778)	3.176	(3.070)	72.39%	73
NDX	-0.343	(-8.855)	-0.038	(-0.718)	-7.475	(-5.037)	2.939	(1.255)	6.107	(2.463)	2.554	(3.473)	2.425	(2.023)	69.62%	72
AA	-0.192	(-3.495)	-0.025	(-0.372)	-6.751	(-3.100)	1.724	(0.385)	-0.737	(-0.233)	0.887	(2.679)	0.941	(0.965)	65.07%	30
MO	-0.303	(-4.186)	-0.067	(-0.918)	-7.146	(-2.581)	6.430	(2.149)	2.363	(0.990)	0.929	(3.141)	1.349	(1.149)	43.97%	60
AMZN	-0.250	(-4.274)	-0.037	(-0.608)	-1.434	(-1.012)	-2.717	(-1.053)	-1.287	(-0.447)	1.852	(3.238)	1.561	(1.760)	43.23%	73
AXP	-0.177	(-3.550)	0.062	(0.924)	-6.423	(-4.722)	6.073	(2.321)	6.681	(2.558)	2.573	(2.666)	1.985	(1.220)	56.84%	69
AMGN	-0.319	(-4.746)	-0.086	(-1.282)	-4.685	(-2.456)	0.833	(0.371)	2.824	(1.153)	1.057	(2.879)	1.375	(1.863)	36.43%	71
ADI	-0.095	(-1.869)	-0.038	(-0.868)	-2.185	(-1.269)	-2.766	(-0.514)	-1.336	(-0.705)	1.595	(6.520)	-0.329	(-0.252)	43.88%	18
AAPL	-0.373	(-7.284)	-0.123	(-1.998)	-5.425	(-4.200)	2.565	(0.958)	6.756	(2.037)	2.447	(1.835)	0.270	(0.309)	45.32%	73
BAC	-0.039	(-0.578)	0.300	(2.201)	-16.543	(-7.021)	1.478	(0.360)	5.615	(0.921)	3.382	(2.862)	-4.700	(-2.811)	64.98%	43
BA	-0.192	(-4.370)	-0.018	(-0.336)	-5.748	(-4.317)	2.651	(1.411)	1.997	(1.012)	0.393	(1.440)	1.922	(1.259)	37.66%	73
CSCO	-0.235	(-4.639)	0.070	(0.865)	-7.238	(-4.532)	8.714	(1.598)	5.525	(2.614)	1.608	(2.038)	3.091	(2.403)	43.55%	66
XOM	-0.283	(-5.962)	0.055	(0.493)	-10.519	(-2.198)	5.001	(1.429)	5.849	(1.744)	1.702	(3.860)	4.041	(3.472)	53.85%	72
FB	-0.367	-6.826	-0.304	(-5.874)	1.150	(0.250)	7.012	(1.113)	5.216	(1.596)	1.088	(1.833)	-7.691	(-2.199)	26.23%	23
GE	-0.194	(-3.115)	0.080	(0.920)	-5.712	(-3.658)	3.685	(0.854)	6.382	(2.116)	3.535	(2.785)	1.094	(0.797)	53.44%	59
HD	-0.328	(-7.568)	-0.133	(-3.449)	-2.451	(-2.751)	-0.449	(-0.300)	2.279	(2.051)	1.467	(8.513)	1.805	(2.372)	53.15%	69
IBM	-0.346	(-7.446)	-0.147	(-3.266)	-3.374	(-2.959)	-0.918	(-0.500)	1.951	(1.013)	1.208	(2.984)	1.781	(1.645)	49.61%	73
JNJ	-0.334	(-5.043)	-0.134	(-3.141)	-2.505	(-1.882)	-0.920	(-0.554)	3.465	(1.572)	0.881	(1.872)	2.959	(3.560)	49.88%	51
MCD	-0.347	(-8.947)	-0.155	(-3.637)	-5.356	(-2.923)	1.297	(0.686)	5.164	(2.674)	0.182	(0.664)	2.561	(3.213)	47.61%	73
MRK	-0.320	(-5.242)	-0.064	(-0.809)	-2.084	(-1.215)	1.060	(0.378)	3.855	(1.562)	1.372	(2.647)	1.709	(1.250)	22.68%	69
MET	-0.102	-2.157	0.317	(1.614)	-15.178	(-1.973)	17.978	(1.533)	16.453	(1.935)	6.221	(2.089)	1.261	(0.469)	57.41%	60
MSFT	-0.181	(-2.609)	0.047	(0.585)	-6.858	(-3.148)	3.776	(1.478)	2.444	(0.996)	0.933	(1.497)	0.961	(0.807)	29.79%	73
MON	-0.246	(-5.600)	-0.077	(-1.576)	-2.712	(-2.039)	2.049	(0.883)	-0.841	(-0.478)	1.090	(3.112)	2.400	(2.711)	40.18%	73
NKE	-0.102	(-1.488)	0.224	(2.203)	-8.780	(-3.171)	5.481	(1.323)	5.964	(1.626)	1.075	(1.378)	3.474	(3.326)	41.49%	54
PFE	-0.309	(-4.643)	-0.149	(-3.064)	-1.447	(-1.525)	-1.648	(-0.799)	-0.916	(-0.546)	1.508	(5.004)	1.771	(2.193)	56.14%	45
PG	-0.365	(-5.794)	-0.135	(-1.619)	-5.958	(-1.824)	1.848	(0.653)	3.393	(1.847)	0.462	(1.869)	2.165	(2.800)	38.96%	67
SBUX	-0.223	(-5.022)	-0.012	(-0.196)	-4.885	(-2.987)	1.270	(0.505)	1.695	(0.742)	0.343	(0.775)	2.187	(0.972)	27.23%	68
TSLA	-0.337	-4.944	-0.141	(-2.566)	-1.026	(-0.609)	8.101	(2.085)	-1.058	(-0.170)	-0.105	(-0.285)	1.193	(0.966)	8.81%	43
VLO	-0.118	(-1.966)	0.088	(1.387)	-5.524	(-3.089)	7.220	(2.292)	2.020	(0.724)	1.522	(2.846)	1.531	(1.137)	41.09%	70
VZ	-0.235	(-4.835)	-0.049	(-0.897)	-4.769	(-2.279)	1.229	(0.485)	2.984	(1.643)	1.113	(3.975)	2.318	(3.168)	52.13%	70
WMT	-0.410	(-7.141)	-0.180	(-3.072)	-4.534	(-3.007)	-1.450	(-0.563)	2.509	(1.522)	0.336	(1.321)	1.487	(1.605)	31.12%	70
AEX	-0.311	-5.383	-0.155	-2.239	5.126	1.489	-0.036	-0.895	-0.094	-2.020	3.275	2.506	7.806	2.752	0.725	21
CAC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
DAX	-0.245	-4.375	-0.014	-0.169	-6.879	-3.466	-0.075	-2.092	-0.008	-0.254	1.893	3.047	3.203	2.671	0.757	31
ESX	-0.212	-2.876	-0.019	-0.245	-2.940	-0.786	0.008	0.149	-0.074	-2.372	1.599	1.382	3.985	1.865	0.749	21
SMI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0

Note: Entries refer to data over the time horizon from January 1st 2008 to July 29th 2015 for the US underlyings and from January 2008 to August 2015 for the European underlyings, and report the OLS-estimates and t-statistics (in parentheses) of non-overlapping regressions of 22-day raw variance swap returns, defined as $RV_{0,T}/E_t^{\mathbb{Q}}[RV_{0,T}] - 1$, on the corresponding excess return on the market portfolio and the two additional factors, SMB and HML, identified by Fama and French (1993), as well as on the jump-risk mimicking portfolio JUMP and the VOL factor. For the US, the market excess return is proxied by the 22-day excess return on the value-weighted portfolio of all stocks traded at the NYSE, NASDAQ, and AMEX. For the European indices, the market excess return refers to the return on a proxy for a European market portfolio taken from Kenneth French's website. t-statistics are not adjusted for serial correlation. N denotes the total number of observations. In order to allow direct comparisons, the second and third column show the regression intercepts and corresponding t-statistics for the same regression specification with LVRP as dependent variable.

Figure A 1 - Cumulative daily returns on European risk-factor-mimicking portfolios

Note: The black lines show the cumulative daily returns on the jump-risk mimicking portfolios JUMP (calculated from discrete returns). The red lines show the cumulative daily returns on the VOL factor over the same period.