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BACHELOR THESIS

**Do crypto-currencies form a new asset
class?**

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Academic Year: 2014/2015

Appendix A

Tables

Table A.1: Correlogram for **BTC!**

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.1198 | 0.1204 | 19.206 | 0.0000 |
| 2 | 0.0137 | 0.0002 | 19.458 | 0.0001 |
| 3 | -0.0625 | -0.0679 | 24.691 | 0.0000 |
| 4 | 0.0696 | 0.0875 | 31.184 | 0.0000 |
| 5 | 0.0632 | 0.0532 | 36.554 | 0.0000 |
| 6 | 0.0538 | 0.0341 | 40.44 | 0.0000 |
| 7 | -0.0594 | -0.0641 | 45.182 | 0.0000 |

Table A.2: Correlogram for **XRP!**

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | -0.2950 | -0.3003 | 39.6 | 0.0000 |
| 2 | 0.0101 | -0.0683 | 39.646 | 0.0000 |
| 3 | -0.0649 | -0.0910 | 41.573 | 0.0000 |
| 4 | 0.0056 | -0.0525 | 41.587 | 0.0000 |
| 5 | 0.0575 | 0.0412 | 43.104 | 0.0000 |
| 6 | -0.0401 | -0.0084 | 43.845 | 0.0000 |
| 7 | 0.0284 | 0.0419 | 44.216 | 0.0000 |

Table A.3: Correlogram for **EUR!**

| Lag | AC | PAC | Q | Prob > Q |
|------------|-----------|------------|----------|--------------------|
| 1 | -0.0760 | -0.0762 | 7.3229 | 0.0068 |
| 2 | -0.0001 | -0.0058 | 7.3229 | 0.0257 |
| 3 | 0.0180 | 0.0176 | 7.7318 | 0.0519 |
| 4 | -0.0134 | -0.0104 | 7.9592 | 0.0931 |
| 5 | -0.0338 | -0.0372 | 9.4101 | 0.0938 |
| 6 | 0.0363 | 0.0338 | 11.082 | 0.0859 |
| 7 | -0.0062 | -0.0032 | 11.132 | 0.1330 |

Table A.4: Correlogram for **SP500!**

| Lag | AC | PAC | Q | Prob > Q |
|------------|-----------|------------|----------|--------------------|
| 1 | -0.0385 | -0.0502 | 1.098 | 0.2947 |
| 2 | 0.0146 | 0.0228 | 1.2568 | 0.5334 |
| 3 | 0.0346 | 0.1189 | 2.1437 | 0.5431 |
| 4 | -0.0005 | . | 2.1438 | 0.7093 |
| 5 | -0.0962 | . | 9.0343 | 0.1077 |
| 6 | 0.0155 | . | 9.2131 | 0.1619 |
| 7 | -0.1510 | . | 26.217 | 0.0005 |

Table A.5: Skewness-Kurtosis Test for **SP500!**

| Variable | Obs | Pr(Skewness) | Pr(Kurtosis) | adj χ^2 (2) | Prob > χ^2 |
|----------------------------|------------|---------------------|---------------------|------------------------------------|--------------------------------------|
| two-day log. return | 276 | 0.0000 | 0.0000 | 35.80 | 0.0000 |
| four-day log. return | 139 | 0.0001 | 0.0000 | 28.61 | 0.0000 |
| eight-day log. return | 92 | 0.0006 | 0.0056 | 15.55 | 0.0004 |
| sixteen-day log. return | 35 | 0.0917 | 0.2592 | 4.26 | 0.1187 |
| thirty-two-day log. return | 17 | 0.0197 | 0.0931 | 7.20 | 0.0273 |

Table A.6: Correlogram for **EUR!**'s Absolute Values

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.2334 | 0.2340 | 68.992 | 0.0000 |
| 2 | -0.0075 | -0.0658 | 69.064 | 0.0000 |
| 3 | -0.0479 | -0.0330 | 71.979 | 0.0000 |
| 4 | -0.0491 | -0.0323 | 75.037 | 0.0000 |
| 5 | -0.0037 | 0.0144 | 75.055 | 0.0000 |
| 6 | 0.1258 | 0.1270 | 95.195 | 0.0000 |
| 7 | 0.2378 | 0.2163 | 167.18 | 0.0000 |
| 8 | 0.1102 | 0.0609 | 182.64 | 0.0000 |
| 9 | -0.0204 | -0.0474 | 183.17 | 0.0000 |
| 10 | -0.0342 | 0.0004 | 184.66 | 0.0000 |
| 11 | -0.0554 | -0.0395 | 188.57 | 0.0000 |
| 12 | -0.0629 | -0.0655 | 193.63 | 0.0000 |
| 13 | 0.0971 | 0.0972 | 205.7 | 0.0000 |
| 14 | 0.2282 | 0.2057 | 272.36 | 0.0000 |
| 15 | 0.1282 | 0.0487 | 293.43 | 0.0000 |
| 16 | -0.0114 | -0.0361 | 293.6 | 0.0000 |
| 17 | -0.0454 | -0.0331 | 296.24 | 0.0000 |
| 18 | -0.0586 | -0.0191 | 300.65 | 0.0000 |
| 19 | -0.0340 | 0.0067 | 302.14 | 0.0000 |
| 20 | 0.1060 | 0.0865 | 316.6 | 0.0000 |
| 21 | 0.2447 | 0.1915 | 393.7 | 0.0000 |
| 22 | 0.0966 | -0.0103 | 405.71 | 0.0000 |
| 23 | 0.0000 | 0.0181 | 405.71 | 0.0000 |
| 24 | -0.0258 | 0.0059 | 406.57 | 0.0000 |
| 25 | -0.0282 | 0.0389 | 407.59 | 0.0000 |
| 26 | -0.0581 | -0.0658 | 411.96 | 0.0000 |
| 27 | 0.1108 | 0.1029 | 427.84 | 0.0000 |
| 28 | 0.2115 | 0.1029 | 485.77 | 0.0000 |
| 29 | 0.1103 | 0.0197 | 501.52 | 0.0000 |
| 30 | 0.0218 | 0.0370 | 502.14 | 0.0000 |

Table A.7: Correlogram for **EUR!**'s Squared Values

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.4004 | 0.4006 | 203.17 | 0.0000 |
| 2 | -0.0032 | -0.1949 | 203.19 | 0.0000 |
| 3 | -0.0092 | 0.0872 | 203.29 | 0.0000 |
| 4 | -0.0025 | -0.0422 | 203.3 | 0.0000 |
| 5 | 0.0049 | 0.0264 | 203.33 | 0.0000 |
| 6 | 0.0391 | 0.0327 | 205.28 | 0.0000 |
| 7 | 0.0386 | 0.0106 | 207.17 | 0.0000 |
| 8 | 0.0126 | 0.0088 | 207.38 | 0.0000 |
| 9 | -0.0031 | -0.0219 | 207.39 | 0.0000 |
| 10 | -0.0014 | 0.0095 | 207.39 | 0.0000 |
| 11 | -0.0057 | -0.0306 | 207.43 | 0.0000 |
| 12 | -0.0081 | -0.0265 | 207.52 | 0.0000 |
| 13 | 0.0131 | 0.0789 | 207.74 | 0.0000 |
| 14 | 0.0255 | 0.0838 | 208.57 | 0.0000 |
| 15 | 0.0246 | 0.0726 | 209.35 | 0.0000 |
| 16 | -0.0016 | -0.0574 | 209.35 | 0.0000 |
| 17 | -0.0021 | 0.0208 | 209.36 | 0.0000 |
| 18 | -0.0060 | -0.0367 | 209.4 | 0.0000 |
| 19 | -0.0074 | -0.0147 | 209.47 | 0.0000 |
| 20 | 0.0291 | 0.1585 | 210.57 | 0.0000 |
| 21 | 0.0456 | 0.1344 | 213.24 | 0.0000 |
| 22 | 0.0135 | -0.0352 | 213.47 | 0.0000 |
| 23 | 0.0008 | 0.0300 | 213.47 | 0.0000 |
| 24 | 0.0044 | 0.0225 | 213.5 | 0.0000 |
| 25 | -0.0010 | -0.0101 | 213.5 | 0.0000 |
| 26 | -0.0123 | -0.0694 | 213.7 | 0.0000 |
| 27 | 0.0205 | 0.1353 | 214.24 | 0.0000 |
| 28 | 0.0259 | 0.0031 | 215.1 | 0.0000 |
| 29 | 0.0162 | 0.0520 | 215.45 | 0.0000 |
| 30 | 0.0042 | -0.0084 | 215.47 | 0.0000 |

Table A.8: Correlogram for **EUR!**'s Absolute Values (adjusted)

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.1795 | 0.1995 | 35.037 | 0.0000 |
| 2 | 0.0233 | -0.0300 | 35.629 | 0.0000 |
| 3 | 0.0314 | 0.0334 | 36.702 | 0.0000 |
| 4 | 0.0171 | 0.0309 | 37.021 | 0.0000 |
| 5 | 0.0331 | 0.0153 | 38.215 | 0.0000 |
| 6 | 0.0676 | . | 43.207 | 0.0000 |
| 7 | 0.1836 | . | 80.08 | 0.0000 |
| 8 | 0.0520 | . | 83.039 | 0.0000 |
| 9 | 0.0162 | . | 83.329 | 0.0000 |
| 10 | 0.0332 | . | 84.54 | 0.0000 |
| 11 | 0.0169 | . | 84.853 | 0.0000 |
| 12 | -0.0279 | . | 85.709 | 0.0000 |
| 13 | 0.0409 | . | 87.553 | 0.0000 |
| 14 | 0.1748 | . | 121.21 | 0.0000 |
| 15 | 0.0684 | . | 126.37 | 0.0000 |
| 16 | 0.0238 | . | 126.99 | 0.0000 |
| 17 | 0.0144 | . | 127.22 | 0.0000 |
| 18 | 0.0088 | . | 127.31 | 0.0000 |
| 19 | 0.0021 | . | 127.31 | 0.0000 |
| 20 | 0.0476 | . | 129.82 | 0.0000 |
| 21 | 0.1912 | . | 170.34 | 0.0000 |
| 22 | 0.0336 | . | 171.59 | 0.0000 |
| 23 | 0.0395 | . | 173.33 | 0.0000 |
| 24 | 0.0367 | . | 174.83 | 0.0000 |
| 25 | 0.0408 | . | 176.68 | 0.0000 |
| 26 | -0.0223 | . | 177.23 | 0.0000 |
| 27 | 0.0545 | . | 180.55 | 0.0000 |
| 28 | 0.1568 | . | 207.98 | 0.0000 |
| 29 | 0.0529 | . | 211.1 | 0.0000 |
| 30 | 0.0531 | . | 214.25 | 0.0000 |

Table A.9: Correlogram for **EUR!**'s Squared Values (adjusted)

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.3945 | 0.3986 | 169.36 | 0.0000 |
| 2 | -0.0033 | -0.2090 | 169.38 | 0.0000 |
| 3 | 0.0047 | 0.2074 | 169.4 | 0.0000 |
| 4 | 0.0097 | 0.0115 | 169.5 | 0.0000 |
| 5 | 0.0051 | 0.0042 | 169.53 | 0.0000 |
| 6 | 0.0307 | . | 170.56 | 0.0000 |
| 7 | 0.0321 | . | 171.69 | 0.0000 |
| 8 | 0.0048 | . | 171.71 | 0.0000 |
| 9 | -0.0018 | . | 171.72 | 0.0000 |
| 10 | 0.0087 | . | 171.8 | 0.0000 |
| 11 | 0.0040 | . | 171.82 | 0.0000 |
| 12 | -0.0064 | . | 171.86 | 0.0000 |
| 13 | 0.0058 | . | 171.9 | 0.0000 |
| 14 | 0.0196 | . | 172.32 | 0.0000 |
| 15 | 0.0165 | . | 172.62 | 0.0000 |
| 16 | -0.0007 | . | 172.62 | 0.0000 |
| 17 | 0.0067 | . | 172.67 | 0.0000 |
| 18 | 0.0033 | . | 172.68 | 0.0000 |
| 19 | -0.0062 | . | 172.72 | 0.0000 |
| 20 | 0.0218 | . | 173.25 | 0.0000 |
| 21 | 0.0398 | . | 175.01 | 0.0000 |
| 22 | 0.0056 | . | 175.04 | 0.0000 |
| 23 | 0.0028 | . | 175.05 | 0.0000 |
| 24 | 0.0137 | . | 175.26 | 0.0000 |
| 25 | 0.0086 | . | 175.34 | 0.0000 |
| 26 | -0.0112 | . | 175.48 | 0.0000 |
| 27 | 0.0133 | . | 175.68 | 0.0000 |
| 28 | 0.0201 | . | 176.13 | 0.0000 |
| 29 | 0.0087 | . | 176.21 | 0.0000 |
| 30 | 0.0047 | . | 176.24 | 0.0000 |

Table A.10: Correlogram for **SP500!**'s Absolute Values

| Lag | AC | PAC | Q | Prob $> Q$ |
|-----|--------|--------|--------|------------|
| 1 | 0.1792 | 0.2234 | 23.773 | 0.0000 |
| 2 | 0.1912 | 0.3682 | 50.873 | 0.0000 |
| 3 | 0.0518 | 0.1078 | 52.865 | 0.0000 |
| 4 | 0.0659 | . | 56.092 | 0.0000 |
| 5 | 0.1465 | . | 72.053 | 0.0000 |
| 6 | 0.1885 | . | 98.522 | 0.0000 |
| 7 | 0.2558 | . | 147.33 | 0.0000 |
| 8 | 0.2056 | . | 178.9 | 0.0000 |
| 9 | 0.1315 | . | 191.84 | 0.0000 |
| 10 | 0.0869 | . | 197.5 | 0.0000 |
| 11 | 0.0467 | . | 199.13 | 0.0000 |
| 12 | 0.1147 | . | 209.02 | 0.0000 |
| 13 | 0.1562 | . | 227.39 | 0.0000 |
| 14 | 0.3056 | . | 297.72 | 0.0000 |
| 15 | 0.1470 | . | 314.02 | 0.0000 |
| 16 | 0.1366 | . | 328.12 | 0.0000 |
| 17 | 0.0500 | . | 330.01 | 0.0000 |
| 18 | 0.0481 | . | 331.76 | 0.0000 |
| 19 | 0.1387 | . | 346.35 | 0.0000 |
| 20 | 0.0384 | . | 347.47 | 0.0000 |
| 21 | 0.1702 | . | 369.5 | 0.0000 |
| 22 | 0.1298 | . | 382.34 | 0.0000 |
| 23 | 0.1168 | . | 392.75 | 0.0000 |
| 24 | 0.0697 | . | 396.46 | 0.0000 |
| 25 | 0.0429 | . | 397.87 | 0.0000 |
| 26 | 0.1010 | . | 405.68 | 0.0000 |
| 27 | 0.1301 | . | 418.67 | 0.0000 |
| 28 | 0.1321 | . | 432.07 | 0.0000 |
| 29 | 0.1254 | . | 444.16 | 0.0000 |
| 30 | 0.0638 | . | 447.29 | 0.0000 |

Table A.11: Correlogram for **SP500!**'s Squared Values

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.2428 | 0.2769 | 43.63 | 0.0000 |
| 2 | 0.2125 | 0.4435 | 77.078 | 0.0000 |
| 3 | 0.0284 | 0.0474 | 77.675 | 0.0000 |
| 4 | 0.0301 | . | 78.348 | 0.0000 |
| 5 | 0.1916 | . | 105.68 | 0.0000 |
| 6 | 0.1869 | . | 131.69 | 0.0000 |
| 7 | 0.3202 | . | 208.18 | 0.0000 |
| 8 | 0.2184 | . | 243.82 | 0.0000 |
| 9 | 0.1765 | . | 267.12 | 0.0000 |
| 10 | 0.0685 | . | 270.63 | 0.0000 |
| 11 | 0.0224 | . | 271.01 | 0.0000 |
| 12 | 0.0919 | . | 277.36 | 0.0000 |
| 13 | 0.1432 | . | 292.79 | 0.0000 |
| 14 | 0.3191 | . | 369.48 | 0.0000 |
| 15 | 0.1144 | . | 379.35 | 0.0000 |
| 16 | 0.1308 | . | 392.28 | 0.0000 |
| 17 | 0.0403 | . | 393.51 | 0.0000 |
| 18 | 0.0203 | . | 393.83 | 0.0000 |
| 19 | 0.1607 | . | 413.42 | 0.0000 |
| 20 | 0.0035 | . | 413.43 | 0.0000 |
| 21 | 0.1199 | . | 424.36 | 0.0000 |
| 22 | 0.1015 | . | 432.2 | 0.0000 |
| 23 | 0.0808 | . | 437.18 | 0.0000 |
| 24 | 0.0645 | . | 440.36 | 0.0000 |
| 25 | 0.0278 | . | 440.95 | 0.0000 |
| 26 | 0.0789 | . | 445.73 | 0.0000 |
| 27 | 0.0991 | . | 453.26 | 0.0000 |
| 28 | 0.1324 | . | 466.72 | 0.0000 |
| 29 | 0.1467 | . | 483.28 | 0.0000 |
| 30 | 0.0511 | . | 485.29 | 0.0000 |

Table A.12: Correlogram for **BTC!**'s Absolute Values

| Lag | AC | PAC | Q | Prob > Q |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.3408 | 0.3422 | 155.47 | 0.0000 |
| 2 | 0.3251 | 0.2417 | 297.06 | 0.0000 |
| 3 | 0.2759 | 0.1340 | 399.14 | 0.0000 |
| 4 | 0.2137 | 0.0461 | 460.44 | 0.0000 |
| 5 | 0.2267 | 0.0880 | 529.48 | 0.0000 |
| 6 | 0.1804 | 0.0347 | 573.25 | 0.0000 |
| 7 | 0.2044 | 0.0749 | 629.45 | 0.0000 |
| 8 | 0.1494 | -0.0038 | 659.48 | 0.0000 |
| 9 | 0.1914 | 0.0799 | 708.85 | 0.0000 |
| 10 | 0.1448 | 0.0037 | 737.13 | 0.0000 |
| 11 | 0.1779 | 0.0663 | 779.84 | 0.0000 |
| 12 | 0.1455 | 0.0152 | 808.42 | 0.0000 |
| 13 | 0.1370 | 0.0041 | 833.77 | 0.0000 |
| 14 | 0.1825 | 0.0635 | 878.83 | 0.0000 |
| 15 | 0.1619 | 0.0290 | 914.29 | 0.0000 |
| 16 | 0.1645 | 0.0212 | 950.93 | 0.0000 |
| 17 | 0.1814 | 0.0514 | 995.55 | 0.0000 |
| 18 | 0.1292 | -0.0521 | 1018.2 | 0.0000 |
| 19 | 0.1490 | 0.0142 | 1048.3 | 0.0000 |
| 20 | 0.1773 | 0.0699 | 1091 | 0.0000 |
| 21 | 0.1361 | 0.0041 | 1116.2 | 0.0000 |
| 22 | 0.1450 | 0.0095 | 1144.8 | 0.0000 |
| 23 | 0.1115 | -0.0259 | 1161.7 | 0.0000 |
| 24 | 0.0826 | -0.0271 | 1171 | 0.0000 |
| 25 | 0.0703 | -0.0301 | 1177.8 | 0.0000 |
| 26 | 0.0887 | 0.0118 | 1188.5 | 0.0000 |
| 27 | 0.1113 | 0.0184 | 1205.4 | 0.0000 |
| 28 | 0.1630 | 0.0619 | 1241.7 | 0.0000 |
| 29 | 0.1248 | 0.0095 | 1263 | 0.0000 |
| 30 | 0.1134 | -0.0143 | 1280.6 | 0.0000 |

Table A.13: Correlogram for **BTC!**'s Squared Values

| Lag | AC | PAC | Q | Prob > Q |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.1465 | 0.1467 | 28.727 | 0.0000 |
| 2 | 0.2936 | 0.2813 | 144.24 | 0.0000 |
| 3 | 0.2070 | 0.1519 | 201.71 | 0.0000 |
| 4 | 0.1188 | 0.0071 | 220.66 | 0.0000 |
| 5 | 0.1578 | 0.0585 | 254.08 | 0.0000 |
| 6 | 0.0601 | -0.0190 | 258.95 | 0.0000 |
| 7 | 0.1325 | 0.0642 | 282.56 | 0.0000 |
| 8 | 0.0440 | -0.0150 | 285.17 | 0.0000 |
| 9 | 0.1222 | 0.0701 | 305.27 | 0.0000 |
| 10 | 0.0425 | -0.0150 | 307.71 | 0.0000 |
| 11 | 0.0704 | 0.0154 | 314.39 | 0.0000 |
| 12 | 0.0541 | 0.0058 | 318.34 | 0.0000 |
| 13 | 0.0445 | 0.0116 | 321.02 | 0.0000 |
| 14 | 0.0597 | 0.0095 | 325.85 | 0.0000 |
| 15 | 0.0460 | 0.0115 | 328.71 | 0.0000 |
| 16 | 0.0637 | 0.0091 | 334.2 | 0.0000 |
| 17 | 0.0583 | 0.0260 | 338.82 | 0.0000 |
| 18 | 0.0429 | -0.0241 | 341.31 | 0.0000 |
| 19 | 0.1123 | 0.0642 | 358.43 | 0.0000 |
| 20 | 0.0931 | 0.0683 | 370.19 | 0.0000 |
| 21 | 0.0707 | 0.0149 | 376.98 | 0.0000 |
| 22 | 0.1183 | 0.0582 | 396.02 | 0.0000 |
| 23 | 0.0465 | -0.0219 | 398.96 | 0.0000 |
| 24 | 0.0469 | -0.0356 | 401.95 | 0.0000 |
| 25 | 0.0204 | -0.0415 | 402.52 | 0.0000 |
| 26 | 0.0123 | -0.0227 | 402.73 | 0.0000 |
| 27 | 0.0305 | -0.0049 | 404 | 0.0000 |
| 28 | 0.0797 | 0.0419 | 412.68 | 0.0000 |
| 29 | 0.0346 | 0.0024 | 414.32 | 0.0000 |
| 30 | 0.0481 | -0.0052 | 417.48 | 0.0000 |

Table A.14: Correlogram for **XRP!**'s Absolute Values

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.3607 | 0.3669 | 59.194 | 0.0000 |
| 2 | 0.0706 | -0.0460 | 61.466 | 0.0000 |
| 3 | 0.0871 | 0.0867 | 64.93 | 0.0000 |
| 4 | 0.1060 | 0.0575 | 70.081 | 0.0000 |
| 5 | 0.0310 | -0.0115 | 70.521 | 0.0000 |
| 6 | 0.0643 | 0.0560 | 72.422 | 0.0000 |
| 7 | 0.0757 | 0.0169 | 75.065 | 0.0000 |
| 8 | 0.1216 | 0.0258 | 81.903 | 0.0000 |
| 9 | 0.0806 | -0.0292 | 84.913 | 0.0000 |
| 10 | 0.1107 | 0.0823 | 90.604 | 0.0000 |
| 11 | 0.1026 | 0.0348 | 95.501 | 0.0000 |
| 12 | 0.1375 | 0.1075 | 104.32 | 0.0000 |
| 13 | 0.0403 | -0.0529 | 105.08 | 0.0000 |
| 14 | 0.0727 | 0.0307 | 107.55 | 0.0000 |
| 15 | 0.0442 | -0.0252 | 108.47 | 0.0000 |
| 16 | 0.0795 | 0.0837 | 111.45 | 0.0000 |
| 17 | 0.0340 | -0.0033 | 111.99 | 0.0000 |
| 18 | 0.0738 | 0.0723 | 114.57 | 0.0000 |
| 19 | 0.0176 | -0.0521 | 114.72 | 0.0000 |
| 20 | 0.0433 | 0.0162 | 115.61 | 0.0000 |
| 21 | 0.0496 | 0.0297 | 116.78 | 0.0000 |
| 22 | 0.0937 | 0.0047 | 120.97 | 0.0000 |
| 23 | 0.1143 | 0.0448 | 127.22 | 0.0000 |
| 24 | 0.1140 | 0.0243 | 133.45 | 0.0000 |
| 25 | 0.0303 | 0.0121 | 133.89 | 0.0000 |
| 26 | 0.0452 | 0.0356 | 134.87 | 0.0000 |
| 27 | 0.0359 | 0.0398 | 135.49 | 0.0000 |
| 28 | 0.0115 | -0.0297 | 135.56 | 0.0000 |
| 29 | -0.0121 | -0.0288 | 135.63 | 0.0000 |
| 30 | 0.0100 | -0.0211 | 135.68 | 0.0000 |

Table A.15: Correlogram for **XRP!**'s Squared Values

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.4221 | 0.4234 | 81.077 | 0.0000 |
| 2 | -0.0025 | -0.1753 | 81.08 | 0.0000 |
| 3 | 0.0257 | 0.1179 | 81.383 | 0.0000 |
| 4 | 0.0501 | -0.0142 | 82.532 | 0.0000 |
| 5 | 0.0182 | 0.0162 | 82.684 | 0.0000 |
| 6 | 0.0161 | 0.0057 | 82.803 | 0.0000 |
| 7 | 0.0142 | -0.0005 | 82.896 | 0.0000 |
| 8 | 0.0841 | -0.0018 | 86.166 | 0.0000 |
| 9 | 0.0630 | -0.0314 | 88.006 | 0.0000 |
| 10 | 0.0244 | 0.0251 | 88.284 | 0.0000 |
| 11 | 0.0568 | 0.0607 | 89.783 | 0.0000 |
| 12 | 0.0549 | 0.0267 | 91.191 | 0.0000 |
| 13 | -0.0078 | -0.0246 | 91.219 | 0.0000 |
| 14 | 0.0038 | 0.0093 | 91.226 | 0.0000 |
| 15 | 0.0217 | 0.0180 | 91.447 | 0.0000 |
| 16 | 0.0328 | 0.0324 | 91.953 | 0.0000 |
| 17 | -0.0054 | -0.0221 | 91.967 | 0.0000 |
| 18 | 0.0251 | 0.0394 | 92.266 | 0.0000 |
| 19 | 0.0033 | -0.0325 | 92.271 | 0.0000 |
| 20 | 0.0015 | 0.0096 | 92.272 | 0.0000 |
| 21 | 0.0140 | 0.0153 | 92.365 | 0.0000 |
| 22 | 0.0429 | 0.0009 | 93.245 | 0.0000 |
| 23 | 0.0629 | 0.0242 | 95.138 | 0.0000 |
| 24 | 0.0700 | 0.0445 | 97.489 | 0.0000 |
| 25 | 0.0137 | 0.0020 | 97.579 | 0.0000 |
| 26 | 0.0088 | 0.0202 | 97.617 | 0.0000 |
| 27 | 0.0028 | 0.0036 | 97.62 | 0.0000 |
| 28 | -0.0173 | -0.0232 | 97.765 | 0.0000 |
| 29 | -0.0233 | -0.0199 | 98.027 | 0.0000 |
| 30 | -0.0073 | 0.0042 | 98.053 | 0.0000 |

Table A.16: Correlogram for **LTC!**'s Absolute Values

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.4216 | 0.4302 | 81.953 | 0.0000 |
| 2 | 0.1037 | -0.0879 | 86.919 | 0.0000 |
| 3 | 0.0796 | 0.1029 | 89.856 | 0.0000 |
| 4 | 0.0563 | -0.0064 | 91.329 | 0.0000 |
| 5 | 0.1044 | 0.1321 | 96.397 | 0.0000 |
| 6 | 0.0731 | -0.0345 | 98.89 | 0.0000 |
| 7 | 0.1212 | 0.1605 | 105.75 | 0.0000 |
| 8 | 0.1447 | 0.0588 | 115.55 | 0.0000 |
| 9 | 0.0920 | 0.0018 | 119.52 | 0.0000 |
| 10 | 0.0959 | 0.0235 | 123.84 | 0.0000 |
| 11 | 0.1019 | 0.0410 | 128.74 | 0.0000 |
| 12 | 0.1210 | 0.0764 | 135.65 | 0.0000 |
| 13 | 0.0817 | 0.0024 | 138.81 | 0.0000 |
| 14 | 0.0707 | 0.0541 | 141.18 | 0.0000 |
| 15 | 0.1172 | 0.0364 | 147.71 | 0.0000 |
| 16 | 0.0393 | -0.0842 | 148.44 | 0.0000 |
| 17 | -0.0042 | 0.0389 | 148.45 | 0.0000 |
| 18 | 0.0104 | -0.0350 | 148.5 | 0.0000 |
| 19 | 0.0261 | 0.0024 | 148.83 | 0.0000 |
| 20 | 0.0406 | 0.0147 | 149.62 | 0.0000 |
| 21 | 0.0377 | 0.0184 | 150.31 | 0.0000 |
| 22 | 0.0024 | -0.0368 | 150.31 | 0.0000 |
| 23 | -0.0213 | -0.0460 | 150.53 | 0.0000 |
| 24 | 0.0193 | 0.0365 | 150.71 | 0.0000 |
| 25 | 0.0122 | -0.0460 | 150.79 | 0.0000 |
| 26 | 0.0617 | 0.0717 | 152.64 | 0.0000 |
| 27 | 0.0610 | -0.0167 | 154.46 | 0.0000 |
| 28 | -0.0032 | -0.0099 | 154.47 | 0.0000 |
| 29 | -0.0111 | -0.0362 | 154.53 | 0.0000 |
| 30 | -0.0366 | -0.0234 | 155.19 | 0.0000 |

Table A.17: Correlogram for **LTC!**'s Squared Values

| Lag | AC | PAC | Q | Prob $> Q$ |
|------------|-----------|------------|-----------------------|---------------------------------|
| 1 | 0.4614 | 0.4644 | 98.15 | 0.0000 |
| 2 | 0.0377 | -0.2298 | 98.806 | 0.0000 |
| 3 | 0.0288 | 0.1572 | 99.191 | 0.0000 |
| 4 | 0.0236 | -0.0713 | 99.448 | 0.0000 |
| 5 | 0.0751 | 0.1582 | 102.07 | 0.0000 |
| 6 | 0.0367 | -0.1083 | 102.7 | 0.0000 |
| 7 | 0.0377 | 0.1304 | 103.36 | 0.0000 |
| 8 | 0.0698 | -0.0073 | 105.64 | 0.0000 |
| 9 | 0.0338 | 0.0010 | 106.18 | 0.0000 |
| 10 | 0.0589 | 0.0232 | 107.81 | 0.0000 |
| 11 | 0.0617 | 0.0177 | 109.61 | 0.0000 |
| 12 | 0.0486 | 0.0366 | 110.72 | 0.0000 |
| 13 | 0.0330 | -0.0028 | 111.24 | 0.0000 |
| 14 | 0.0201 | 0.0333 | 111.43 | 0.0000 |
| 15 | 0.0812 | 0.0353 | 114.56 | 0.0000 |
| 16 | 0.0340 | -0.0498 | 115.11 | 0.0000 |
| 17 | -0.0218 | 0.0198 | 115.34 | 0.0000 |
| 18 | -0.0087 | -0.0405 | 115.38 | 0.0000 |
| 19 | -0.0044 | 0.0322 | 115.39 | 0.0000 |
| 20 | 0.0060 | -0.0209 | 115.4 | 0.0000 |
| 21 | -0.0068 | -0.0089 | 115.43 | 0.0000 |
| 22 | -0.0252 | -0.0135 | 115.73 | 0.0000 |
| 23 | -0.0183 | -0.0172 | 115.9 | 0.0000 |
| 24 | -0.0074 | 0.0008 | 115.92 | 0.0000 |
| 25 | -0.0020 | -0.0136 | 115.92 | 0.0000 |
| 26 | 0.0200 | 0.0038 | 116.12 | 0.0000 |
| 27 | 0.0044 | -0.0150 | 116.13 | 0.0000 |
| 28 | -0.0192 | -0.0166 | 116.31 | 0.0000 |
| 29 | -0.0204 | -0.0117 | 116.51 | 0.0000 |
| 30 | -0.0205 | -0.0141 | 116.72 | 0.0000 |

Table A.18: VAR! for BTC!

| Variable | Coefficient | (Std. Err.) |
|--|--------------|-------------|
| Equation 1 : $\log \Delta V(t)$ | | |
| 1 st Lag of $\log \Delta V(t)$ | -0.1473405* | (0.0722836) |
| 2 nd Lag of $\log \Delta V(t)$ | 0.1877619** | (0.0724446) |
| 1 st Lag of $ \log R(t) $ | 0.7164479** | (0.1694261) |
| 2 nd Lag of $ \log R(t) $ | 0.0487642 | (0.1770715) |
| Intercept | -0.0256593** | (0.0087954) |
| Equation 2 : $ \log R(t) $ | | |
| 1 st Lag of $\log \Delta V(t)$ | -0.1053222** | (0.0305879) |
| 2 nd Lag of $\log \Delta V(t)$ | 0.0942769** | (0.030656) |
| 1 st Lag of $ \log R(t) $ | 0.3783418** | (0.0716951) |
| 2 nd Lag of $ \log R(t) $ | 0.1666404* | (0.0749304) |
| Intercept | 0.0144897** | (0.0037219) |
| N | 179 | |
| Log-likelihood | 542.7405 | |
| Significance levels : † : 10% * : 5% ** : 1% | | |

Table A.19: VAR! for LTC!

| Variable | Coefficient | (Std. Err.) |
|--|-------------|-------------|
| Equation 1 : $\log \Delta$ Volume | | |
| 1 st Lag of $\log \Delta V(t)$ | 0.0520198 | (0.0728686) |
| 2 nd Lag of $\log \Delta V(t)$ | -0.0664955 | (0.0724421) |
| 1 st Lag of $ \log R(t) $ | -0.0260652 | (0.0897247) |
| 2 nd Lag of $ \log R(t) $ | 0.2788267** | (0.0895332) |
| Intercept | -0.0180667 | (0.0141913) |
| Equation 2 : $ \log R(t) $ | | |
| 1 st Lag of $\log \Delta V(t)$ | 0.036742 | (0.0587468) |
| 2 nd Lag of $\log \Delta V(t)$ | 0.1367027* | (0.058403) |
| 1 st Lag of $ \log R(t) $ | 0.0413287 | (0.0723363) |
| 2 nd Lag of $ \log R(t) $ | 0.1458086* | (0.0721818) |
| Intercept | 0.0645154** | (0.0114411) |
| N | 190 | |
| Log-likelihood | 247.3436 | |
| Significance levels : † : 10% * : 5% ** : 1% | | |

Table A.20: VAR! for XRP!

| Variable | Coefficient | (Std. Err.) |
|---|------------------------|-------------|
| Equation 1 : $\log \Delta$ Volume | | |
| 1 st Lag of $\log \Delta$ Volume | 0.4600027 | (0.6246843) |
| 2 nd Lag of $\log \Delta$ Volume | -0.3286515 | (0.6358771) |
| 1 st Lag of $ \log R(t) $ | 0.4982969 | (0.8579283) |
| 2 nd Lag of $ \log R(t) $ | 0.491426 | (0.8413331) |
| Intercept | -0.2217062 | (0.1801991) |
| Equation 2 : $ \log R(t) $ | | |
| 1 st Lag of $\log \Delta V(t)$ | 0.1319151* | (0.0549993) |
| 2 nd Lag of $\log \Delta V(t)$ | 0.0273143 | (0.0559848) |
| 1 st Lag of $ \log R(t) $ | 0.0092369 | (0.0755349) |
| 2 nd Lag of $ \log R(t) $ | 0.1302045 [†] | (0.0740738) |
| Intercept | 0.0963356** | (0.0158653) |
| N | 172 | |
| Log-likelihood | -214.011 | |
| Significance levels : † : 10% * : 5% ** : 1% | | |

Appendix B

Figures

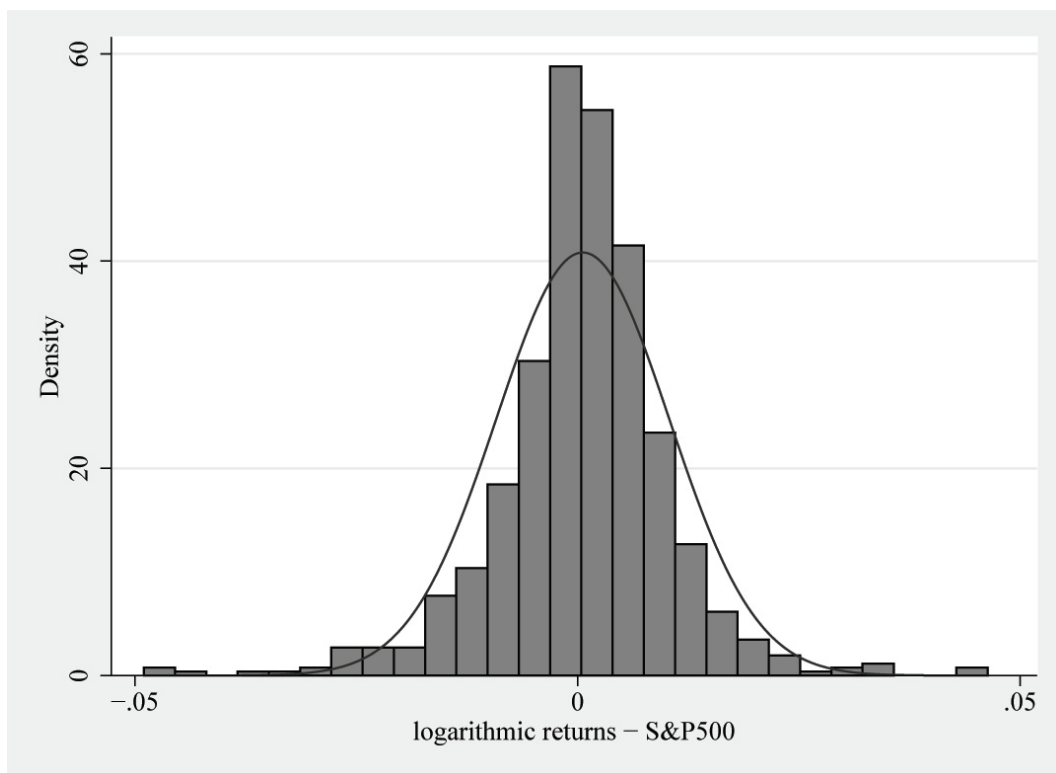
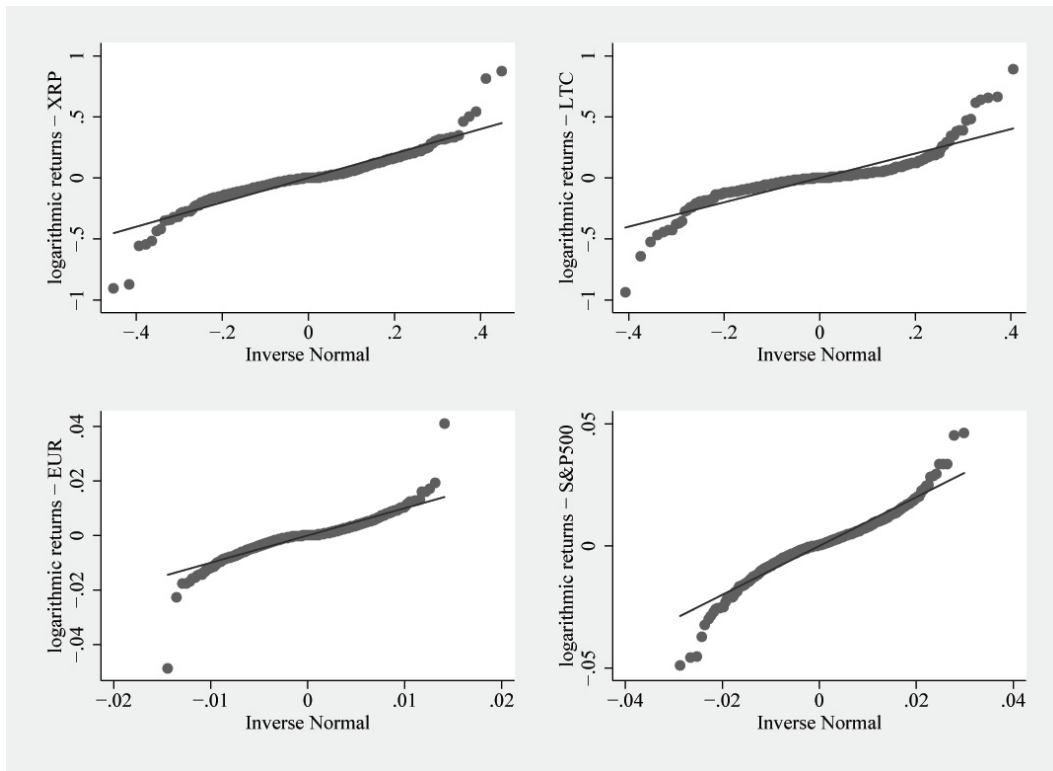
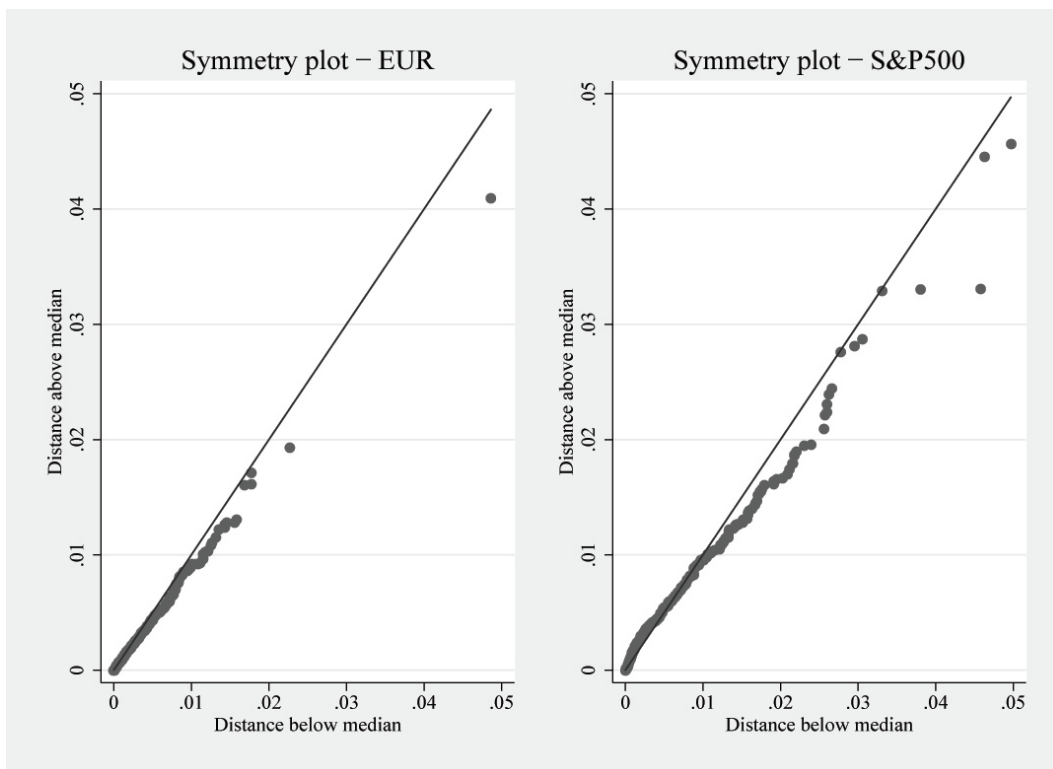


Figure B.1: Histogram for SP500!

Figure B.2: Quantile-normal plot for **XRP!**, **LTC!**, **EUR!** and **SP500!**Figure B.3: Symmetry plot for **EUR!** and **SP500!**

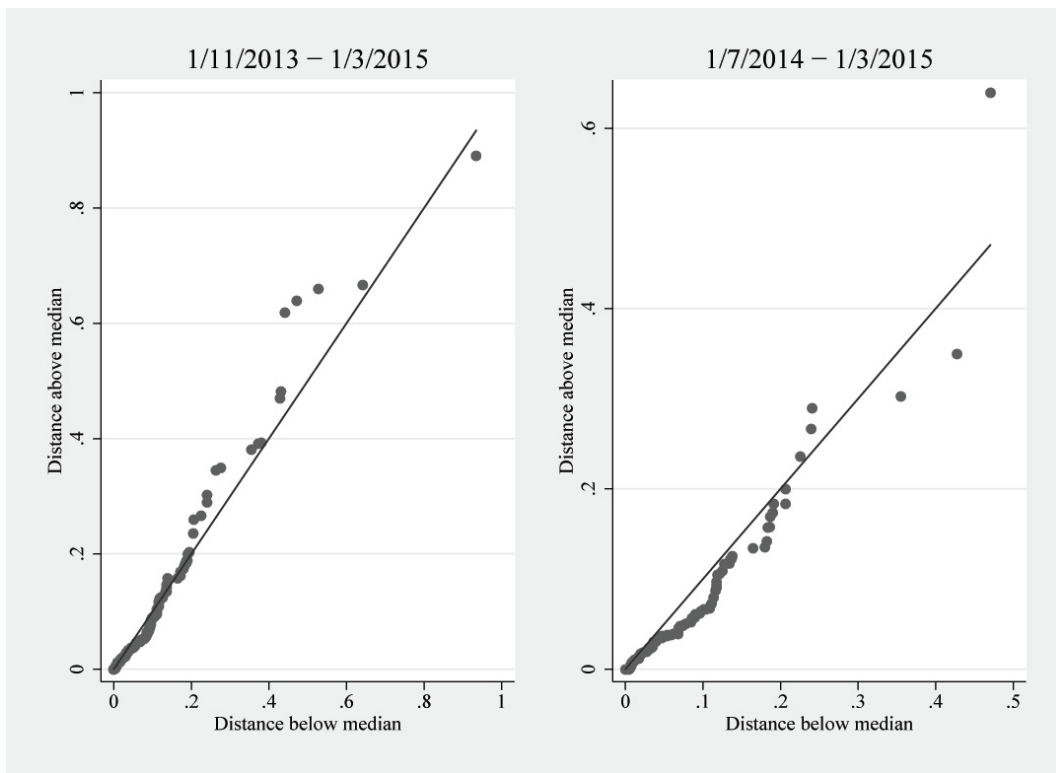


Figure B.4: Symmetry plot for **LTC!**

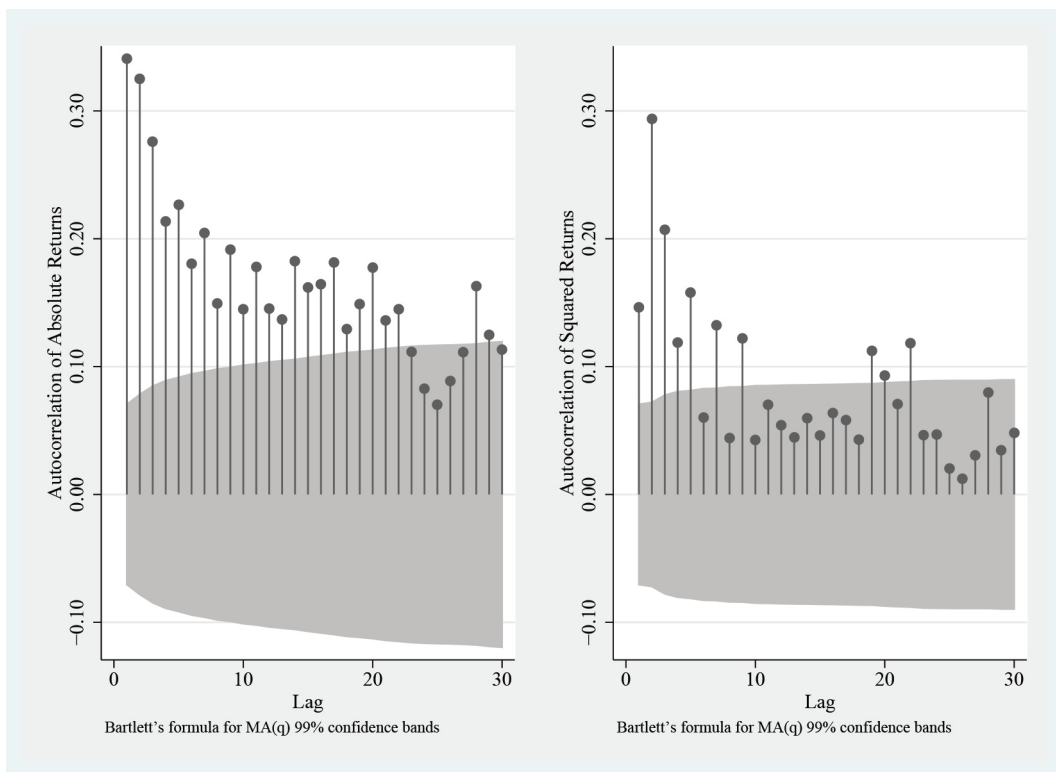


Figure B.5: Autocorrelations of Absolute and Squared Returns for **BTC!**

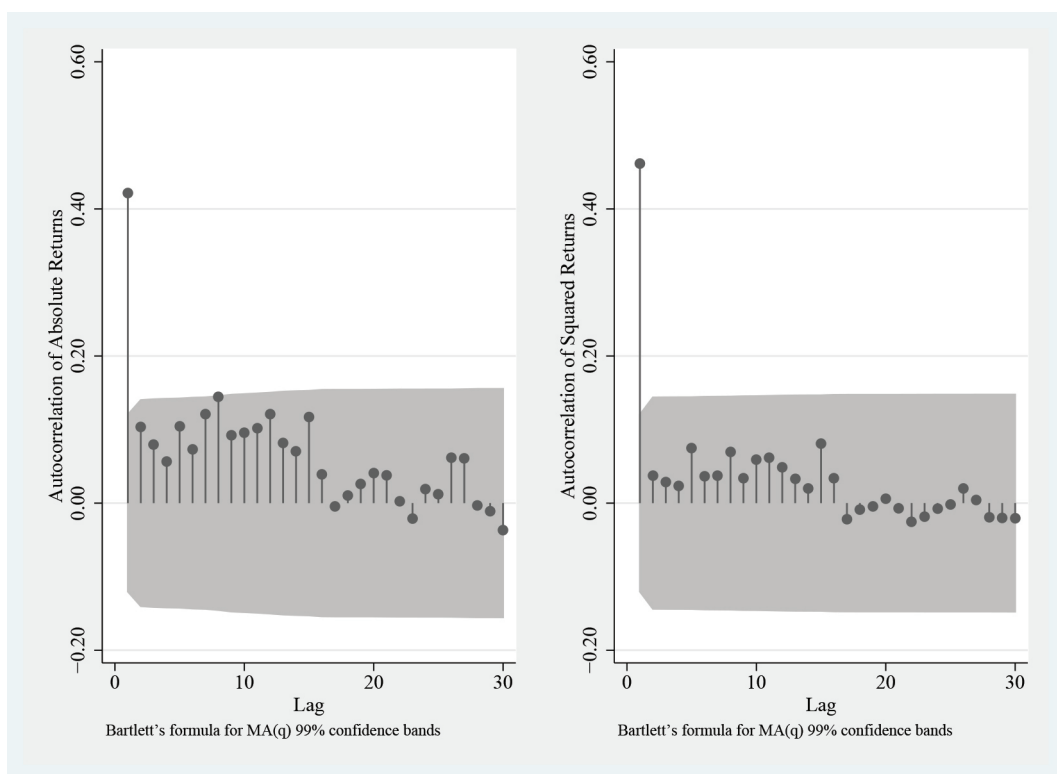


Figure B.6: Autocorrelations of Absolute and Squared Returns for **LTC!**

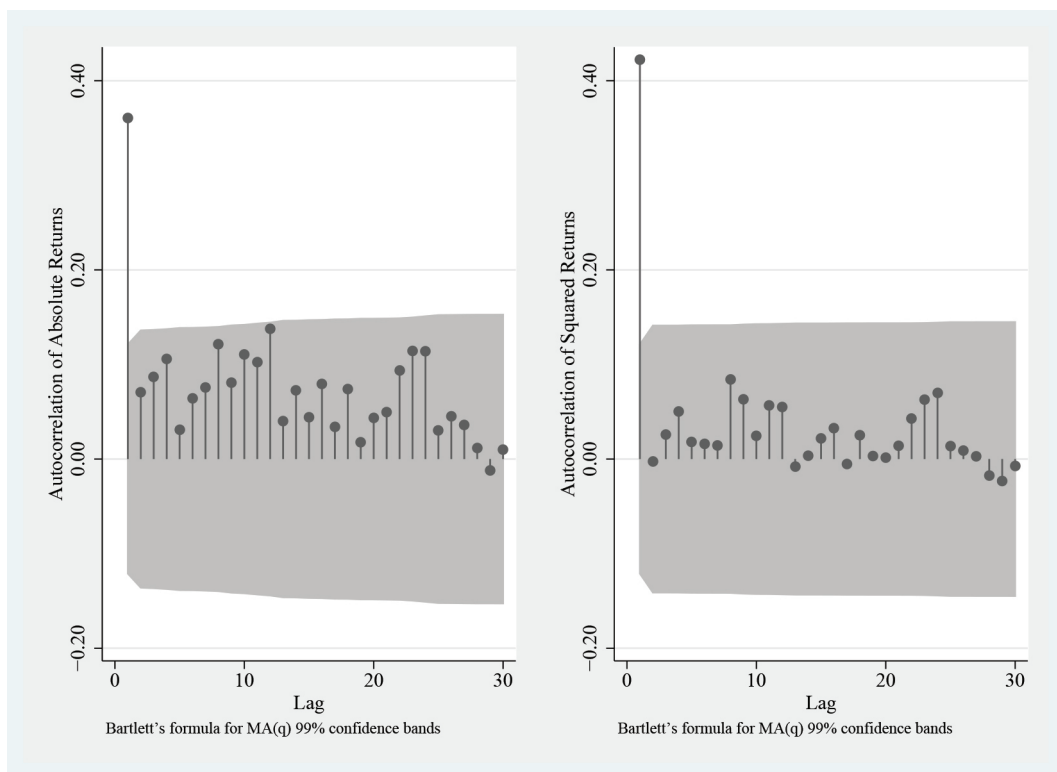


Figure B.7: Autocorrelations of Absolute and Squared Returns for **XRP!**