



## Online-Appendix zu

# „Cryptocurrencies as an Alternative Asset Class“

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# Appendix A

## Introductory Appendix

Figure A.1 shows the typical structure of a Merkle tree with a "root" on the top and "leaves" at the bottom.

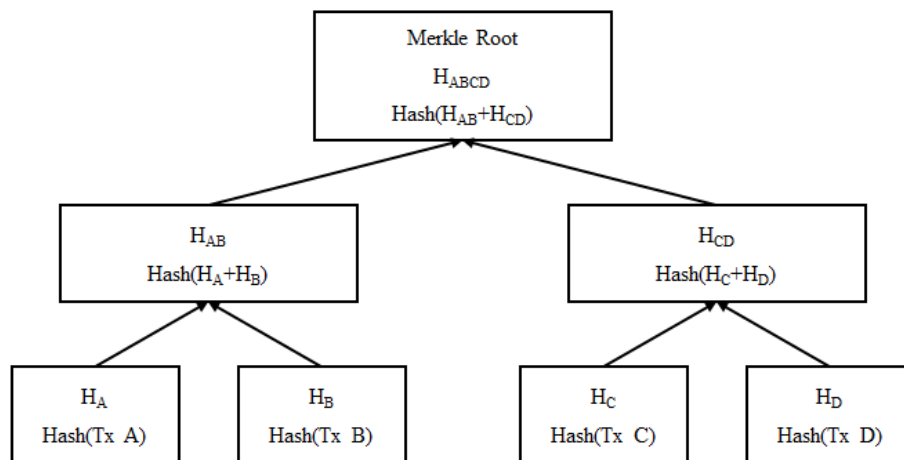


Figure A.1: Merkle Tree  
Adapted from Antonopoulos [1].

# Appendix B

## Technical Appendix

Table B.1: Correlations between cryptocurrencies and asset classes including individual components of each asset class (1/2)

|                | BTC  | ETH   | XRP   | XEM   | LTC   | Equity | E-U.S. | E-Int. | E-E.M. |
|----------------|------|-------|-------|-------|-------|--------|--------|--------|--------|
| BTC            | 1    | 0.22* | 0.19* | 0.29* | 0.53* | -0.02  | -0.01  | -0.03  | -0.02  |
| ETH            | 0.00 | 1     | 0.00  | 0.01  | 0.11* | -0.07  | -0.02  | -0.10* | -0.06  |
| XRP            | 0.00 | 0.94  | 1     | 0.20* | 0.22* | 0.00   | 0.00   | 0.00   | 0.01   |
| XEM            | 0.00 | 0.77  | 0.00  | 1     | 0.19* | -0.05  | -0.02  | -0.07  | -0.04  |
| LTC            | 0.00 | 0.01  | 0.00  | 0.00  | 1     | -0.01  | -0.01  | 0.00   | -0.02  |
| Equity         | 0.60 | 0.14  | 0.92  | 0.24  | 0.78  | 1      | 0.76*  | 0.90*  | 0.89*  |
| E-U.S.         | 0.82 | 0.68  | 0.93  | 0.61  | 0.84  | 0.00   | 1      | 0.52*  | 0.47*  |
| E-Int.         | 0.53 | 0.04  | 0.93  | 0.12  | 0.94  | 0.00   | 0.00   | 1      | 0.77*  |
| E-E.M.         | 0.66 | 0.21  | 0.83  | 0.35  | 0.68  | 0.00   | 0.00   | 0.00   | 1      |
| Fixed Income   | 0.67 | 0.64  | 0.87  | 0.73  | 0.69  | 0.00   | 0.22   | 0.00   | 0.00   |
| FI-U.S.        | 0.62 | 0.81  | 0.49  | 0.47  | 0.60  | 0.00   | 0.00   | 0.01   | 0.19   |
| FI-Int.        | 0.72 | 0.93  | 0.81  | 0.85  | 0.71  | 0.67   | 0.00   | 0.03   | 0.73   |
| FI-H.Y.        | 0.87 | 0.11  | 0.75  | 0.30  | 0.98  | 0.00   | 0.00   | 0.00   | 0.00   |
| Commodities    | 0.27 | 0.21  | 0.78  | 0.52  | 0.80  | 0.00   | 0.00   | 0.00   | 0.00   |
| Real Estate    | 0.96 | 0.62  | 0.96  | 0.98  | 0.86  | 0.00   | 0.00   | 0.00   | 0.00   |
| Hedge Funds    | 0.67 | 0.58  | 0.93  | 0.28  | 0.93  | 0.00   | 0.00   | 0.00   | 0.00   |
| Private Equity | 0.68 | 0.03  | 0.75  | 0.41  | 0.70  | 0.00   | 0.00   | 0.00   | 0.00   |

The upper triangular displays the correlations of cryptocurrencies and asset classes including their components against each other and the lower triangular shows the corresponding  $p$  – values over the time period from 08/10/2015 until 06/09/2017. Correlations with an asterisk are significant at the 5% level. E-U.S. represents U.S. Equity, E.-Int. represents International Equity, E-E.M. represents Emerging Markets Equity, FI-U.S. represents U.S. Fixed Income, FI-Int. represents International Fixed Income, FI-H.Y. represents High Yield Fixed Income.

## Appendix B. Technical Appendix

Table B.2: Correlations between cryptocurrencies and asset classes including individual components of each asset class (2/2)

|                | FI    | FI-U.S. | FI-Int. | FI-H.Y. | Commodities | Real Estate | Hedge Funds | Private Equity |
|----------------|-------|---------|---------|---------|-------------|-------------|-------------|----------------|
| BTC            | 0.02  | 0.02    | 0.02    | 0.01    | 0.05        | 0.00        | -0.02       | -0.02          |
| ETH            | -0.02 | 0.01    | 0.00    | -0.07   | -0.06       | -0.02       | -0.03       | -0.10*         |
| XRP            | 0.01  | 0.03    | 0.01    | -0.02   | -0.01       | 0.00        | 0.00        | -0.01          |
| XEM            | -0.02 | 0.03    | -0.01   | -0.05   | 0.03        | 0.00        | -0.05       | -0.04          |
| LTC            | -0.02 | -0.03   | -0.02   | 0.00    | -0.01       | 0.01        | 0.00        | -0.02          |
| Equity         | 0.19* | -0.19*  | -0.02   | 0.71*   | 0.47*       | 0.54*       | 0.81*       | 0.83*          |
| E-U.S.         | -0.06 | -0.31*  | -0.19*  | 0.41*   | 0.40*       | 0.67*       | 0.82*       | 0.72*          |
| E-Int.         | 0.29* | -0.13*  | 0.10*   | 0.72*   | 0.41*       | 0.37*       | 0.66*       | 0.75*          |
| E-E.M.         | 0.24* | -0.06   | 0.02    | 0.67*   | 0.39*       | 0.35*       | 0.61*       | 0.66*          |
| Fixed Income   | 1     | 0.58*   | 0.92*   | 0.57*   | 0.13*       | 0.16*       | -0.08       | 0.05           |
| FI-U.S.        | 0.00  | 1       | 0.44*   | -0.01   | -0.18*      | 0.11*       | -0.28*      | -0.28*         |
| FI-Int.        | 0.00  | 0.00    | 1       | 0.30*   | 0.04        | 0.02        | -0.29*      | -0.15*         |
| FI-H.Y.        | 0.00  | 0.85    | 0.00    | 1       | 0.42*       | 0.34*       | 0.54*       | 0.63*          |
| Commodities    | 0.01  | 0.00    | 0.37    | 0.00    | 1           | 0.22*       | 0.43*       | 0.43*          |
| Real Estate    | 0.00  | 0.02    | 0.60    | 0.00    | 0.00        | 1           | 0.52*       | 0.47*          |
| Hedge Funds    | 0.10  | 0.00    | 0.00    | 0.00    | 0.00        | 0.00        | 1           | 0.80*          |
| Private Equity | 0.27  | 0.00    | 0.00    | 0.00    | 0.00        | 0.00        | 0.00        | 1              |

The upper triangular displays the correlations of cryptocurrencies and asset classes including their components against each other and the lower triangular shows the corresponding  $p$  – values over the time period from 08/10/2015 until 06/09/2017. Correlations with an asterisk are significant at the 5% level. E-U.S. represents U.S. Equity, E-Int. represents International Equity, E-E.M. represents Emerging Markets Equity, FI represents Fixed Income, FI-U.S. represents U.S. Fixed Income, FI-Int. represents International Fixed Income, FI-H.Y. represents High Yield Fixed Income.