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# Testing Report

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Portfolio  
Management  
Software Ltd.,  
Software Testing

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## Abstract

This report evaluates the performance of the software when used by an untrained investor. This is simulated through the use of randomly generated portfolios. We evidence that the software requires an intelligent investor in order to fully utilise the benefits of the software. Included is a demonstration that; statistical and fundamental analysis can be used by an intelligent investor to analyse issues with portfolios using the software. Using the software to aid analysis, changes can be made that dramatically improve the performance of a portfolio. The conclusion of the report is that an intelligent, well trained DFM is required to fully maximise and leverage the software's potential.



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## Introduction

The vPMS highly innovative software is a rule based algorithm construct that enables fund managers to tailor-make, optimal investment portfolios from a correlation risk constraint and above benchmark buy and hold designed to optimise alpha. The software empowers the fund manager to optimise portfolios which are then continually monitored and rebalanced to keep them in line with the specific investment goals and risk limits set by the manager.

This report looks at a series of tests that demonstrate that a manager can use vPMS to test, analyses and improve upon a given portfolio. For further details on optimum portfolio construction, please view alternative testing reports and training materials.

## Testing Brief

This batch of tests was conducted to explore the how the VaR Portfolio Management Software (vPMS) created by Portfolio Management Software Ltd., handles a series of randomly selected portfolios. The purpose of these random portfolios is to simulate the use of the software, by an untrained manager. An additional test was included to test the performance difference of a randomly selected asset portfolio and a portfolio, composing of 50% random assets and 50% scientifically selected assets. This was to simulate and intelligent manager making changes to an untrained manager's portfolio, and demonstrates the benefits of a well-trained manager using the software.

A set of three randomly generated portfolios were produced. The random portfolios were subjected to a standard set of tests, using the same settings. The semi random portfolio was created based on the assets of one of the three random portfolios. Due to the uneven number of assets in the semi random portfolio the test is conducted with 53% manually selected component instruments.

## Testing Procedure

### Testing Hardware

PMS standard testing procedure performs the tests on varying hardware, via different editions of the Windows Operating System. The majority of the tests were performed in on Intel I5 or I7 processors (mix of generations), on standard OEM motherboards, with RAM varying from 4-8GB depending on the testing machine. As the software does not employ GPU based calculations, no aftermarket GPU was used. Three primary variants of the Windows operating system used were; Windows 7, Windows 8.1 & Windows 10.

### Test Settings

Each test was set up with the following parameters:

- Base Weightings: Adventurous,
- Starting Date: 4/01/2016
- Rebalance Period: Dynamic
- Rebalance Factor: VaR Solver (for VaR), None (for buy and hold)
- Initial Investment: 25,000
- Charges: AMC only

- Regular Continuous Investment: False
- Rebalance Triggers:
  - Logic: Or
  - VaR Limit
  - Volatility
  - Asymmetric Volatility
- Mode Switch Triggers:
  - Logic: Or
  - Drawdown Count (Days, set at; 5 days)
  - Rolling Drawdown Limit (%; 1% of total portfolio value)
- Minimum period between rebalances: Week
- Maximum period between rebalances: Quarter
- VaR Confidence Level: 95%
- VaR Time Horizon: 21 days (month)
- VaR Optimisation Settings:
  - Optimise by: Range
    - Max Range: 25%
    - Min Range: 18%
    - Time Horizon: Year
- Constraints:
  - Max Portfolio Allocation: True, at 100%
  - Min Portfolio Allocation: True, at 95%
  - No shorting of assets: True
  - Minimum asset allocation: True, at 0%
  - Maximum asset allocation: True, at 60%
  - Custom constraints: None

## Generating random portfolios

To generate the random portfolios, there was a requirement to reduce the instrument universe from 3000+ to a more manageable 100. To ensure that no bias was able to affect the selection process, the reduction selection method was arbitrary. Any instrument from the universe that did not meet the following criteria was eliminated:

- A specific currency derivative.
- Instruments that contain numbers in their symbol or the symbol are less than or greater than four characters long.
- Instruments are assigned a random number between 1 and 10.

The elimination process provides a pseudo random instrument universe of 110 ETFs.

The test instruments are categorised into four categories: Equities, Commodities, Property, Bonds. To keep the random portfolios comparable the decision was taken to ensure the portfolio was formed of the following number of assets from each category:

- 5 Equities
- 1 Property
- 7 Bonds
- 2 Commodities

The portfolios were generated using a random number generator. See attached appendix for the components in each portfolio.

### Selecting assets to replace components of a random portfolio

Random Portfolio 1 was chosen to be the base of the semi random portfolio. A process of research and analysis was employed to decide which instruments were appropriate to be replaced.

Instruments were removed based on their close correlation with other assets present in the portfolio. Other instruments were removed based on periods of high volatility in their price history.

To produce a fair test, only research materials published before the test period were used. The replacement instruments were selected based on the following factors:

- Stable Historical volatility
- Popularity (in the period just before the test)
- CVaR within a reasonable range for the year leading to the test period
- Underlying instruments based on a trusted metric or well know industry/theme

A list of instruments in the semi random portfolio can be found in the appendix.

## Test Results

### Key Result Metric

The metric used to evaluate tests was the daily end balance; the end of day balance is used as it is the most reliable price point. This value is calculated using the following formula:

$$b = \sum_{i=m}^n (p^m \times q^m)$$

Where:

b = balance, n= number of instruments, i =individual instrument, m= current instrument, p = current instrument price, q= current instrument quantity.

In simple terms, the formula can be described as follows: For every instrument in a portfolio, calculate a current value by multiplying the current price by current quantity. Take the calculated current values of each instrument and add these together to produce the end balance.

### Supplementary metrics

For investigation purposes we applied portfolio change data, to evaluate how the portfolio changes over time. This data is composed of the individual weighing of each instrument in respect to the portfolio as a whole. The calculation used is as follows:

$$w^i = (p^i \times q^i) \div \sum_{i=m}^n (p^m \times q^m)$$

Or simply:

$$w^i = (p^i \times q^i) \div b$$

Where:

w= weighting, v = volume, i = individual asset, m = current asset, n =number of assets, p = current asset price, q= current asset quantity and b = balance.

### Random portfolio 1 results

The first random portfolio's tests concluded successfully without incident, for both the VaR controlled test and the benchmark buy and hold test. The data produced was used to generate an end balance graph (*fig 1.a*) comparing the VaR controlled test to the buy and hold bench mark and an area chart illustrating the portfolio change over time for the VaR controlled test (*fig 1.b found in Appendix*).

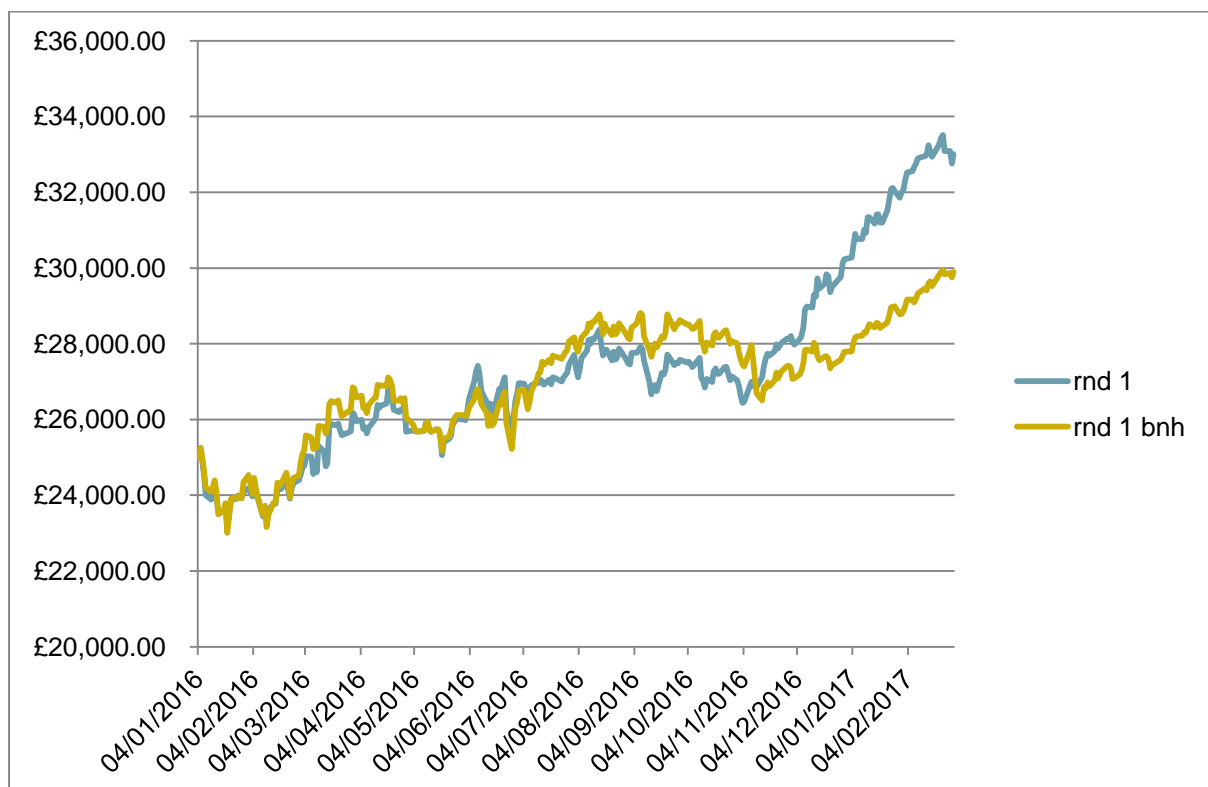


Fig 1.a

We can see from the analysis of *fig 1.a*, that although the VaR controlled test does outperform the benchmark by the end of the test. The first three-quarters of the test struggle to keep up with the performance of the bench mark.

### In-depth Analysis

After studying the raw instrument data and *fig 1.a* and *fig 1.b*, we were able to determine the reason for the performance of the portfolio.

The first three-quarters of the test underperformed for the following primary reasons: correlation and extreme volatility. When carefully studying the randomly selected instruments. It was discovered that a large number of the bonds employed in this random portfolio was almost entirely correlated with four of the instruments in the portfolio being

duplicates, namely: SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF and SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF.

The correlation table for the bonds can be found in the Appendix. The average correlation of the bonds in this portfolio is 0.8960788. This value significantly exceeds our maximum advised correlation of  $\pm 0.01$ . The issue with having such correlated instruments becomes most apparent during periods of high volatility for individual instruments.

When an instrument enters a period of excessive volatility, the software is designed in such a way, that lower volatility instruments are used to counter higher volatility ones. When some instruments are closely correlated the model has great difficulty in finding an appropriate weighing mix to counter highly volatile instruments, and as such struggles to find and optimised risk weighting, this can lead to lower performance. This issue affects all investment portfolios with little diversity, not just portfolios that are to be controlled by vPMS.

The problem of correlation is only half the story with random portfolio 1. The next major issues in the inherent high volatility of the equity based ETFs. Using proprietary methods we calculated that on two occasions the equity based ETFs exceed 35% yearly VaR (when optimised to produce the lowest achievable VaR and CVaR Value). These periods caused the software to substantially reduce weighting to towards the equity based ETFs in favour of Bonds and Commodities. This extreme volatility combined with the close correlation of the bond ETFs, lead to brief periods of little diversity, causing the software to underperform for the first three-quarters of the test.

The outperformance of the fourth quarter was down to two key factors, a surge in value in the Palladium ETF, that also enjoying positive volatility. And stabilisation of the volatility in the equity based ETFs that helped reduce the affected of the closely correlated bond ETFs.

### Random portfolio 2 results

The second random portfolio's test concluded successfully, however, due to issues explained in detail later in the documentation computation time was longer than expected. The data produced was used to generate an end balance graph (*fig 2.a*) comparing the VaR controlled test to the buy and hold bench mark and an area chart illustrating the portfolio change over time for the VaR controlled test (*fig 2.b found in Appendix*).



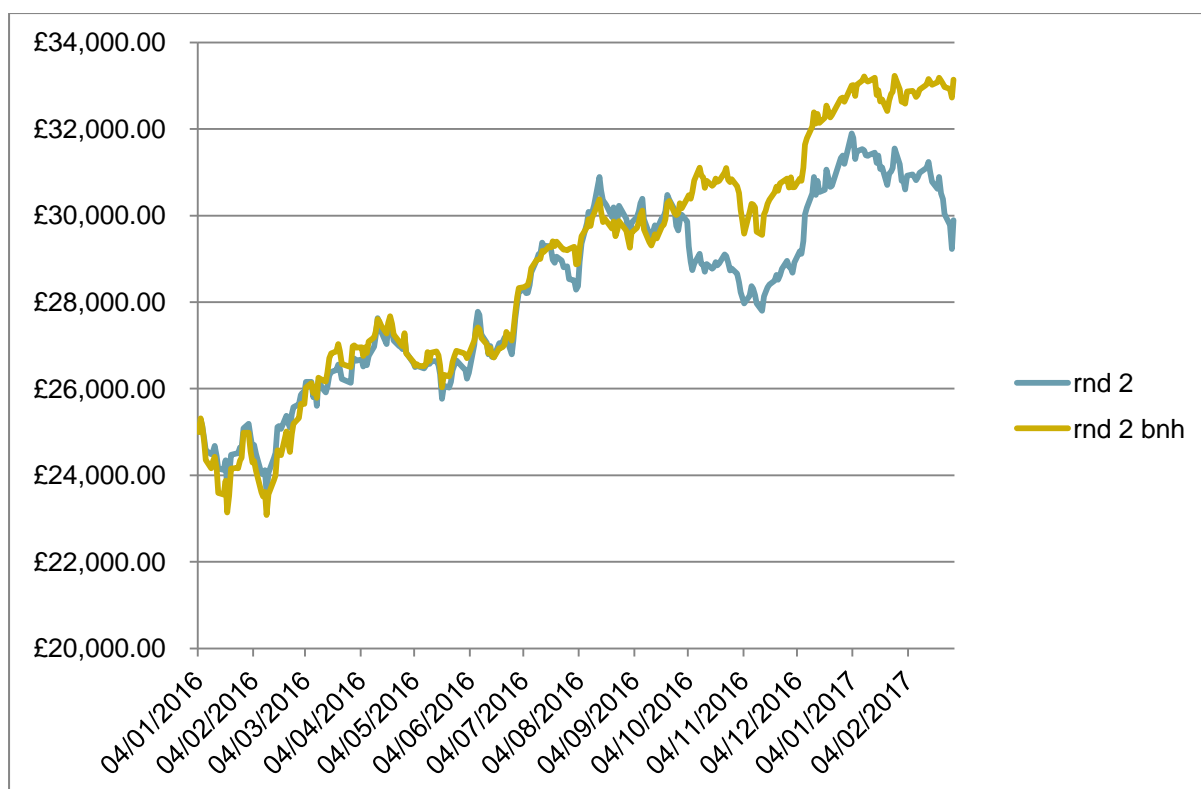


fig 2.a

As can be seen in Fig 2.a, the VaR controlled test kept pace with its bench mark for the majority of the test period. The divergence that occurred in the latter third of the test as can be seen in Fig 2.a was due to the primary underlying issue with the portfolio.

### In-depth Analysis

This portfolio can be regarded as a good example of a poorly constructed themed portfolio. Analysing the ETFs used, we can see that a large part of the underlining instruments focuses on the BRICK country based instruments. The majority of the focus of this portfolio seems based around China and Russia. During the test period, both Chinese and Russian instruments rallied quite sharply after poor performance throughout 2015. The firm performance of both the benchmark and the VaR controlled tests show this to be the case.

However, we do not see the expected performance of the VaR controlled test. After a careful analysis of the ETFs, we can see the whole portfolio suffers from high correlation. The correlation table for random portfolio 2 in the appendix shows this instrument in the portfolio is closely related. Due to this close correlation, the software had great difficulty in finding the most optimum weights for a given period. A consequence of this was lower than expected performance and efficiency.

The fundamental problem with the high correlation of this portfolio is fully expressed in the period 26/09/2016 to 6/10/2016. In this period the software correctly calculated that a number of the underlying instruments were going through a period of above average volatility causing the portfolios overall risk profile to increase. To counter this the software's only mathematical choice was to select a large allocation to the least correlated instrument, in this case: ETFs Silver ETC. The software allocated 45% of the fund's value in ETFS Silver ETC order to remain within the given risk parameters. This can be seen clearly in Fig 2.b, where by ETFs Silver ETC made up the majority of the allocation in that period. This had an

unfortunate knock on effect where by the slight decrease in the price of ETFS Silver ETC had a large impact on the portfolio. In normal circumstances where a suggested a maximum average portfolio correlation of  $\pm 0.01$  is used this situation would not have formed as the software would have naturally used a larger number of the instruments in the portfolio to reduce risk rather than solely relying on the single low correlated instrument.

### Random portfolio 3 results

Like the second random portfolio, the third random portfolio completed successfully, however, the calculation time was again longer than expected. The data produced was used to generate an end balance graph (fig 3.a) comparing the VaR controlled test to the buy and hold bench mark and an area chart illustrating the portfolio change over time for the VaR controlled test (fig 3.b found in Appendix).

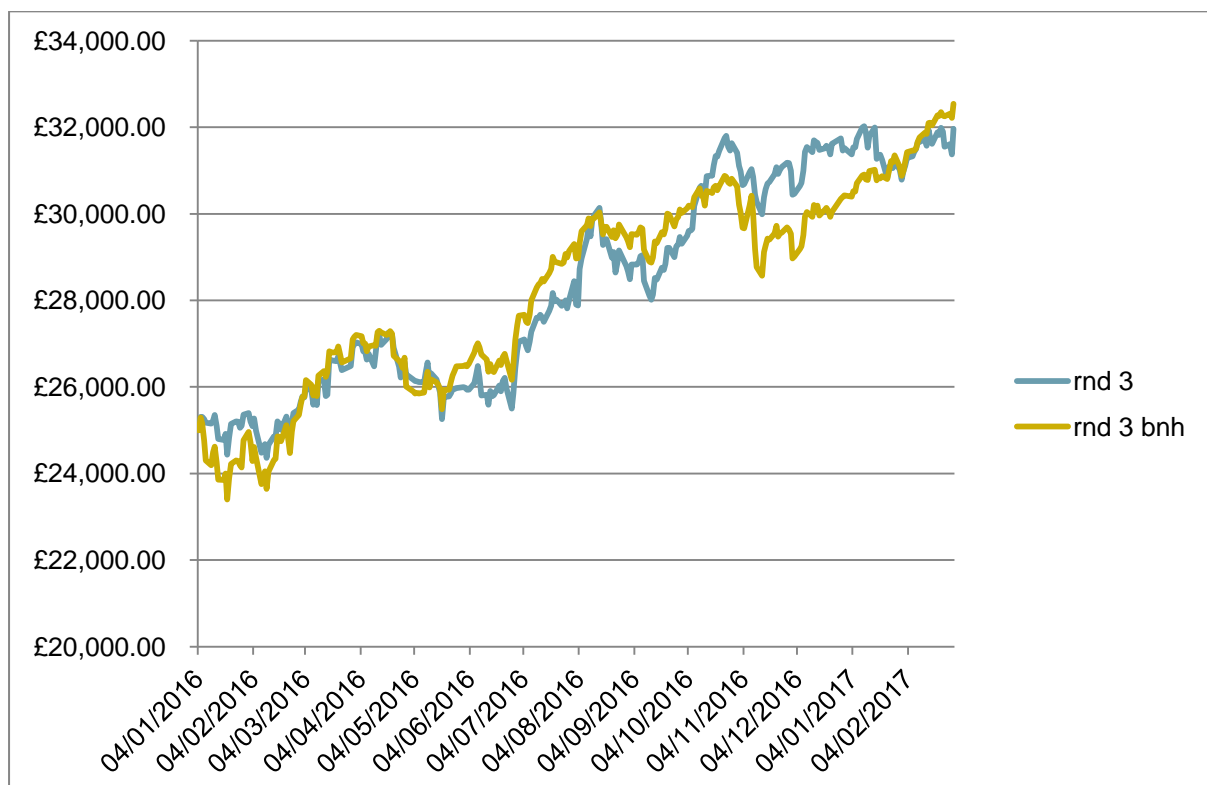


Fig 3.a

At first glance, the data displayed in fig 3.a and 3.b show the same symptoms of high correlation. When analysing the correlation table for this portfolio (as seen in the Appendix), it becomes immediately apparent that this portfolio is by far the worst for high correlation. Although all of the issues present in random portfolio 2 also apply to this portfolio, there is another problem hidden in the data that is not immediately apparent. When comparing the data from this portfolio, with data produced by the software from testing closely correlated portfolios, we notice only one symptom of closely correlated instruments, e.g. extended periods of tracking the bench mark. However, we are missing the second symptom: a rapid divergence, due to high volatility. The actual second symptom we see is the VaR controlled test unifying with the bench mark as soon as possible after a divergence. This symptom is usually only present in instruments whose underlying risk/variance are very similar if not identical.

The underlying mathematics at the heart of the software requires that instruments are provided with the widest range of natural variance possible, for it to effectively out perform its bench mark. The following summary statics shows the historical data of instruments in random portfolio 3.

| <i>Groups</i>  | <i>Average</i> | <i>Variance</i> |
|--|----------------|-----------------|
| HSBC MSCI EM Latin America UCITS ETF   | 1712.173       | 76062.28        |
| SPDR® MSCI Emerging Markets UCITS ETF  | 98.68525       | 102.7272        |
| SPDR® S&P US Dividend Aristocrats UCITS ETF                                      | 98.68525       | 102.7272        |
| BC MSCI Indonesia UCITS ETF  | 5113.632       | 493223.3        |
| SPDR® MSCI Emerging Markets Small Cap UCITS ETF GBP                              | 98.68525       | 102.7272        |
| SPDR® Dow Jones Global Real Estate UCITS ETF GBP                                 | 98.68525       | 102.7272        |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP                      | 98.68525       | 102.7272        |
| PIMCO Sterling Short Maturity Source UCITS ETF                                   | 101.0591       | 0.085738        |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP                      | 98.68525       | 102.7272        |
| PIMCO Emerging Markets Advantage Local Bond Index Source UCITS ETF Acc USD GBP   | 93.80792       | 44.85436        |
| PIMCO Short-Term High Yield Corporate Bond Index Source UCITS ETF Inc EUR Hedged | 95.71889       | 21.71152        |
| SPDR® Barclays US Treasury Bond UCITS ETF  | 98.68525       | 102.7272        |
| SPDR® Citi Asia Local Government Bond UCITS ETF                                  | 98.68525       | 102.7272        |
| Source LGIM Commodity Composite UCITS ETF  | 949.2727       | 17703.9         |
| DB Physical Silver ETC   | 3.7702         | 0.157494        |

Examining the variance column, we can see that eight of the instruments share the same variance. The underlying reason for this is the same as the cause of the high correlation. The majority of the ETFs in this portfolio use the same or similar primary instruments with only slight variations. When a given portfolio's instruments are very close or highly similar in their variance, the underlying mathematics of the software will be unable to leverage instrument diversity to its maximum potential. Fundamentally the wider the range of instrument variances, the better and more efficiently the software can perform.

### Random portfolio test comparison

When comparing all of the results from the random portfolios, the most obvious issue is that they all suffer from high levels of correlation. This was unexpected from a random selection of instruments. However, a closer examination of the ETF universe, in general, shows that although ETFs can appear very diverse, they are ultimately composed of underlying instruments, of which there is a finite number. This means that ETFs, that would be expected to be entirely uncorrelated, on close examination share underlining instruments and are thus ultimately correlated. From this, our core recommendation would be that; any portfolio that is designed for our software must undergo comprehensive research and statistical testing. To ensure that both, fundamentally and mathematically, the instruments that are used in a portfolio are truly diverse, to maximise the software's potential.

### Semi Random portfolio Results

The semi random portfolio completed without issue and was calculated faster than expected, by a small margin. As with the other tests, the graphs and data tables can be found in the

Appendix. The results of the semi random portfolio are more in line with expected performance when the software is combined with an intelligently designed portfolio, see fig 4.a.

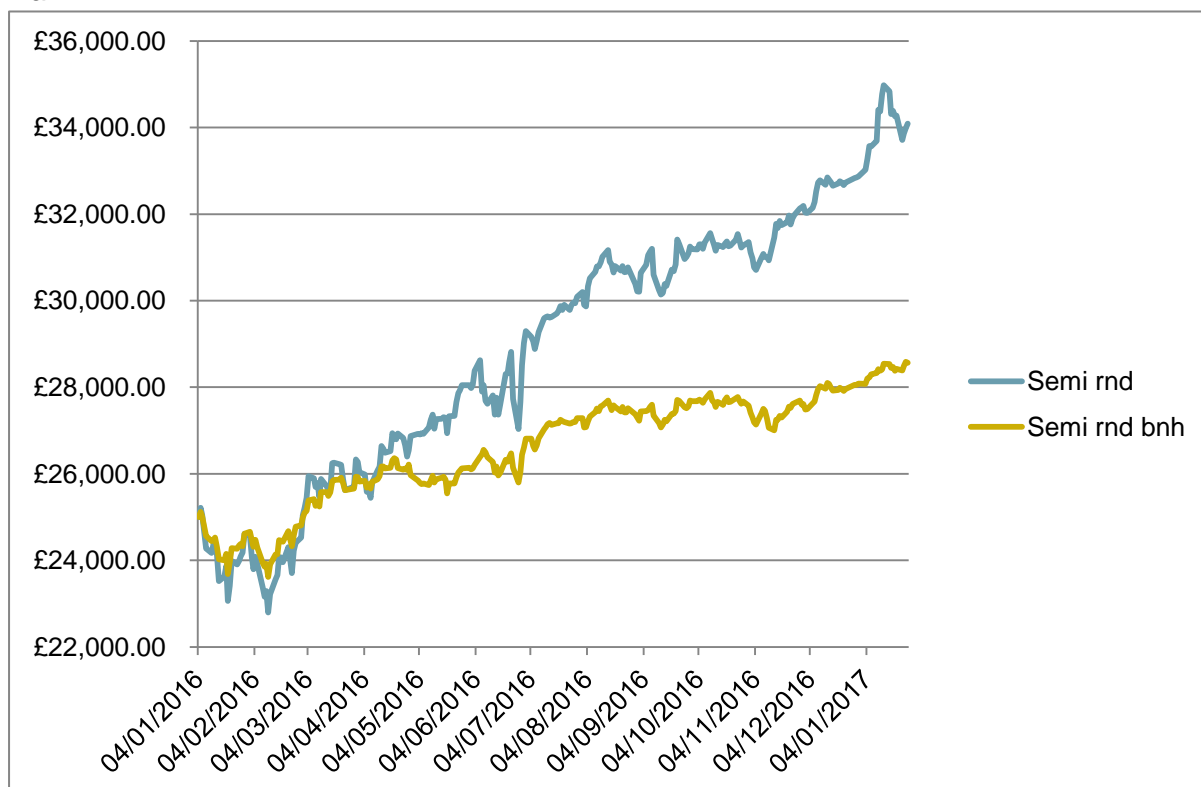


Fig 4.a

The changes made to the ETFs in the semi random can be seen to have a positive effect on both the VaR controlled test and the buy and hold benchmark. The correlation of the instruments in the portfolio has been improved producing an average instrument correlation is now 0.32988. Although not ideal, it is a real improvement on the original base portfolio (random portfolio 1). Looking closely at the correlation table (Appendix) we can see that: SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF, SPDR® Barclays Emerging Markets Local Bond UCITS ETF and SPDR® S&P 500 Low Volatility UCITS ETF need revising or replacing. The ETFs created and managed by PIMCO would also need reconsidering or replacing with less correlated alternatives.

When comparing the risk spread in the variance, as seen in the summary statistics table (Appendix), marked improvements can be viewed in an increasing range of variances. This increase in range was successfully leveraged by the VaR controlled test.

The most striking difference can be seen when comparing the portfolio change over time area graph. Fig 1.b (random portfolio 1) and fig 4.b (semi random) represent these graphs and can be found in the appendix. The first and most striking difference is the complexity of change illustrated in both graphs. While Fig 1.b looks very chaotic with its near constant change, fig 4.b, in contrast, is far more tranquil with comparatively longer periods between portfolio changes. Both graphs serve as one of the best ways to view the portfolio through out the test, and their appearance very much reflects the underlying portfolio's performance during the test period. We can see that the random portfolio 1 test had great difficulty in finding the most optimum weighting for the given risk. The semi random portfolio, in contrast,

was able to maintain a weighing within the same risk parameters for up to six consecutive weeks. At first, this may not seem relevant. However, if the tests were re-produced to account for all of the costs involved in trading, we would see a huge difference in the total costs. The semi random portfolio would only incur a fraction of the costs of the random portfolios tested.

## Conclusions

Based on the tests produced and their subsequent analysis the following summary conclusions can be drawn:

- The PMS software can use a set of randomly constructed portfolios. However to maximise the software's efficiency and benefits, an intelligently designed portfolio is required. It is highly recommended to research each potential instrument's fundamentals and statistics. It is also recommended that all portfolios undergo a correlation analysis.
- High instrument correlation in the portfolio has a negative impact on both a buy and hold strategies and a VaR controlled strategy. Ensuring the lowest possible correlation values for a portfolio will have a positive effect on both strategies. In the case of a VaR managed strategy, a low correlated portfolio can be leveraged and optimised more efficient leading to significant gains over a buy and hold strategy.
- Low-risk diversity is not recommended when designing portfolios. A lack of risk diversity can lead to increase costs across the life of the portfolio, compared to portfolios with instruments that contain a wider spread of risk amounts its instruments.

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## Appendix

### Portfolio compositions

Random portfolio 1:

1. DB x-trackers MSCI India Index UCITS ETF 1C USD
2. SPDR® S&P 500 Low Volatility UCITS ETF
3. Ossiäm Emerging Markets Minimum Variance NR UCITS ETF 1C (USD) USD
4. Amundi ETF MSCI Emerging Markets UCITS ETF USD USD
5. HSBC MSCI Korea UCITS ETF
6. HSBC FTSE EPRANAREIT Developed UCITS ETF
7. SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF
8. SPDR® Barclays Emerging Markets Local Bond UCITS ETF
9. SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF GBP
10. SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP
11. SPDR® Barclays 0-3 Year Euro Corporate Bond UCITS ETF GBP
12. SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF
13. SPDR® Barclays Emerging Markets Local Bond UCITS ETF
14. Source Physical Palladium ETC (P-ETC)
15. ETFS Longer Dated All Commodities GO UCITS ETF

Random portfolio 2:

1. Ossiam World Minimum Variance NR UCITS ETF 1C (USD)
2. Ossiam US Minimum Variance NR UCITS ETF 1C (USD) USD
3. HSBC MSCI Russia Capped UCITS ETF
4. Amundi ETF MSCI EM Asia UCITS ETF USD USD
5. HSBC MSCI Russia Capped UCITS ETF
6. SPDR® Dow Jones Global Real Estate UCITS ETF GBP
7. SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF
8. SPDR® BofA Merrill Lynch Emerging Markets Corporate Bond UCITS ETF
9. FinEx Tradable Russian Corporate Bonds UCITS ETF (USD)
10. SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF GBP
11. SPDR® Barclays 0-3 Year US Corporate Bond UCITS ETF GBP
12. SPDR® Citi Asia Local Government Bond UCITS ETF
13. SPDR® Citi Asia Local Government Bond UCITS ETF
14. ETFS 1x Daily Short Coffee ETC
15. ETFS Silver ETC

Random portfolio 3:

1. HSBC MSCI EM Latin America UCITS ETF
2. SPDR® MSCI Emerging Markets UCITS ETF
3. SPDR® S&P US Dividend Aristocrats UCITS ETF
4. HSBC MSCI Indonesia UCITS ETF
5. SPDR® MSCI Emerging Markets Small Cap UCITS ETF GBP
6. SPDR® Dow Jones Global Real Estate UCITS ETF GBP
7. SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP
8. PIMCO Sterling Short Maturity Source UCITS ETF
9. SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP
10. PIMCO Emerging Markets Advantage Local Bond Index Source UCITS ETF Acc USD GBP
11. PIMCO Short-Term High Yield Corporate Bond Index Source UCITS ETF Inc EUR Hedged
12. SPDR® Barclays US Treasury Bond UCITS ETF
13. SPDR® Citi Asia Local Government Bond UCITS ETF
14. Source LGIM Commodity Composite UCITS ETF
15. DB Physical Silver ETC

Semi Random portfolio:

1. Vanguard FTSE 100 UCITS ETF
2. SPDR® S&P 500 Low Volatility UCITS ETF iShares Core S&P 500 ETF
3. Amundi ETF MSCI Emerging Markets UCITS ETF USD USD
4. iShares Core MSCI World UCITS ETF USD (Acc)
5. HSBC FTSE EPRANAREIT Developed UCITS ETF
6. SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF
7. FinEx Tradable Russian Corporate Bonds UCITS ETF (USD)
8. PIMCO Sterling Short Maturity Source UCITS ETF
9. SPDR® BofA Merrill Lynch Emerging Markets Corporate Bond UCITS ETF GBP
10. SPDR® Barclays 0-3 Year Euro Corporate Bond UCITS ETF GBP
11. ETFS Copper ETC



12. SPDR® Barclays Emerging Markets Local Bond UCITS ETF
13. Source Physical Palladium ETC (P-ETC)
14. ETFS Longer Dated All Commodities GO UCITS ETF
15. PIMCO Short-Term High Yield Corporate Bond Index Source UCITS ETF Inc EUR  
Hedged
16. Cash

## Graphs

Fig 1.b

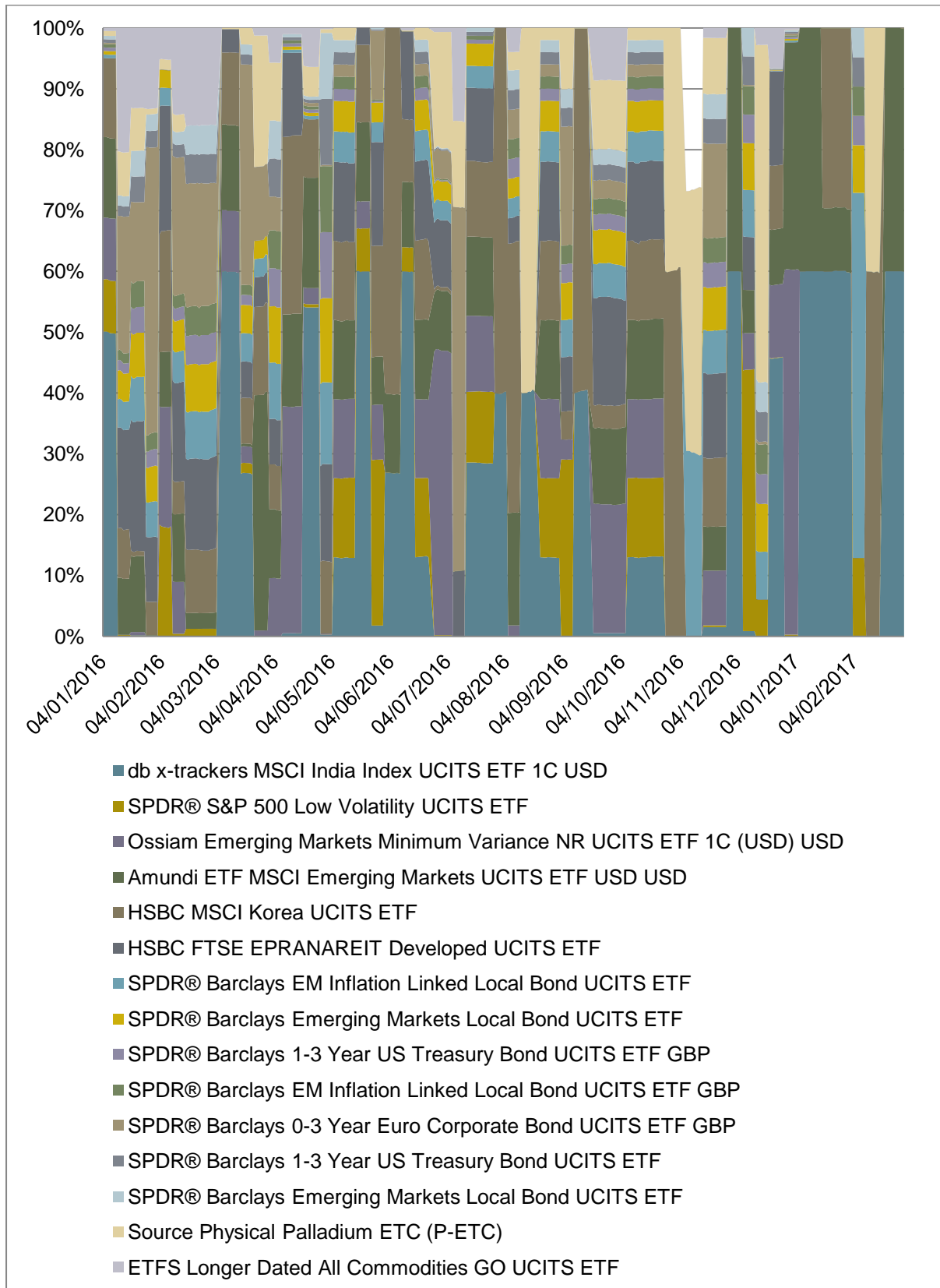


Fig 2.b

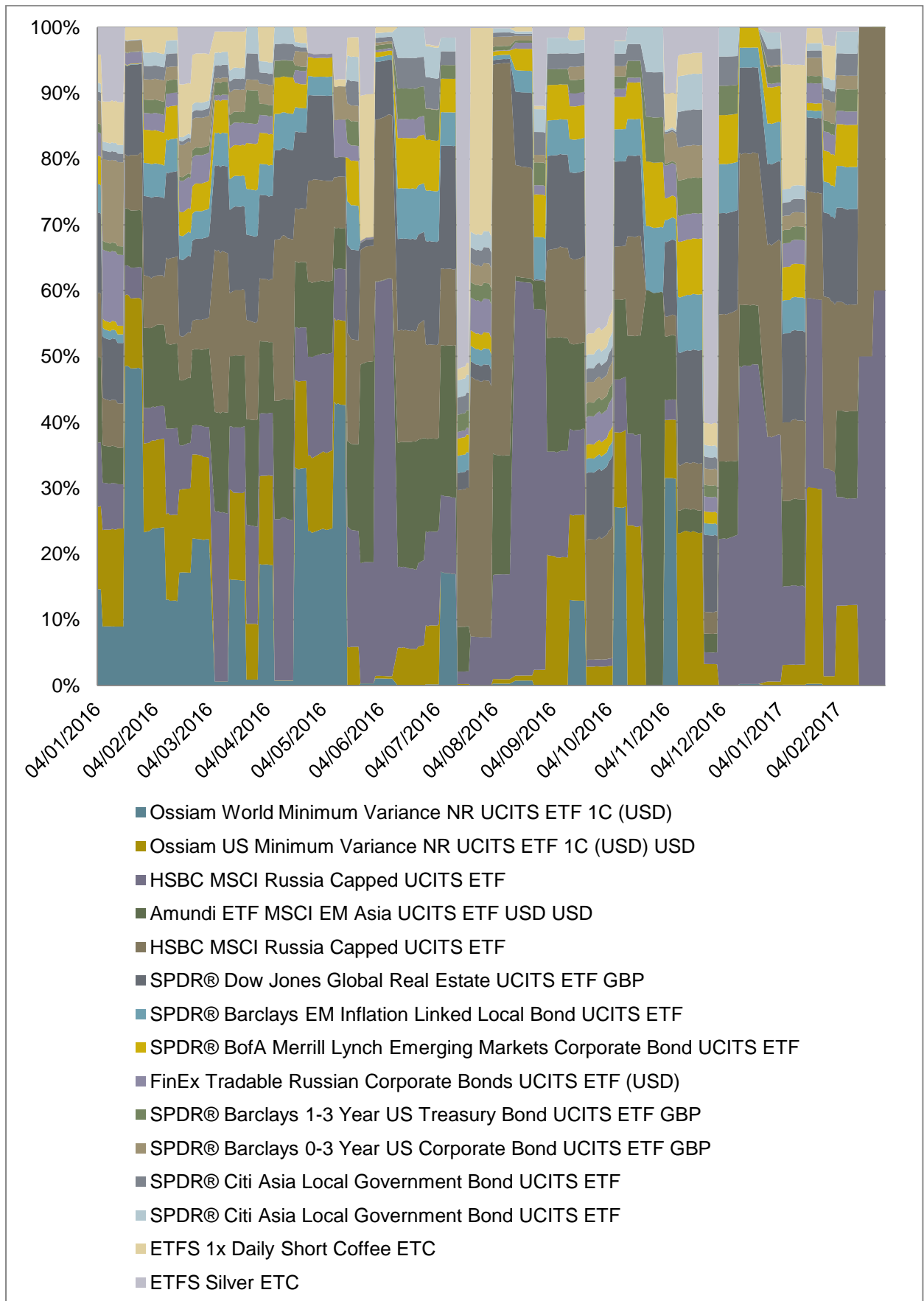


Fig 3.b

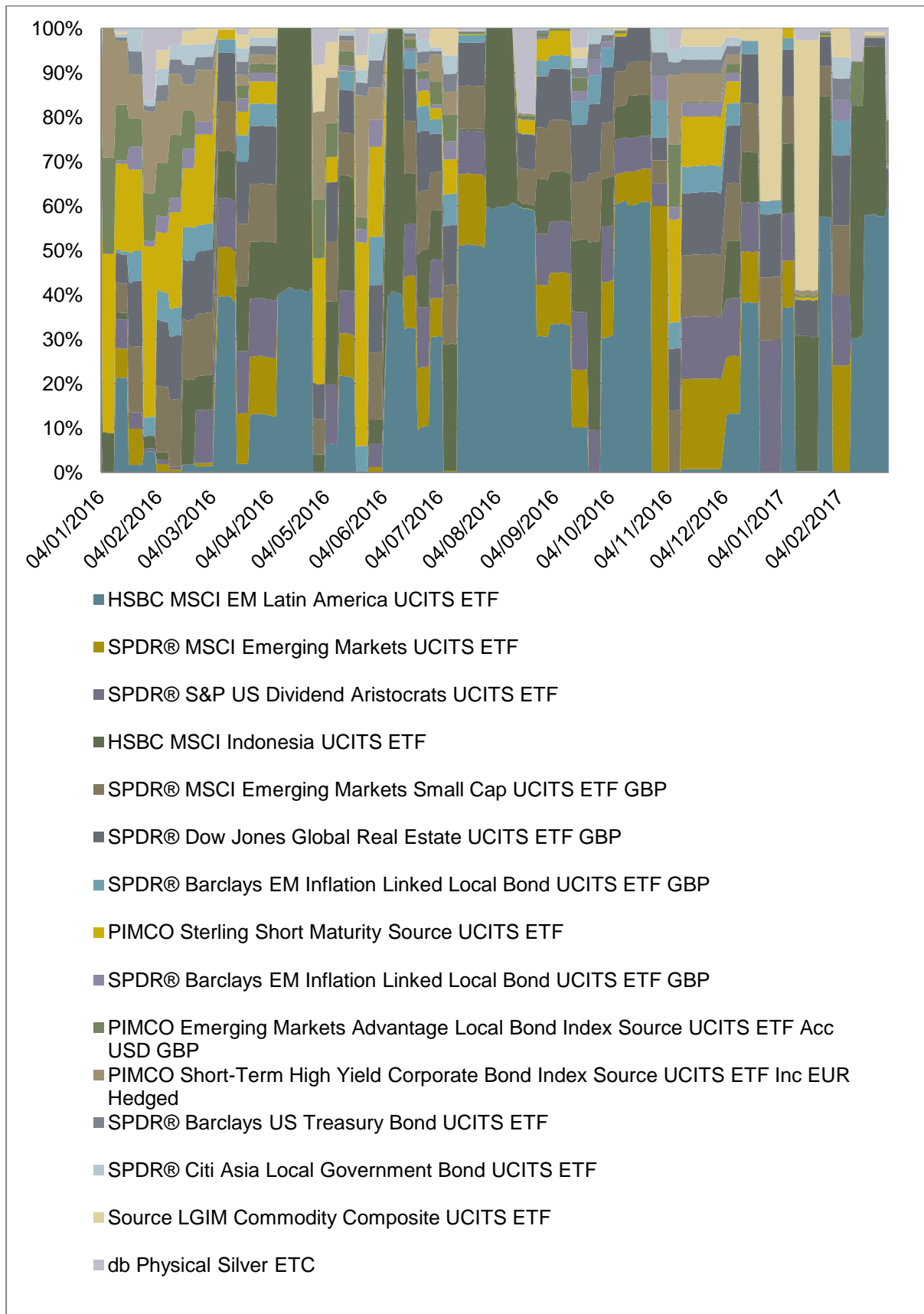
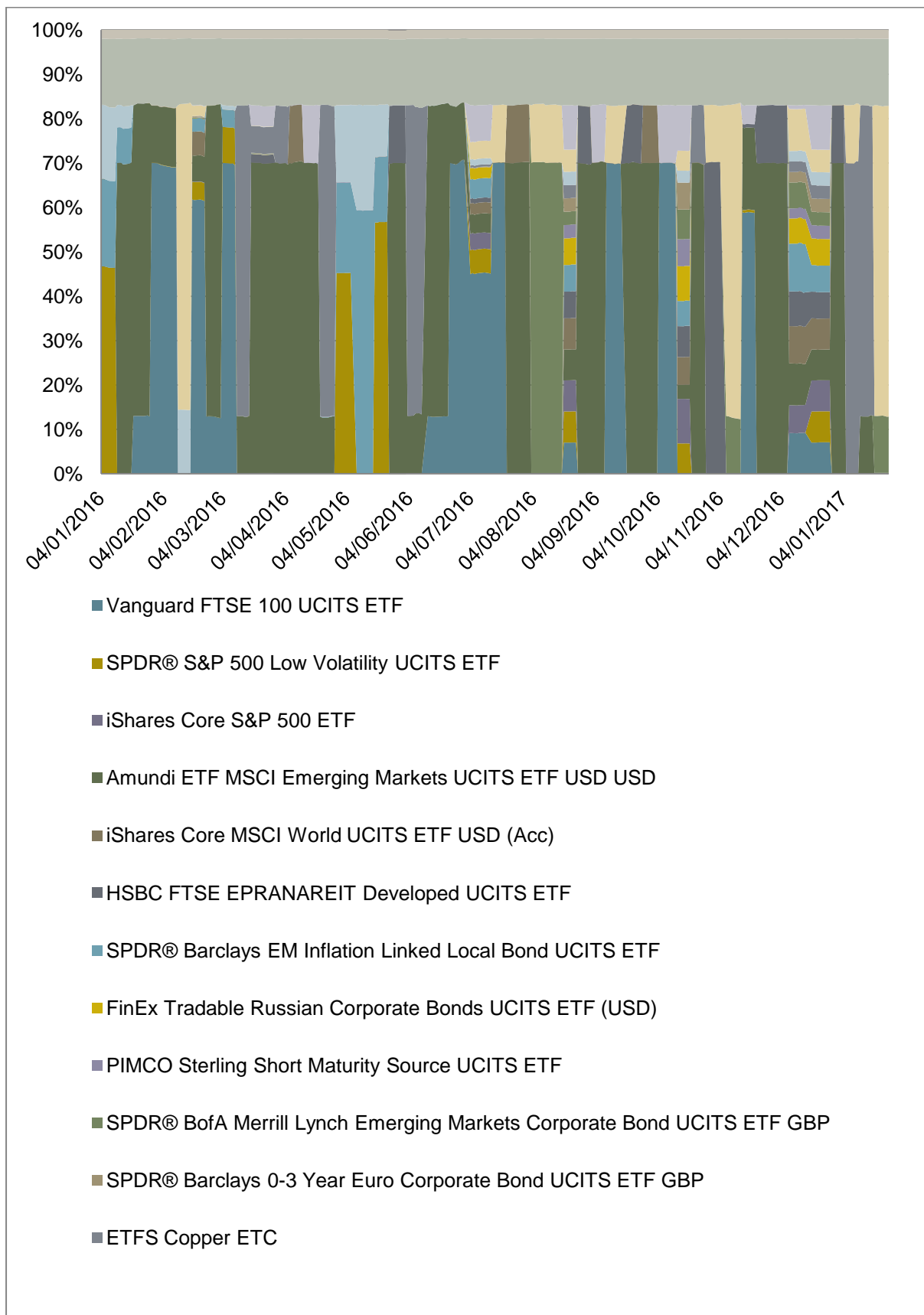


Fig 4.b



## Summary Statistics

Random portfolio 1:

| <i>Groups</i>  | <i>Average</i> | <i>Variance</i> |
|--|----------------|-----------------|
| DB x-trackers MSCI India Index UCITS ETF 1C USD                    | 3.7702         | 0.157494        |
| SPDR® S&P 500 Low Volatility UCITS ETF                             | 98.68525       | 102.7272        |
| Ossiam Emerging Markets Minimum Variance NR UCITS ETF 1C (USD) USD | 111.1421       | 111.9096        |
| Amundi ETF MSCI Emerging Markets UCITS ETF USD USD                 | 3.7702         | 0.157494        |
| HSBC MSCI Korea UCITS ETF  | 39.23411       | 12.14876        |
| HSBC FTSE EPRANAREIT Developed UCITS ETF                           | 22.21511       | 1.034946        |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF            | 98.68525       | 102.7272        |
| SPDR® Barclays Emerging Markets Local Bond UCITS ETF               | 98.68525       | 102.7272        |
| SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF GBP             | 98.68525       | 102.7272        |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP        | 98.68525       | 102.7272        |
| SPDR® Barclays 0-3 Year Euro Corporate Bond UCITS ETF GBP          | 30.33595       | 0.005864        |
| SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF                 | 98.68525       | 102.7272        |
| SPDR® Barclays Emerging Markets Local Bond UCITS ETF               | 98.68525       | 102.7272        |
| Source Physical Palladium ETC (P-ETC)                              | 949.2727       | 17703.9         |
| ETFS Longer Dated All Commodities GO UCITS ETF                     | 15.85656       | 7.91776         |

Random portfolio 2:

| <i>Groups</i>  | <i>Average</i> | <i>Variance</i> |
|--|----------------|-----------------|
| Ossiam World Minimum Variance NR UCITS ETF 1C (USD)                | 144.3355       | 68.45488        |
| Ossiam US Minimum Variance NR UCITS ETF 1C (USD) USD               | 10872.17       | 2787154         |
| HSBC MSCI Russia Capped UCITS ETF                                  | 611.0749       | 11674.18        |
| Amundi ETF MSCI EM Asia UCITS ETF USD USD                          | 25.2014        | 5.214278        |
| HSBC MSCI Russia Capped UCITS ETF                                  | 611.0749       | 11674.18        |
| SPDR® Dow Jones Global Real Estate UCITS ETF GBP                   | 98.68525       | 102.7272        |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF            | 98.68525       | 102.7272        |
| SPDR® BofA Merrill Lynch Emerging Markets Corporate Bond UCITS ETF | 98.68525       | 102.7272        |
| FinEx Tradable Russian Corporate Bonds UCITS ETF (USD)             | 95.65441       | 39.57332        |
| SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF GBP             | 98.68525       | 102.7272        |
| SPDR® Barclays 0-3 Year US Corporate Bond UCITS ETF GBP            | 50.35042       | 0.028642        |
| SPDR® Citi Asia Local Government Bond UCITS ETF                    | 98.68525       | 102.7272        |
| SPDR® Citi Asia Local Government Bond UCITS ETF                    | 98.68525       | 102.7272        |
| ETFS 1x Daily Short Coffee ETC                                     | 42.09762       | 46.44469        |
| ETFS Silver ETC  | 18.23782       | 5.60231         |

Random portfolio 3:

| <i>Groups</i>                         | <i>Average</i> | <i>Variance</i> |
|---------------------------------------|----------------|-----------------|
| HSBC MSCI EM Latin America UCITS ETF  | 1712.173       | 76062.28        |
| SPDR® MSCI Emerging Markets UCITS ETF | 98.68525       | 102.7272        |

|  |          |          |
|--|----------|----------|
| SPDR® S&P US Dividend Aristocrats UCITS ETF                                      | 98.68525 | 102.7272 |
| HSBC MSCI Indonesia UCITS ETF  | 5113.632 | 493223.3 |
| SPDR® MSCI Emerging Markets Small Cap UCITS ETF GBP                              | 98.68525 | 102.7272 |
| SPDR® Dow Jones Global Real Estate UCITS ETF GBP                                 | 98.68525 | 102.7272 |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP                      | 98.68525 | 102.7272 |
| PIMCO Sterling Short Maturity Source UCITS ETF                                   | 101.0591 | 0.085738 |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP                      | 98.68525 | 102.7272 |
| PIMCO Emerging Markets Advantage Local Bond Index Source UCITS ETF Acc USD GBP   | 93.80792 | 44.85436 |
| PIMCO Short-Term High Yield Corporate Bond Index Source UCITS ETF Inc EUR Hedged | 95.71889 | 21.71152 |
| SPDR® Barclays US Treasury Bond UCITS ETF  | 98.68525 | 102.7272 |
| SPDR® Citi Asia Local Government Bond UCITS ETF                                  | 98.68525 | 102.7272 |
| Source LGIM Commodity Composite UCITS ETF  | 949.2727 | 17703.9  |
| DB Physical Silver ETC   | 3.7702   | 0.157494 |

Semi random portfolio:

| <i>Groups</i>  | <i>Average</i> | <i>Variance</i> |
|--|----------------|-----------------|
| Vanguard FTSE 100 UCITS ETF  | 29.80635       | 2.588477        |
| SPDR® S&P 500 Low Volatility UCITS ETF   | 98.6871        | 102.9826        |
| iShares Core S&P 500 ETF   | 170.7261       | 0.023289        |
| Amundi ETF MSCI Emerging Markets UCITS ETF USD USD                               | 3.779625       | 0.122219        |
| iShares Core MSCI World UCITS ETF USD (Acc)                                      | 41.63289       | 3.538211        |
| HSBC FTSE EPRANAREIT Developed UCITS ETF   | 22.21335       | 1.036287        |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF                          | 98.6871        | 102.9826        |
| FinEx Tradable Russian Corporate Bonds UCITS ETF (USD)                           | 95.68003       | 39.37801        |
| PIMCO Sterling Short Maturity Source UCITS ETF                                   | 101.0595       | 0.085897        |
| SPDR® BofA Merrill Lynch Emerging Markets Corporate Bond UCITS ETF GBP           | 65.40515       | 46.0941         |
| SPDR® Barclays 0-3 Year Euro Corporate Bond UCITS ETF GBP                        | 30.33576       | 0.005865        |
| ETFS Copper ETC  | 26.22539       | 19.79812        |
| SPDR® Barclays Emerging Markets Local Bond UCITS ETF                             | 98.6871        | 102.9826        |
| Source Physical Palladium ETC (P-ETC)  | 949.3578       | 17745.31        |
| ETFs Longer Dated All Commodities GO UCITS ETF                                   | 15.85439       | 7.935653        |
| PIMCO Short-Term High Yield Corporate Bond Index Source UCITS ETF Inc EUR Hedged | 95.71361       | 21.75467        |
| Cash   | 1              | 0               |

## Correlation Tables

Random portfolio 1: Bond Correlation Table

|   | <i>SPDR®<br/>Barclays EM<br/>Inflation<br/>Linked Local<br/>Bond UCITS<br/>ETF</i> | <i>SPDR®<br/>Barclays<br/>Emerging<br/>Markets<br/>Local Bond<br/>UCITS ETF</i> | <i>SPDR®<br/>Barclays 1-3<br/>Year US<br/>Treasury<br/>Bond UCITS<br/>ETF GBP</i> | <i>SPDR®<br/>Barclays EM<br/>Inflation<br/>Linked Local<br/>Bond UCITS<br/>ETF GBP</i> | <i>SPDR®<br/>Barclays 0-3<br/>Year Euro<br/>Corporate<br/>Bond UCITS<br/>ETF GBP</i> | <i>SPDR®<br/>Barclays<br/>1-3 Year<br/>US<br/>Treasury<br/>Bond<br/>UCITS<br/>ETF</i> | <i>SPDR®<br/>Barclays<br/>Emerging<br/>Markets<br/>Local<br/>Bond<br/>UCITS<br/>ETF</i> |
|---|--|---|---|--|--|---|---|
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF     | 1  |   |   |  |  |   |   |
| SPDR® Barclays Emerging Markets Local Bond UCITS ETF        | 1  | 1   |   |  |  |   |   |
| SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF GBP      | 1  | 1   | 1   |  |  |   |   |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP | 1  | 1   | 1   | 1  |  |   |   |
| SPDR® Barclays 0-3 Year Euro Corporate Bond UCITS ETF GBP   | 0.515034399  | 0.515034399   | 0.515034399   | 0.515034399  | 1  |   |   |
| SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF          | 1  | 1   | 1   | 1  | 0.515034399  | 1   |   |
| SPDR® Barclays Emerging Markets Local Bond UCITS ETF        | 1  | 1   | 1   | 1  | 0.515034399  | 1   | 1   |

Random portfolio 1: Whole portfolio correlation table





|   |             |             |              |              |             |              |          |              |          |          |      |      |           |      |   |
|---|-------------|-------------|--------------|--------------|-------------|--------------|----------|--------------|----------|----------|------|------|-----------|------|---|
|   |             | 196         |              |              |             |              |          |              |          |          |      |      |           |      |   |
| HSBC FTSE EPRANAREIT Developed UCITS ETF                    | 0.26<br>917 | 0.47<br>077 | 0.12<br>36   | 0.26<br>9172 | 0.17<br>344 | 1            | 1        |              |          |          |      |      |           |      |   |
|   | 2           | 7           |              |              |             |              |          |              |          |          |      |      |           |      |   |
|   | -           |             | -            | -            | -           |              |          |              |          |          |      |      |           |      |   |
| SPDR® Barclays EM Inflation-Linked Local Bond UCITS ETF     | 0.15<br>093 |             | 0.51<br>66   | 0.15<br>093  | 0.21<br>196 | 0.470<br>777 | 1        |              |          |          |      |      |           |      |   |
|   | -           |             | -            | -            | -           |              |          |              |          |          |      |      |           |      |   |
| SPDR® Barclays Emerging Markets Local Bond UCITS ETF        | 0.15<br>093 |             | 0.51<br>66   | 0.15<br>093  | 0.21<br>196 | 0.470<br>777 | 1        | 1            |          |          |      |      |           |      |   |
|   | -           |             | -            | -            | -           |              |          |              |          |          |      |      |           |      |   |
| SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF GBP      | 0.15<br>093 |             | 0.51<br>66   | 0.15<br>093  | 0.21<br>196 | 0.470<br>777 | 1        | 1            | 1        |          |      |      |           |      |   |
|   | -           |             | -            | -            | -           |              |          |              |          |          |      |      |           |      |   |
| SPDR® Barclays EM Inflation-Linked Local Bond UCITS ETF GBP | 0.15<br>093 |             | 0.51<br>66   | 0.15<br>093  | 0.21<br>196 | 0.470<br>777 | 1        | 1            | 1        | 1        |      |      |           |      |   |
|   |             | 0.51        |              |              | 0.18        |              | 0.51     |              | 0.51     | 0.51     | 0.51 |      |           |      |   |
| SPDR® Barclays 0-3 Year Euro Corporate Bond UCITS ETF GBP   | 0.27<br>846 | 503<br>4    | 0.13<br>8446 | 0.27<br>846  | 0.199<br>4  | 0.747<br>588 | 503<br>4 | 0.51<br>5034 | 503<br>4 | 503<br>4 |      |      | 1         |      |   |
|   | -           |             | -            | -            | -           |              |          |              |          |          |      |      |           |      |   |
| SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF          | 0.15<br>093 |             | 0.51<br>66   | 0.15<br>093  | 0.21<br>196 | 0.470<br>777 | 1        | 1            | 1        | 1        | 5034 |      | 0.51<br>1 |      |   |
|   | -           |             | -            | -            | -           |              |          |              |          |          |      |      |           |      |   |
| SPDR® Barclays Emerging Markets Local Bond UCITS ETF        | 0.15<br>093 |             | 0.51<br>66   | 0.15<br>093  | 0.21<br>196 | 0.470<br>777 | 1        | 1            | 1        | 1        | 5034 |      | 0.51<br>1 | 1    |   |
|   | -           | 0.95        | -            | -            | -           |              | 0.95     |              | 0.95     | 0.95     |      |      | 0.95      |      |   |
|   | 0.11        | 254         | 0.49         | 0.11         | 0.14        | 0.363        | 254      | 0.95         | 254      | 254      | 0.45 | 254  | 0.95      |      |   |
| Source Physical Palladium ETC (P-ETC)                       | 796         | 1           | 463          | 796          | 138         | 078          | 1        | 2541         | 1        | 1        | 9365 | 1    | 2541      | 1    |   |
|   | 0.63        | -           |              |              | 0.78        |              | -        | -            | -        | -        | -    | -    | -         | -    | - |
| ETFS Longer Dated All Commodities GO UCITS ETF              | 947         | 0.69        | 0.89         | 0.63         | 493         | 0.196        | 0.69     | 0.69         | 0.69     | 0.69     | 0.13 | 0.69 | 0.69      | 0.60 |   |
|   | 9           | 872         | 0088         | 9479         | 3           | 32           | 872      | 872          | 872      | 872      | 52   | 872  | 872       | 142  | 1 |

Random portfolio 2: Whole portfolio correlation table

|  | SPDR®  |  |  |  |  |  |                                    |  |   |   |   |  |  |  |
|--|--|--|--|--|--|--|------------------------------------|--|---|---|---|--|--|--|
|  | Ossiam                                       |  |  |  |  | BofA   |                                    |  |   |   |   |  |  |  |
|  | World Minimum Variance NR UCITS ETF 1C (USD) | World Minimum Variance NR UCITS ETF 1C (USD) | World Minimum Variance NR UCITS ETF 1C (USD) | World Minimum Variance NR UCITS ETF 1C (USD) | World Minimum Variance NR UCITS ETF 1C (USD) | SPDR® Dow Jones Global Real Estate UCITS ETF GBP | SPDR® Barclays EM Inflation Linked | SPDR® Merriam Lynch Emerging Markets Inflation Corp Bond UCITS ETF (USD) | SPDR® FinEx Tradeable Russian Corp Bond UCITS ETF (USD) | SPDR® Barclays 1-3 Year US Gov Bond UCITS ETF (USD) | SPDR® Barclays 0-3 Year US Gov Bond UCITS ETF (USD) | SPDR® Citi Asia Local Gov Bond UCITS ETF | SPDR® Citi Asia Local Gov Bond UCITS ETF | ETFS Daily FS Short Term US Gov Bond UCITS ETF |
| Ossiam World Minimum Variance NR UCITS ETF 1C (USD)  | 1  |  |  |  |  |  |                                    |  |   |   |   |  |  |  |
| Ossiam US Minimum Variance NR UCITS ETF 1C (USD) USD | 0.90   | 1  |  |  |  |  |                                    |  |   |   |   |  |  |  |
|  |  |  |  |  |  |  |                                    |  |   |   |   |  |  |  |
| HSBC MSCI Russia Capped UCITS ETF                    | 0.04   | 0.18   |  |  |  |  |                                    |  |   |   |   |  |  |  |
| Amundi ETF MSCI EM Asia UCITS ETF USD USD            | 0.14   | 0.05   | 0.36   |  |  |  |                                    |  |   |   |   |  |  |  |
|  | 3494   | 7461   | 3314   | 1  |  |  |                                    |  |   |   |   |  |  |  |
|  |  |  |  |  |  |  |                                    |  |   |   |   |  |  |  |
| HSBC MSCI Russia Capped UCITS ETF                    | 0.04   | 0.18   |  | 0.36   |  |  |                                    |  |   |   |   |  |  |  |
| SPDR® Dow Jones Global Real Estate UCITS ETF GBP     | 0.91   | 0.95   | 0.15   | 0.10   | 0.15   |  |                                    |  |   |   |   |  |  |  |
| SPDR® Barclays EM Inflation Linked                   | 5553   | 0683   | 6056   | 428  | 6056   | 1  |                                    |  |   |   |   |  |  |  |
|  | 0.91   | 0.95   | 0.15   | 0.10   | 0.15   | 1  | 1                                  |  |   |   |   |  |  |  |

|  |      |      |      |      |      |      |      |      |      |      |      |        |        |      |   |
|--|------|------|------|------|------|------|------|------|------|------|------|--------|--------|------|---|
| Local Bond UCITS ETF   | 5553 | 0683 | 6056 | 428  | 6056 |      |      |      |      |      |      |        |        |      |   |
| SPDR® BofA Merrill Lynch Emerging Markets Corporate Bond UCITS ETF | 0.91 | 0.95 | 0.15 | 0.10 | 0.15 |      |      |      |      |      |      |        |        |      |   |
|  | 5553 | 0683 | 6056 | 428  | 6056 | 1    | 1    | 1    |      |      |      |        |        |      |   |
|  |      |      |      | -    |      |      |      |      |      |      |      |        |        |      |   |
| FinEx Tradable Russian Corporate Bonds UCITS ETF (USD)             | 0.28 | 0.46 | 0.55 | 0.17 | 0.55 | 0.44 | 0.44 | 0.44 |      |      |      |        |        |      |   |
|  | 424  | 2895 | 2095 | 63   | 2095 | 2206 | 2206 | 2206 | 1    |      |      |        |        |      |   |
| SPDR® Barclays 1-3 Year US Treasury Bond UCITS ETF GBP             | 0.91 | 0.95 | 0.15 | 0.10 | 0.15 |      |      |      | 0.44 |      |      |        |        |      |   |
|  | 5553 | 0683 | 6056 | 428  | 6056 | 1    | 1    | 1    | 2206 | 1    |      |        |        |      |   |
|  | -    | -    |      |      |      | -    | -    | -    |      |      |      |        |        |      |   |
| SPDR® Barclays 0-3 Year US Corporate Bond UCITS ETF GBP            | 0.17 | 0.17 | 0.42 | 0.28 | 0.42 | 0.23 | 0.23 | 0.23 | 0.12 | 0.23 |      |        |        |      |   |
|  | 336  | 748  | 3893 | 5918 | 3893 | 74   | 74   | 74   | 3211 | 74   | 1    |        |        |      |   |
|  |      |      |      |      |      |      |      |      |      |      | -    |        |        |      |   |
| SPDR® Citi Asia Local Government Bond UCITS ETF                    | 0.91 | 0.95 | 0.15 | 0.10 | 0.15 |      |      |      | 0.44 |      | 0.23 |        |        |      |   |
|  | 5553 | 0683 | 6056 | 428  | 6056 | 1    | 1    | 1    | 2206 | 1    | 74   | 1      |        |      |   |
|  |      |      |      |      |      |      |      |      |      |      | -    |        |        |      |   |
| SPDR® Citi Asia Local Government Bond UCITS ETF                    | 0.91 | 0.95 | 0.15 | 0.10 | 0.15 |      |      |      | 0.44 |      | 0.23 |        |        |      |   |
|  | 5553 | 0683 | 6056 | 428  | 6056 | 1    | 1    | 1    | 2206 | 1    | 74   | 1      | 1      |      |   |
|  |      |      |      |      |      |      |      |      |      |      | -    |        |        |      |   |
|  | 0.07 | 0.03 | 0.34 | 0.42 | 0.34 | 0.05 | 0.05 | 0.05 | 0.19 | 0.05 | 0.38 | 0.0512 | 0.0512 |      |   |
| ETFs 1x Daily Short Coffee ETC                                     | 5091 | 5742 | 383  | 041  | 383  | 1279 | 1279 | 1279 | 303  | 1279 | 489  | 79     | 79     | 1    |   |
|  | -    | -    |      |      |      | -    | -    | -    |      |      | -    | -      | -      |      |   |
|  | 0.41 | 0.32 | 0.61 | 0.28 | 0.61 | 0.40 | 0.40 | 0.40 | 0.21 | 0.40 | 0.64 | 0.4044 | 0.4044 | 0.45 |   |
| ETFS Silver ETC  | 167  | 328  | 0628 | 859  | 0628 | 442  | 442  | 442  | 7396 | 442  | 3086 | 2      | 2      | 027  | 1 |

Random portfolio 3: Whole portfolio correlation table



|  |      |      |      |      |      |      |      |      |      |      |      |      |       |       |   |
|--|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|---|
|  | 8    | 1    |      |      |      |      |      |      |      |      |      |      |       |       |   |
|  | 0.04 |      |      | 0.65 |      |      |      |      |      |      |      |      |       |       |   |
| SPDR® MSCI Emerging Markets Small Cap UCITS ETF GBP                              | 351  |      |      | 337  |      |      |      |      |      |      |      |      |       |       |   |
|  | 8    | 1    | 1    | 1    | 1    |      |      |      |      |      |      |      |       |       |   |
|  | 0.04 |      |      | 0.65 |      |      |      |      |      |      |      |      |       |       |   |
| SPDR® Dow Jones Global Real Estate UCITS ETF GBP                                 | 351  |      |      | 337  |      |      |      |      |      |      |      |      |       |       |   |
|  | 8    | 1    | 1    | 1    | 1    | 1    | 1    |      |      |      |      |      |       |       |   |
|  | 0.04 |      |      | 0.65 |      |      |      |      |      |      |      |      |       |       |   |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP                      | 351  |      |      | 337  |      |      |      |      |      |      |      |      |       |       |   |
|  | 8    | 1    | 1    | 1    | 1    | 1    | 1    |      |      |      |      |      |       |       |   |
|  | 0.30 | 0.87 |      | 0.78 | 0.87 | 0.87 | 0.87 |      |      |      |      |      |       |       |   |
| PIMCO Sterling Short Maturity Source UCITS ETF                                   | 179  | 625  | 0.87 | 122  | 625  | 625  | 625  |      |      |      |      |      |       |       |   |
|  | 8    | 2    | 6252 | 3    | 2    | 2    | 2    |      |      | 1    |      |      |       |       |   |
|  | 0.04 |      |      | 0.65 |      |      |      |      |      | 0.87 |      |      |       |       |   |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF GBP                      | 351  |      |      | 337  |      |      |      |      |      | 625  |      |      |       |       |   |
|  | 8    | 1    | 1    | 1    | 1    | 1    | 1    | 2    | 1    |      |      |      |       |       |   |
|  | 0.85 | -    | -    | 0.27 | -    | -    | -    | -    | -    |      |      |      |       |       |   |
| PIMCO Emerging Markets Advantage Local Bond Index Source UCITS ETF Acc USD GBP   | 996  | 0.33 | 0.33 | 698  | 0.33 | 0.33 | 0.33 | 0.06 | 0.33 |      |      |      |       |       |   |
|  | 7    | 809  | 809  | 1    | 809  | 809  | 809  | 319  | 809  | 1    |      |      |       |       |   |
| PIMCO Short-Term High Yield Corporate Bond Index Source UCITS ETF Inc EUR Hedged | 0.70 | -    | -    |      | -    | -    | -    | -    | -    |      |      |      |       |       |   |
|  | 278  | 0.50 | 0.50 | 0.00 | 0.50 | 0.50 | 0.50 | 0.30 | 0.50 | 0.78 |      |      |       |       |   |
|  | 2    | 157  | 157  | 212  | 157  | 157  | 157  | 536  | 157  | 5239 | 1    |      |       |       |   |
|  | 0.04 |      |      | 0.65 |      |      |      |      |      | 0.87 | -    | -    |       |       |   |
| SPDR® Barclays US Treasury Bond UCITS ETF  | 351  |      |      | 337  |      |      |      |      |      | 625  | 0.33 | 0.50 |       |       |   |
|  | 8    | 1    | 1    | 1    | 1    | 1    | 1    | 2    | 1    | 809  | 157  | 1    |       |       |   |
|  | 0.04 |      |      | 0.65 |      |      |      |      |      | 0.87 | -    | -    |       |       |   |
| SPDR® Citi Asia Local Government Bond UCITS ETF                                  | 351  |      |      | 337  |      |      |      |      |      | 625  | 0.33 | 0.50 |       |       |   |
|  | 8    | 1    | 1    | 1    | 1    | 1    | 1    | 2    | 1    | 809  | 157  | 1    | 1     |       |   |
|  | 0.14 | 0.95 |      | 0.70 | 0.95 | 0.95 | 0.95 | 0.92 | 0.95 | -    | -    | 0.95 |       |       |   |
| Source LGIM Commodity Composite UCITS ETF  | 889  | 254  | 0.95 | 818  | 254  | 254  | 254  | 081  | 254  | 0.28 | 0.39 | 254  | 0.952 |       |   |
|  | 6    | 1    | 2541 | 9    | 1    | 1    | 1    | 1    | 1    | 001  | 072  | 1    | 541   | 1     |   |
|  | 0.72 | -    | -    | 0.28 | -    | -    | -    | -    | -    | 0.71 | 0.73 | -    | -     | -     |   |
| DB Physical Silver ETC   | 774  | 0.15 | 0.15 | 085  | 0.15 | 0.15 | 0.15 | 0.05 | 0.15 | 1794 | 8611 | 0.15 | 0.150 | 0.117 | 1 |



|  |      |     |     |     |     |       |     |      |     |      |   |
|--|------|-----|-----|-----|-----|-------|-----|------|-----|------|---|
| ETF  | 232  |     |     |     |     |       |     |      |     |      |   |
|  | 5    |     |     |     |     |       |     |      |     |      |   |
|  | 0.40 | 0.6 |     |     |     |       |     |      |     |      |   |
|  | 419  | 381 |     |     |     |       |     |      |     |      |   |
| iShares Core S&P 500 ETF   | 1    | 41  | 1   |     |     |       |     |      |     |      |   |
|  |      | -   |     |     |     |       |     |      |     |      |   |
|  | 0.76 | 0.1 | 0.0 |     |     |       |     |      |     |      |   |
| Amundi ETF MSCI Emerging Markets UCITS ETF USD USD                     | 808  | 735 | 236 |     |     |       |     |      |     |      |   |
|  | 8    | 2   | 31  | 1   |     |       |     |      |     |      |   |
|  | 0.63 | 0.7 | 0.5 | 0.3 |     |       |     |      |     |      |   |
| iShares Core MSCI World UCITS ETF USD (Acc)                            | 470  | 627 | 039 | 951 |     |       |     |      |     |      |   |
|  | 9    | 8   | 82  | 45  | 1   |       |     |      |     |      |   |
|  | 0.29 | 0.4 | 0.1 | 0.3 | 0.6 |       |     |      |     |      |   |
| HSBC FTSE EPRANAREIT Developed UCITS ETF                               | 116  | 711 | 278 | 248 | 110 |       |     |      |     |      |   |
|  | 1    | 94  | 67  | 63  | 51  | 1     |     |      |     |      |   |
|  |      |     |     | -   |     |       |     |      |     |      |   |
|  | 0.17 |     | 0.6 | 0.1 | 0.7 |       |     |      |     |      |   |
| SPDR® Barclays EM Inflation Linked Local Bond UCITS ETF                | 232  |     | 381 | 735 | 627 | 0.471 |     |      |     |      |   |
|  | 5    | 1   | 41  | 2   | 8   | 194   | 1   |      |     |      |   |
|  | 0.10 | 0.4 | 0.6 | -   | 0.2 | -     | 0.4 |      |     |      |   |
| FinEx Tradable Russian Corporate Bonds UCITS ETF (USD)                 | 227  | 435 | 308 | 0.2 | 217 | 0.091 | 435 |      |     |      |   |
|  | 9    | 1   | 14  | 237 | 33  | 15    | 1   | 1    |     |      |   |
|  |      |     |     | -   |     |       |     |      |     |      |   |
|  | 0.30 | 0.8 | 0.8 | 0.0 | 0.6 |       | 0.8 | 0.60 |     |      |   |
| PIMCO Sterling Short Maturity Source UCITS ETF                         | 770  | 764 | 117 | 770 | 559 | 0.364 | 764 | 713  |     |      |   |
|  | 4    | 51  | 51  | 3   | 19  | 134   | 51  | 8    | 1   |      |   |
|  |      |     |     | -   |     |       |     |      |     |      |   |
|  | 0.25 | 0.8 | 0.7 | 0.1 | 0.6 |       | 0.8 | 0.58 | 0.9 |      |   |
| SPDR® BofA Merrill Lynch Emerging Markets Corporate Bond UCITS ETF GBP | 405  | 948 | 669 | 403 | 158 | 0.381 | 948 | 919  | 583 |      |   |
|  | 9    | 54  | 09  | 6   | 01  | 68    | 54  | 6    | 34  | 1    |   |
|  | 0.28 | 0.5 | 0.2 | 0.3 | 0.5 |       | 0.5 | -    | 0.5 | 0.51 |   |
| SPDR® Barclays 0-3 Year Euro Corporate Bond UCITS ETF GBP              | 631  | 158 | 677 | 430 | 889 | 0.747 | 158 | 0.05 | 036 | 192  |   |
|  | 4    | 19  | 33  | 42  | 64  | 261   | 19  | 749  | 61  | 3    | 1 |



|                                       |      |     |     |     |     |       |     |      |     |      |      |     |     |      |       |   |   |
|---------------------------------------|------|-----|-----|-----|-----|-------|-----|------|-----|------|------|-----|-----|------|-------|---|---|
|                                       |      | -   | -   | -   | -   | -     | -   | -    | -   | -    | -    | -   | -   | -    | -     | - | - |
|                                       | 0.53 | 0.6 | 0.1 | 0.7 | 0.1 | -     | 0.6 | -    | 0.4 | -    | -    | -   | -   | -    | -     | - | - |
|                                       | 121  | 179 | 572 | 574 | 095 | 0.232 | 179 | 0.29 | 471 | 0.52 | 0.14 | -   | -   | -    | -     | - | - |
| ETFS Copper ETC                       | 9    | 5   | 9   | 59  | 2   | 06    | 5   | 245  | 2   | 554  | 048  | 1   | -   | -    | -     | - | - |
|                                       |      |     |     |     |     |       |     |      |     |      |      |     |     |      |       |   |   |
|                                       | 0.17 |     | 0.6 | 0.1 | 0.7 |       |     |      | 0.8 | 0.89 | 0.51 | 0.6 | -   | -    | -     | - | - |
| SPDR® Barclays Emerging Markets       | 232  |     | 381 | 735 | 627 | 0.471 |     | 0.44 | 764 | 485  | 581  | 179 | -   | -    | -     | - | - |
| Local Bond UCITS ETF                  | 5    | 1   | 41  | 2   | 8   | 194   | 1   | 351  | 51  | 4    | 9    | 5   | 1   | -    | -     | - | - |
|                                       |      |     |     |     |     |       |     |      |     |      |      |     |     |      |       |   |   |
|                                       | 0.29 | 0.9 | 0.7 | 0.1 | 0.7 |       | 0.9 | 0.48 | 0.9 | 0.94 | 0.46 | 0.5 | 0.9 | -    | -     | - | - |
|                                       | 909  | 525 | 373 | 409 | 419 | 0.363 | 525 | 422  | 208 | 445  | 056  | 119 | 525 | -    | -     | - | - |
| Source Physical Palladium ETC (P-ETC) | 6    | 8   | 21  | 9   | 1   | 771   | 8   | 3    | 59  | 5    | 9    | 3   | 8   | 1    | -     | - | - |
|                                       |      |     |     |     |     |       |     |      |     |      |      |     |     |      |       |   |   |
|                                       | 0.46 | 0.6 | 0.1 | 0.7 | 0.1 | -     | 0.6 | -    | 0.4 | -    | -    | 0.9 | 0.6 | -    | -     | - | - |
| ETFS Longer Dated All Commodities     | 473  | 987 | 879 | 352 | 977 | 0.196 | 987 | 0.23 | 730 | 0.56 | 0.13 | 381 | 987 | 0.60 | -     | - | - |
| GO UCITS ETF                          | 7    | 5   | 5   | 6   | 5   | 99    | 5   | 747  | 8   | 151  | 614  | 67  | 5   | 134  | 1     | - | - |
|                                       |      |     |     |     |     |       |     |      |     |      |      |     |     |      |       |   |   |
|                                       | 0.68 | 0.5 | 0.0 | 0.8 | 0.0 | -     | 0.5 | -    | 0.3 | -    | 0.02 | 0.9 | 0.5 | -    | -     | - | - |
| PIMCO Short-Term High Yield           | 445  | 016 | 890 | 519 | 836 | 0.007 | 016 | 0.26 | 049 | 0.39 | 730  | 096 | 016 | 0.39 | 0.922 | - | - |
| Corporate Bond Index Source UCITS     | 2    | 2   | 2   | 66  | 87  | 87    | 2   | 479  | 6   | 771  | 9    | 56  | 2   | 056  | 778   | 1 | - |
| ETF Inc EUR Hedged                    |      |     |     |     |     |       |     |      |     |      |      |     |     |      |       |   |   |
| Cash                                  | 0    | 0   | 0   | 0   | 0   | 0     | 0   | 0    | 0   | 0    | 0    | 0   | 0   | 0    | 0     | 0 | 1 |