

# Research Brief

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## The Global Monkey

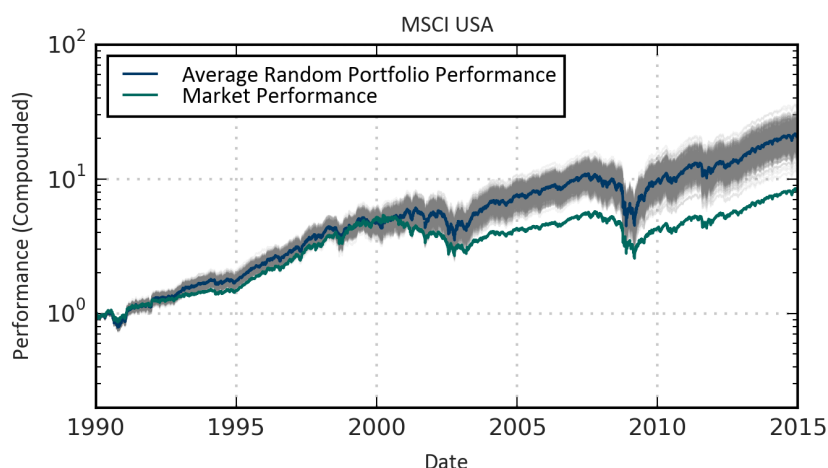
Randomly selected equally weighted portfolios have outperformed market capitalisation weighted portfolios globally and by region over the last fifteen years. These results and structural features of market capitalisation benchmarks call the supposed efficiency of these benchmarks into question.

In October 2011, David Harding published the results of our research into the efficiency, or otherwise, of market capitalisation weighted portfolios<sup>1</sup>. The core result was that randomly chosen equally weighted portfolios had outperformed the S&P500 from 1965 through to 2011. Such a result clearly throws the efficiency of market capitalisation weighted portfolios into doubt. In more colloquial terms, a monkey throwing one hundred darts at a list of stocks in the index would likely have outperformed the supposedly efficient traditional benchmark. Furthermore, while it is possible that the portfolios randomly chosen outperform because they take on higher risk, which would not necessarily violate the Capital Asset Pricing Model (CAPM), in fact the random portfolios also have higher Sharpe ratios.

It is worthwhile to attempt a similar experiment on a global scale to see if the result is US specific or on the contrary, if the monkey wins on a global basis (and if global CAPM is also violated). Using a similar approach to the original research, each year we randomly selected 20% of the average number of stocks for each of the regions in the MSCI global developed market index to obtain our portfolio constituents. We carried out this sampling 1000 times to obtain 1000 randomly generated portfolios. The performances of the random portfolios were then compared to market capitalisation weighted regional indices that make up the MSCI World Index.

In Figure 1 we summarise the performance results for MSCI USA, MSCI Japan, MSCI Pacific excluding Japan, MSCI Europe and MSCI World. The darker blue line is the average performance of the randomly generated portfolios and the green line is the performance of the relevant index and the grey lines are the individual random portfolios.

Figure 1: A performance comparison of randomly generated portfolios and the index for different MSCI regions



<sup>1</sup> David Harding, "Some new ideas in financial mathematics", Pensions and Investments, October 31 2011.

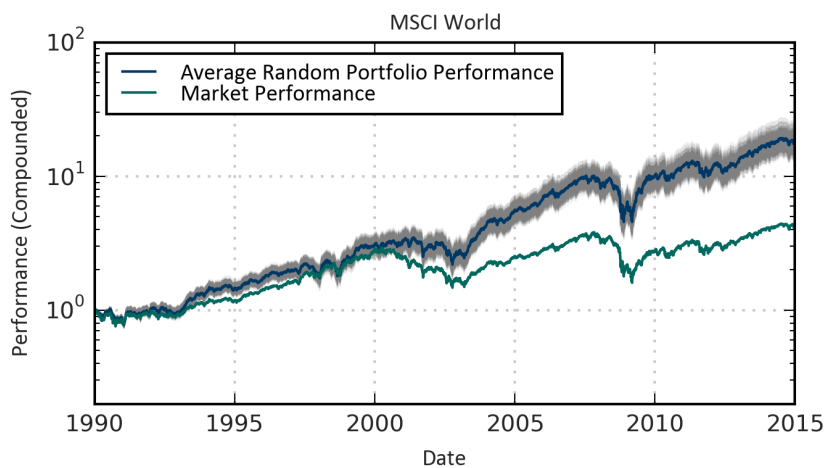
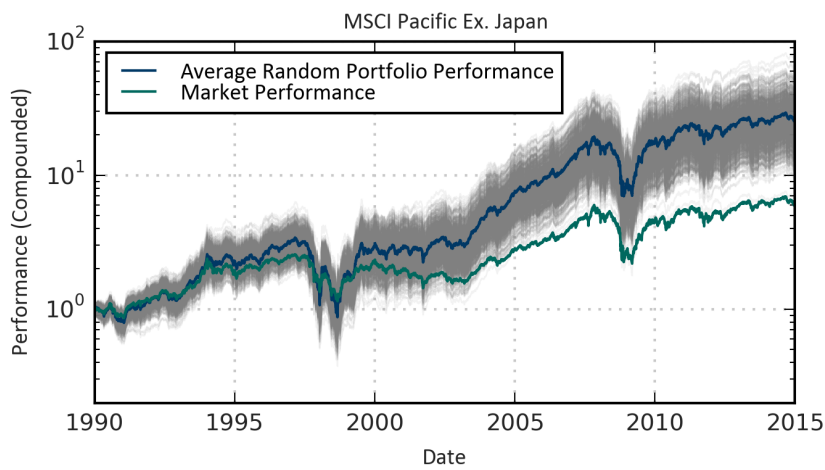
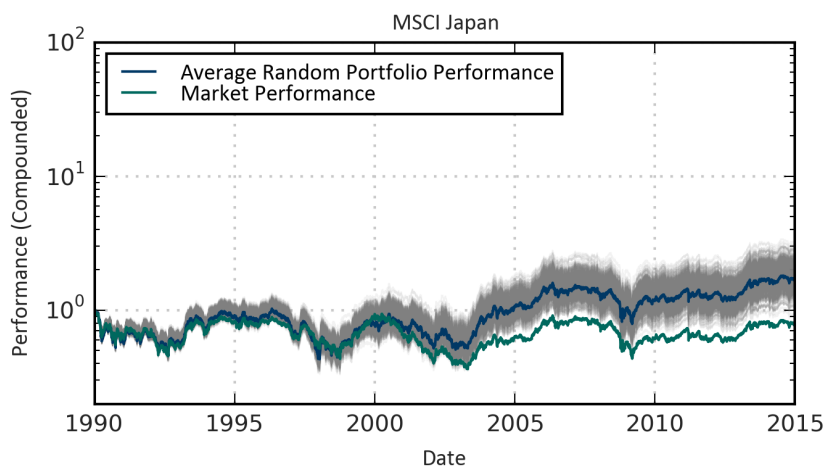
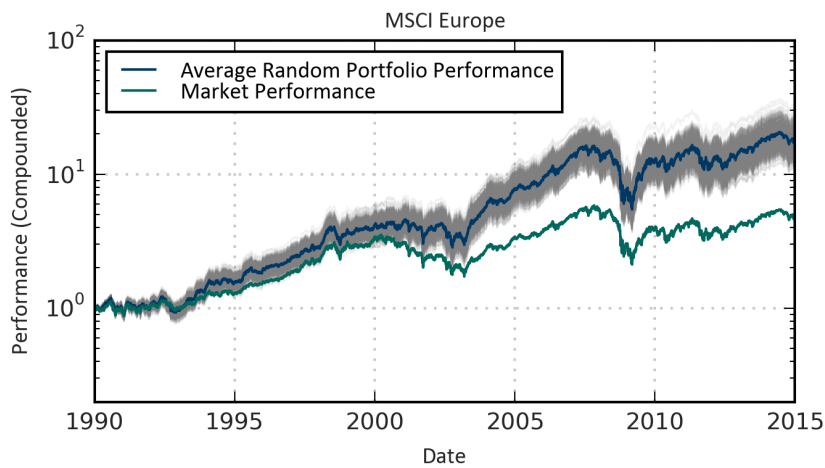
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The key result seems to hold globally. For all the regional portfolios and the MSCI World index itself, the randomly generated portfolios outperformed the index without taking on significantly more risk.

A widely used measure of portfolio efficiency is the Sharpe ratio, the ratio of expected return, minus the risk free rate of interest, to the volatility of return. Accordingly, Table 1 shows the average Sharpe ratio and return for the random portfolios, and the Sharpe ratio and return for the corresponding index. If CAPM were true, it implies that investors should hold the market portfolio because it is the optimal portfolio of risky assets to hold. It is hard to reconcile this implication with the numbers in Table 1 which show that over the last 25 years, monkey-generated portfolios have been superior in not only returns but also in terms of Sharpe ratios to the market capitalisation weighted portfolio in every region of the MSCI World index. It could be argued that these results are specific to these time periods, but 24 years is a long period and so these results can hardly be regarded as a short term anomaly.

Table 1: Sharpe ratio and return comparison between the randomly generated portfolios and the index

Universe	Average Random Portfolio Sharpe Ratio	Average Random Portfolio Return (Annualised, %)	Index Sharpe Ratio	Index Return (Annualised, %)
S&P500	0.74	14.4	0.37	10.2
MSCI Europe	0.66	13.3	0.23	8.1
MSCI Japan	0.22	5.2	-0.08	1.6
MSCI Pacific Ex. Japan	0.67	15.1	0.29	9.0
MSCI USA	0.73	14.3	0.37	10.3
MSCI World	0.82	12.5	0.22	6.8

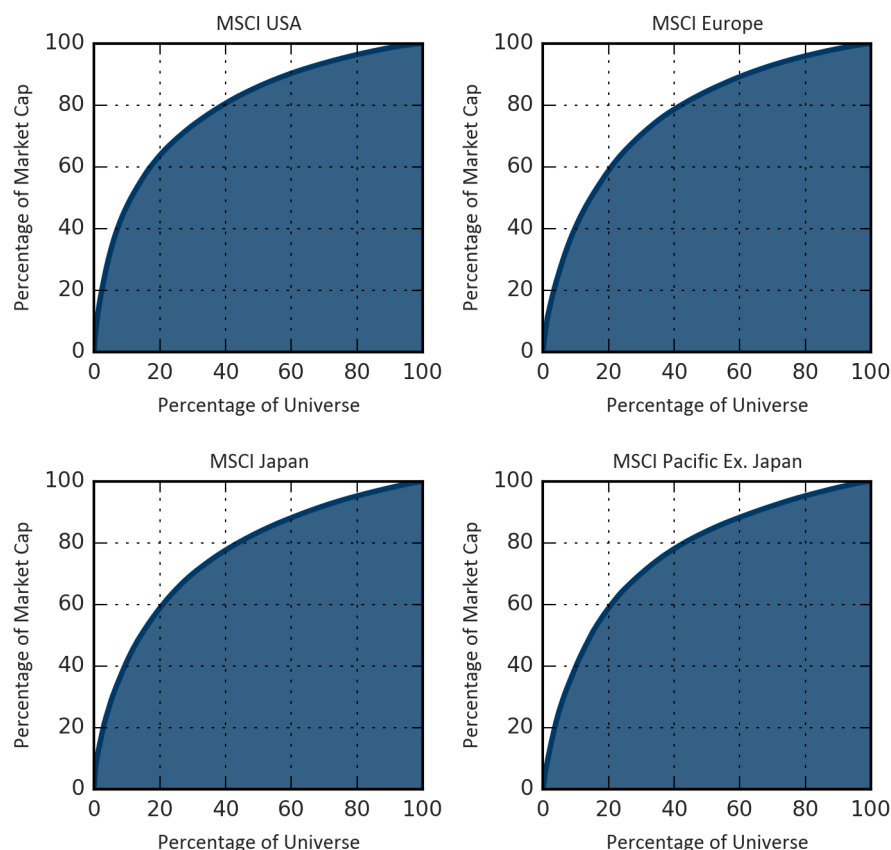
There are other good reasons to doubt that market capitalisation weighted portfolios are the optimal risky asset portfolio as the global CAPM implies. Figure 2 shows the cumulative percentage of market capitalisation accounted for by a given percentage of the number of stocks in the relevant regional index. The stocks are ordered by size and so, the largest stock is added first and the smallest stock is added last. The shape of the cumulative distribution is very similar in each region. A key result from this analysis is that a relatively small number of stocks account for a large proportion of the total market capitalisation of each index. For example, in MSCI Europe the largest 20% of constituents account for roughly 60% of the overall market cap of the index. Similar results hold for the other regional indices. By contrast, if these indices were equally weighted then 20% of the index constituents would account for 20% of the market-cap.

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Figure 2: Concentration by region



Another way of summarising this data is in terms of concentration; the degree to which the overall distribution of weights is dominated by large weights on a few stocks. The Gini coefficient is a measure of concentration. For an equally weighted index the Gini coefficient is zero and ranges between 0 and 1 for other weight distributions where higher values indicate greater concentration. Table 2 shows the Gini coefficient for the various MSCI indices and the S&P500 index. As might be expected from the market capitalisation distributions charts, these indices are very concentrated.

Table 2: Gini coefficient for MSCI indices

Universe	Gini Coefficient
MSCI USA	0.89
MSCI Europe	0.79
MSCI Pacific Ex. Japan	0.73
MSCI Japan	0.89
MSCI World	0.93
S&P 500	0.89

A good reason, therefore, to doubt the global CAPM is that this theory implies that every investor ought to hold stocks in precisely the highly concentrated weights of each regional index. To hold an equally weighted portfolio in this framework is to introduce a substantial “size exposure” relative to the market capitalisation weighted benchmark. If global CAPM does not hold then of course there may be

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no good reason to hold the market capitalisation weighted portfolio and it would seem more reasonable based on this analysis to regard it as having a substantial size exposure. In summary, of course the total holdings of equities must equal the total amount of equity outstanding but different investors may well prefer different portfolios and need not hold highly concentrated index portfolios.

A second issue with the global CAPM theory that follows trivially from the regional analysis is that all investors should hold the same capitalisation weighted global index as their equity allocation. This directly implies that the country weights in each investor's portfolio should be equal to the country weights in the index, regardless of what country they live in. However, in practice, this is very far from being the case. Table 3<sup>2</sup> shows the percentage of market capitalisation of each country in the index and the amount of that market held in domestic equity portfolios for selected countries. According to global CAPM these numbers should be the same<sup>3</sup>. Only a subset of major markets from the working paper is included, Indonesia is not of course a big market but it is included as the country that has the largest home country bias in the world. So in every country, investors hold more of their domestic market in their portfolios than they should if global CAPM was right. A very large number of papers have attempted to reconcile this "Home equity bias" with global CAPM but this has been so far a fruitless task given the extent of the deviations from the theoretically implied portfolio proportions.

Table 3: Home bias in equity portfolios

Country	% Market Cap	% Domestic in Total Equity	Home Bias
United States	40.5	82.2	41.7
Japan	13.2	91.9	78.7
UK	7.3	65.0	57.7
France	4.2	68.8	64.6
Canada	3.5	76.6	73.0
Netherlands	1.4	32.1	30.8
Indonesia	0.2	99.9	99.7

In summary, the monkey is global. Furthermore, there are good reasons unrelated to the dart throwing prowess of the monkey to doubt that capitalisation-weighted portfolios are likely to possess the properties of risk efficiency and optimality implied by global CAPM. On the contrary, it seems that when the monkey is finished throwing darts, it throws a dagger through the heart of global CAPM.

<sup>2</sup> Reproduced with permission from Sercu and Vanpepe (Home Bias in International Equity Portfolios: A Review, Leuven School of Business and Economics Working Paper, 2007). This table is therefore a little dated but the numbers do not change drastically from year to year.

<sup>3</sup> Here we have assumed that purchasing power parity (PPP) is correct and so an investor bears little foreign currency risk.



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