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Behind the performance of Equally Weighted Indices

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A Spreading Concept

Equal Weight approach in broad equity investing is one of the most successful recent novelties in the alternative equity indexing space. Giving the same weight to all stocks in the universe is seemingly the most obvious strategy and as such a most straight-forward benchmark. Boosted by the expansion of ETFs, a perfect wrap that helps to spread and democratise the Equal Weight concept, the product family already counted more than USD 3.5 bln AUM as of Apr-2011 under this wrapper[1]. All major index providers have launched Equal Weight versions of their flagship indices within the last 8 years. Two examples covering the largest US and European stocks are equally weighted versions of S&P 500 and STOXX Europe 600 indices, launched, respectively, in January 2003 and October 2010.

A growing amount of publications on equal weight investing is coming from industry professionals as well as from the academia[2]. The major question being investigated is excess performance of equally weighted portfolios against the dominant benchmarks: market capitalisation weighted portfolios. The debate is still open since performance comparison results exhibit high dependency on period and equity basket selected. Frequent arguments that are often invoked in relation to the equally weighted strategies are size-insensitive allocation, resulting in overweighting small stocks compared to a market-capitalisation weighted portfolio, contrarian-like rebalancing enforced at each reset of the portfolio to equal weights (buy low, sell high), and potentially high turnover associated with the rebalancing activity. Here we intend to shed some light on the impact of these features on the equal weight strategy.

What to expect from an equally weighted allocation?

Quantitative investment generally involves complex modelling in order to extract meaningful and valuable insights from data related to past observations. What can be said about a strategy as straightforward as the equal weighting (further referred as EW) which mostly disregards available information?

Actually, the EW is not totally information free, as it involves the choice of an investment basket. The choice of portfolio constituents is itself a major information. Taking the composition of a broad market index as the investment universe for an EW portfolio allows to build a basket that is representative of the chosen equity market or sector. Such a basket is generally closely monitored by the market and satisfies reasonable liquidity criteria.

Once the basket is chosen, an EW index can be set up as a pure rule based strategy, and the EW methodology is very stable from one index provider to another. An EW index:

1. has the same constituents as its market capitalisation weighted counterpart (MW index),
2. allocates the same investment amount to all its constituents,
3. is rebalanced periodically (usually quarterly) to restore the equally weighted allocation.

The process is estimation free, which means that unlike most quantitative based indices, it requires no

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estimation of either risk profile or expected returns. EW index performance is easy to interpret: it is the average performance of all assets in the universe over the period.

Notwithstanding different allocation scheme and periodic rebalancing feature, the performance of EW portfolio is closely related to that of the market-capitalisation weighted benchmark. Indeed, correlation between market-capitalisation weighted and equally weighted indices on the same basket are often of the order of 95-99%, and their risk levels are very similar. This high level of correlation is not surprising, since an EW strategy is designed to provide access to the chosen market segment, where the corresponding market factor is the dominant one.

To appreciate the value added by the EW investing, one has to focus on excess return - the difference of the returns of equally weighted and market-cap weighted portfolios (Table 1). Here we consider two distinctive features of EW portfolios: periodic rebalancing and size-neutral allocation, and show how each of these features translates into properties of excess return. In the remaining sections, we probe the existence of a rebalancing bonus for the EW strategy, then we estimate the magnitude of the costs associated with portfolio turnover, finally we assess the impact of size neutrality on the excess return.

For this study we use a broad European universe, represented by the components of the STOXX Europe 600 index, along with the performance of auxiliary subportfolios representing performance of non-overlapping subgroups of the main index, containing stocks of different size buckets[3]. To simulate the performance of EW portfolios we use the procedure described above, with quarterly rebalancing made each quarter-end. We also reconstruct the corresponding market-capitalisation portfolios by weighting the stocks by their free-float market capitalisation.

Effect of rebalancing: is it all about being contrarian?

Market capitalisation weighting approach represents the only truly passive investment strategy. Equal weighting cannot remain passive, since price movements imply an allocation drift. At the end of a given period the stocks that performed better than the average end up having higher weights and the stocks that underperformed the average turn underweight with respect to the initial equal allocation. Consequently, one has to reduce periodically the investment in relative over-performers and to increase positions in relative under-performers to restore the equally weighted allocation. Though it may seem a pure maintenance operation, there are claims that this is one of the performance drivers of the strategy. This can be viewed as:

- A profit taking scheme: realise the relative profits at the end of the period. The EW index doesn't let itself be carried away in a momentum pattern.
- A contrarian strategy: it buys (sells) stocks that have been going out of favour (gained momentum) so it may profit from future price corrections when information is fully incorporated in market prices.

These arguments in favour of the equal weight investing seem intuitive and self-evident, and as such they remain under-investigated. Does the equally weighted strategy really benefit from rebalancing? What is the magnitude of its contribution to the excess performance?

We propose to assess the payoff related to rebalancing by using the following decomposition. We compare period-by-period performance of two portfolios (Figure 1):

1. an equally weighted portfolio that at the beginning of each period is rebalanced to exact equally weighted allocation, and
2. a "non-rebalanced" equally weighted portfolio that was exactly equally weighted one period before but hasn't been rebalanced recently.

Another way to visualise this test is to imagine a swap entered in by two parties with payments made at each rebalancing date. Parties exchange the performance of the "rebalanced" EW portfolio and the performance of the "non-rebalanced"' EW portfolio (here a new "non-rebalanced" portfolio is fixed at the preceding rebalancing date). By cumulating the swap

Index	2003-2006	2007	2008	2009	2010	Total	Std %
SPXEWTR	107.37	1.93	-41.16	50.93	20.58	126.35	23.46
SPTR	73.44	6.22	-38.3	29.56	13.91	67.75	21.11
Excess Return	33.93	-4.29	-2.85	21.37	6.67	58.61	4.54
SXXEWR	152.38	-3.28	-48.85	49.32	19.63	123.03	20.73
SXXR	100.6	2.29	-44.14	32.99	11.94	70.62	20.42
Excess Return	51.78	-5.57	-4.71	16.33	7.7	52.41	4.96

Table 1: Indices' performance comparison

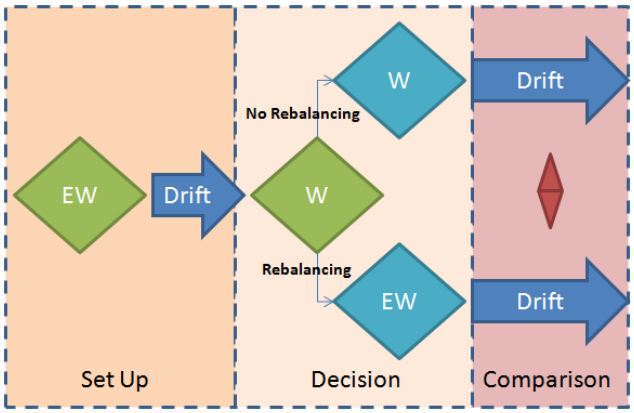

Figure 1: Rebalancing Test Construction

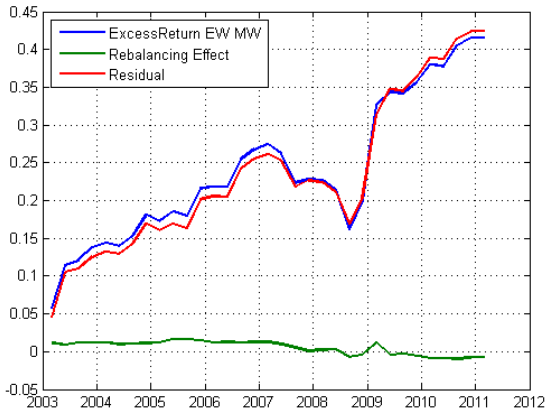

Figure 2: Excess Performance : Contribution of periodic rebalancing [4]

payments one has an idea of the magnitude and persistence of the rebalancing effect.

The two portfolios follow the same Equal Weight concept, and thus have essentially the same fundamental exposures. The differences in performance of these strategies are thus closely related to the stock allocation adjustment performed at the last rebalancing.

Figure 2 depicts the cumulated gains and losses associated with rebalancing activity over a 8 year period for the broad European EW portfolio. This is compared to the cumulated excess return of the EW portfolio with respect to the market capitalisation weighted one (a cumulative sum of one-quarter excess returns is used here). Indeed, the rebalancing payoff can be seen as a part of the excess return coming from the rebalancing activity, the rest being explained by factors other than rebalancing.

The magnitude of this effect is small compared to that of the total excess return, as one could expects given the similarity between the two test portfolios. Important information is in the shape and in the trend of this contribution. There was no systematic rebalancing benefit over time for the EW strategy, with no definite trend. Volatility of the contribution changes with the changes in market conditions, being more important in the times of market stress.

On average, the rebalancing effect was -2.4 basis points per quarter, with standard deviation of 0.5%. This appears to be marginal with respect to the excess performance of equally weighted index over market capitalisation weighted index, that was on average 1.2% per quarter, with standard deviation of 3.05%. The rebalancing contribution is not stable, or even positive, over time and thus cannot be deemed a reli-

able source of performance. The rebalancing adjustment though is essential to the design of the Equally Weighted portfolio, as its keeps the portfolio close to the target weights.

What is the impact of the portfolio turnover?

Implementing an equal weight strategy presents some concerns. The most apparent drawback is a rebalancing cost that is higher than for a passive investment. There are two main sources of turnover. The first one is specific to the EW strategy, it arises when the stocks already present in the portfolio are rebalanced to the target weights. This kind of turnover is directly linked to cross-sectional dispersion of returns in the universe, and is absent in an investment that follows a market-capitalisation weighted index. Indeed, one can show that this price-driven part of rebalancing is proportional to the cross-sectional mean absolute deviation (MAD) of returns (quarterly returns if the strategy is rebalanced quarterly, monthly returns is the strategy is rebalanced monthly, etc..)

$$turnover \sim \frac{\sum_{i=1}^{M} |r_t^i - R_t|}{M(1+R_t)} = \frac{\text{MAD}}{1+R_t} \qquad (1)$$

where R is the average one-period return of the stocks in the portfolio, r_i are the returns of single stocks, and M is the number of stocks in the portfolio.

In the case of normally distributed returns across the universe with zero mean (R = 0), the MAD is just proportional to the cross-sectional dispersion of the stocks' returns: MAD $= \sqrt{\frac{2}{\pi}}$std, or MAD $\sim 0.8\,$std. That is, this part of turnover is proportional to the cross-sectional dispersion of stock returns and does not depend explicitly on the number of stocks M.

For example, if EW strategy is rebalanced quarterly, the relevant measure is the cross-sectional dispersion of quarterly returns, that for a broad European basket since 2003 was situated between [8.8%, 39.1%], with the average of 13.6%. This gives an estimation that the order of magnitude for this "structural" turnover is around 10.9% quarterly. This is only slightly higher than the historical estimate of the structural turnover on our European broad EW portfolio, that is 9.2% per quarter on average.

Another source of turnover is linked to changes in the investment universe. These changes can be quite frequent in a large basket: stocks previously meeting the inclusion criteria fail to do so upon the current review and are replaced accordingly by the runners-up. Some corporate actions, like spin-offs and mergers, also affect the composition of the portfolio. Such a turnover is inherent to both market-capitalisation weighted and equally weighted indices, although not with the same order of magnitude. The main criteria for inclusion being size, universe revisions affect mostly smaller capitalisation stocks. Given that a market-capitalisation weighted index has tiny weights allocated to the smallest stocks, the turnover generated will be smaller than for an EW portfolio that allocates systematically more weight to the small stocks. Swapping one small stock for another would generate a turnover of roughly 0.05% for a capitalisation-weighted portfolio compared to 0.3% for an EW portfolio. Changes in the universe represent a non negligible portion of the overall transaction cost.

The split of the total (annual) turnover into the two factors is given below:

Turnover (%)	Dispersion Contribution	Universe Change	Total
EW	36.8%	17.4%	54.2%
MW	0	5%	5%

Table 2: Breakdown of annual turnover

The turnover of the equal-weighted strategy is clearly dominated by the dispersion factor, accounting for 68% of the total turnover. investment universe changes result in a turnover of 5% per year for the passive MW portfolio, and a three times larger turnover for the EW portfolio. Still, in absolute terms the total impact of rebalancing cost on the performance is negligible. Assuming a transaction fee of 5 basis points, the transaction cost drag for the EW index is less than 3 basis points per year.

Effect of Size Neutrality: One weight fits all?

Size exposure is by far the greatest difference between the market-capitalisation weighted and equally weighted portfolios. In the EW version of the Stoxx Europe 600 index weights of the largest companies are divided roughly by 10 while weights of the smallest companies are multiplied by 10 relative to the MW index. Further, if we rank the STOXX 600 universe by market capitalisation and divide it into three terciles (Large 200, Mid 200 and Small 200) the weight of the Large tercile will be more than halved, the weight of the Mid tercile will be doubled and finally the weight of the Small tercile will be multiplied by 6 in the EW portfolio relative to its MW counterpart.

It is convenient to split our broad European portfolio into separate sub-portfolios representing the three size terciles. Each such sub-portfolio can be constructed using market-capitalisation weighting (MW Large, MW Mid, MW Small), or equal weighting (EW Large, EW Mid, EW Small). For example, a broad EW portfolio can be seen as an equal weight combination of EW Large, EW Mid and EW Small, while a broad MW portfolio is composed of a weighted sum of the MW Large, MW Mid and MW Small sub-portfolios.

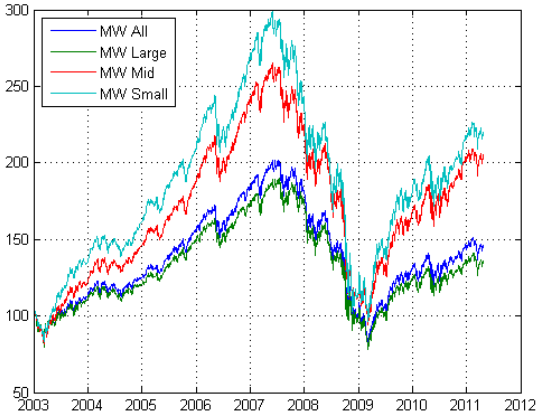

Figure 3: Performance Large/Mid/Small

MW Small and MW Mid size sub-portfolios showed much stronger performance during bull markets than the MW Large sub-portfolio, followed by stronger corrections (Figure 3). One can see that the broad MW portfolio performance was very close to that of the MW Large sub-portfolio, following from the dominance of large stocks in the market-capitalisation weighting. Indeed, the 200 Largest stocks represent 80% of the total market-capitalisation in the broad MW portfolio.

Proceeding along this line, one can decompose the excess performance of the EW portfolio in a way that reflects:

1. **Size allocation**: the effects of different exposure to the market-cap weighted size sub-portfolios in EW and MW cases,

2. **Size selection**: the effects coming from altering the weighting inside each size sub-portfolio, i.e. switching from market-capitalisation weighting to equal weighting inside each size tercile.

We can summarise this decomposition as follows:

$$
\begin{aligned}
\Delta R^{EW-MW} = & \sum_{i=1}^{M} \left(\frac{1}{M} - w_i\right) r_i = \\
& = \frac{1}{3} \sum_{K=L,M,S} \sum_{i} \left(\frac{1}{M'} - 3\, w_i\right) r_i = \\
& = \frac{1}{3} \sum_{K=L,M,S} \sum_{i} \left(\frac{1}{M'} - w_i^K\right) r_i + \\
& + \sum_{K=L,M,S} \left(\frac{1}{3} - \frac{1}{\beta_K}\right) w_i^K\, r_i = \\
& = \frac{1}{3} \sum_{K=L,M,S} \Delta R^K_{EW-MW} + \\
& + \sum_{K=L,M,S} \alpha_K R^K_{MW}
\end{aligned}
$$

Here the $M' = M/3$ is representing the number of stocks in the broad and size portfolios (M = 600 in our example). w_i are the stock weights in the MW portfolio, $w_i^K = \beta_K w_i$ are weights in MW Large, Mid and Small portfolios (rescaled to 100% leverage).

As results from the historical study, the major part of the excess performance of EW portfolio over MW

Portfolio	2003-2006	2007	2008	2009	2010	Total	std
EW All	128.07	-4.75	-49.61	45.7	17.39	87.21	19.86
EW Large	91.8	1.78	-48.82	34.39	12.7	51.33	20.95
EW Mid	141.75	-7.94	-48.56	45.8	18.26	97.42	19.65
EW Small	154.72	-7.98	-51.43	56.1	21.18	115.33	19.76
MW All	79.2	-0.17	-45.56	28.04	8.64	35.47	19.92
MW Large	68.14	1.51	-45.01	25.28	6.12	24.79	20.25
MW Mid	138.01	-7.55	-47.11	41.17	19.6	96.49	19.22
MW Small	156.55	-5.93	-51.16	49.5	22.49	115.84	19.57

Table 3: Performance Large/Mid/Small

portfolio is related to the size *allocation* effect (Figure 4), driven by the excess performance of mid and small stocks over that of the large stocks (Table 3). The *selection* effect, while significantly positive, accounts for less than 1/4 of the total excess performance. On average the selection effect amounts to 27 basis points per quarter while the allocation effect amounts to 99 basis points.

Interestingly, the size-neutral allocation gives very different results across the three size terciles (Figure 5). Only the Large size portfolio really benefits from the EW allocation. On the contrary, the Mid and Small size portfolios have essentially flat contribution, apart the effect of the sharp rebound of the smallest stocks in 2009.

This confirms that Equal Weight allocation is a remedy in the case when there are significant asymmetries present in the market capitalisation, as is the case of the strong mega-cap bias of the Large MW portfolio (Figure 6).

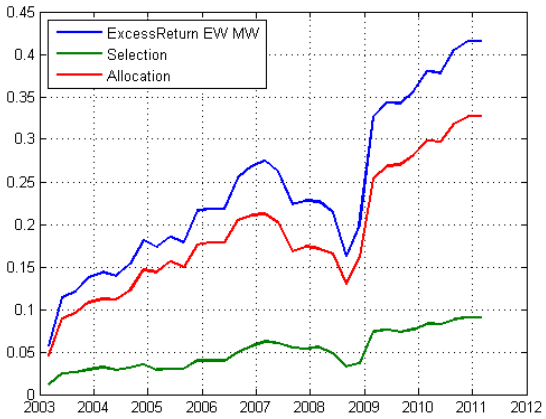

Figure 4: Excess Return : Size Selection and Size Allocation Effects [4]

Conclusion

Though extremely simple in its concept, the Equal Weight alternative raises many non-trivial questions when one attempts to interpret its performance relative to a traditional market-capitalisation weighted benchmark. This strategy has an objective of providing access to a chosen equity market segment while systematically avoiding stock concentration problems. As such, this investing technique requires periodic portfolio adjustments, that come at a cost of higher portfolio turnover, but generate no significant performance drag. Being clearly related to the observed return dispersion, these costs stayed on average under 3 basis points during the past 10 years for the broad European portfolio that we used here as an example.

Contrary to the commonly used argument, we found no definite benefit from the rebalancing contrarian feature on the excess performance of the equally weighted portfolio with respect to its market-capitalisation weighted counterpart. The total effect of the "rebalancing payoff" for the broad European portfolio uder study was slightly negative over the past 8 years, having no definite trend in between. Instead of being an additional performance driver,

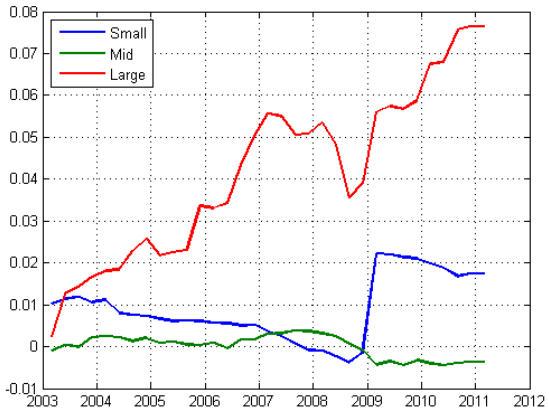

Figure 5: Size Allocation Effect : Small, Mid, Large terciles [4]

the rebalancing played a role of technical adjustment needed to keep the allocation close to the objective.

The size allocation of the equally weighted portfolio could be better understood in the allocation/selection framework, similar to that of the sector decomposition commonly used in the industry. Splitting the size exposure of the equally weighed portfolio into the size allocation (over/under-weighting of different size factors) and size selection (implementing equal weighting inside each size tercile), allows to appreciate the benefits of size-neutral weighting across different size segments. As a result, the main driver of the excess performance came from altering the global size exposure (overweighting mid and small stocks and underweighting the large stocks), while some smaller but significant part came also from imposing Equal Weight allocation inside each size segment. In particular, the Equal Weight scheme worked well only in the Large size sub-portfolio, manifesting the benefit of correcting the mega-cap bias.

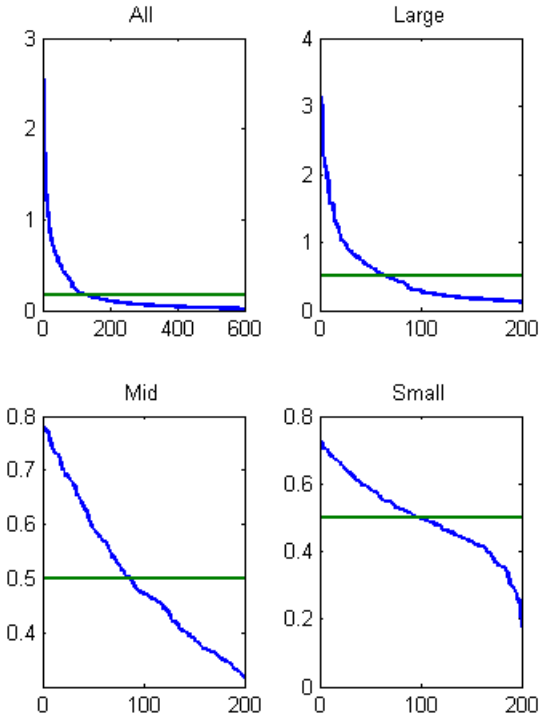

Figure 6: Market Capitalisation Asymmetries : ***Blue*** *- MW sorted weights,* ***Green*** *- EW weights*

Notes

[1]ETF Landscape Global Handbook, BlackRock, Q1 2011

[2]See for example "Equal Weight Indexing: Seven Years Later" by Liyu Zeng, Shrikant Dash (S&P Research), July 2010; "Equal Weight ETFs" by Anthony Davidow (RydexShares), January 2011; and "Optimal Versus Naive Diversification: How Inefficient is the 1/N Portfolio" by Victor DeMiguel, Lorenzo Garlappi and Raman Uppal, Review of Financial Studies, vol. 22, 2009.

[3]*Underlying data is courtesy of Stoxx. The Stoxx indices are the intellectual property (including registered trademarks) of STOXX Limited, Zurich, Switzerland and/or its licensors ("Licensors"), which is used under license. None of the products based on those Indices are sponsored, endorsed, sold or promoted by STOXX and its Licensors and neither of the Licensors shall have any liability with respect thereto.*

[4]Cumulative excess return by quarter, this generates discrepancies with compounded performance figures such as those of Table 3