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# BLENDING SMALL-CAP GROWTH AND VALUE STOCKS: EFFECT UPON A PERIODIC AND THRESHOLD REBALANCING STRATEGY

## Abstract:

The paper is motivated by a preference of many investors for small caps and by the popularity of two prevalent investment styles, out of which one stresses investing into so-called growth stocks whereas the other emphasizes virtues of so-called value stocks. The paper investigates usefulness of periodic rebalancing strategies that are built on investing into small-cap stocks preserving growth and value stocks in some proportions. The usefulness of the proposed rebalancing strategies mixing small caps with growth and value oriented investment styles is evaluated by a case study oriented on the US stock market. Using historical data, several designs for portfolios tracking the S&P 500 Index are constructed out of its constituents and practical advice is drawn for a small investor.

## Keywords:

periodic rebalancing, threshold rebalancing, small-cap stocks, growth and value stocks, mixed investment style, performance, S&P 500 Index

**JEL Classification:** G11

## 1 Introduction

Many investors favour investing into small-cap stocks under the creed that "smaller is better" with the hope that they earn higher returns, albeit at the expense of somewhat increased risks. Some motivation is tied with the fact that small firms are overlooked by institutional investors and are not screened by investment agencies, in which effect their stocks may offer hidden investing opportunities. Investing into small caps become very proliferated in the early 1990s (see Christopherson and Williams, 1995, p. 10-11). Another distinction that is frequently applied to the universe of stocks is into growth (glamour) stocks and value (contrarian) stocks and the definitional criterion for a stock is the relationship between its market price and intrinsic value embodied in a useful fundamental (Penman, 2013, pp. 79-81). When market price is high relative to a fundamental (such as book value, earnings, revenue), then the stock is classified as a growth stock. On the contrary, when market price is low relative to a fundamental, then the stock is singled out as a value stock. Growth stocks are credited with above-average growth prospects and offer frequently superior returns, whereas value stocks represent in fact "cheap" investing opportunities capable of maintaining value in a near future. Their inexpensiveness is owing to their undervaluation in respect to the chosen fundamental. The assessment and classification is based usually on a multiple such as the P/B (price-to-book) or P/E (price-to-earnings) ratio. Combining the focus upon small-cap stocks with the concept of growth/value segments of the stock market lead to two characteristic investment styles:

- Small-cap growth investing orients itself to less seasoned companies with an extraordinary high growth potential.
- Small-cap value investing seeks neglected small firms that sell at low valuations relative to assets, earnings or revenues.

Not only are these approaches relevant in the initial stage of the investment process when assets are first pre-selected for later portfolio construction, but their currency extends naturally through the other stages of investing, and in particular when the portfolio is rebalanced over the investment period. Having in mind that there is sound reasoning behind either of the approaches, the paper explores a possibility of blending these two investment styles in an attempt to improve the risk-return characteristics of the resulting portfolio and to take advantage of different market patterns embodied in growth and value segments of the stock market (see Fabozzi, 1998, pp. 101-109). The explorations concern both the pre-selection and rebalancing stages of investing.

To be more precise, the paper develops a rebalancing strategy that blends small-cap growth and value investment styles into current rebalancing strategies. As indicated by the previous exposition, the proposed strategy centres upon equities and ignores other classes of assets (such as bonds and commodities). Whereas the criterion of small market capitalization stands for itself and is understandable, in distinguishing stocks into growth and value stocks the P/B ratio was put to use in order to identify distant classes of stocks. Blending disparate categories of stocks that are attributed different patterns and performance characteristics should be obviously beneficial to diversification and possibly economical in terms of transaction costs. A similar procedure is frequently applied by practitioners for different categories of assets (such as equities and bonds) and then some pre-determined proportions of shares between these categories are maintained over the investment horizon (e.g. Tokat and Wicas, 2007). Here the idea is to invest into small-cap stocks in some proportions allocated to those with growth and value traits and to strive to keep the pre-defined proportions over time using traditional methods of rebalancing.

The features of the proposed rebalancing approach are assessed experimentally through a case study oriented on the US stock market. In this, the ambition is to track the S&P 500 Index (using the most popular quadratic formulation) using its small-cap constituents and its growth and value sub-classes identified using the P/B ratio. Several portfolios are fictively created, rebalanced under different configurations and compared in terms of their performance. The configurations that are adopted so as to suppress the subjectivity of choice and to increase generalizability vary by investment style, rebalancing strategy, portfolio size and sample period. In defining new rebalancing strategies, two rebalancing approaches are put to use: periodic rebalancing (realized at a regular basis regardless of the actual market situation) and threshold rebalancing (initiated only if there is a deviation from the desired portfolio composition due to market development). Portfolio size of nominal 10, 20, 30 and 40 stocks is chosen to fit the situation of a small investor. Finally, portfolios are constructed and evaluated for four different consecutive data samples represented by a two-year long in-sample period and a two-year investment horizon.

Using historical time series monthly frequency of data and considering the existence of transaction costs, the paper studies the performance of 720 tracking portfolios and finds that periodic rebalancing boost return particularly of portfolios melding big and small caps and threshold rebalancing helps in volatility reduction.

The remainder of the paper is organized into three more sections. Section 2 gives explanations and enlightens the adopted methodological set-up. Section 3 describes the experimental design and presents the obtained results. Finally, Section 4 concludes.

## 2 Remarks on investment styles, rebalancing and the methodology

Since small-cap stocks are typically riskier investments and big-cap stocks are usually safer ones, the size criterion of market capitalization applied in distinguishing two classes of assets may be seen as associated with riskiness. Classical financial theory suggests that smaller firms are more risky than larger companies and this is the main point in explaining why small caps tend to earn better returns than big caps. As far as the growth/value classification is concerned, growth stocks display promising growth prospects whereas low stocks are usually deemed as undervalued. Judgements as to whether a stock belongs to the growth or value category are most frequently based upon a measurable quantifiable characteristic, a multiple, confronting market price and a fundamental. The fundamental must be chosen to capture immeasurable intrinsic properties giving a snapshot of the stock's intrinsic value (e.g. book value of equity, net earnings or revenue). In consequence, the differentiation into growth and value stocks using a multiple is connected to pricing, to which end the present study uses the P/B ratio. A stock with a high value of the P/B ratio is tagged as a growth stock, and – vice versa – a stock with a low value of this multiple is labelled as a value stock. Investing into value stocks means purchasing stocks that are cheap relative to their fundaments and is based on the stylized fact that the market can be beaten by stocks that have prices low relative to their earnings, dividends, historical prices , book values (hence the P/B ratio) or other measures of their value. The role of investment styles recognized by the pricing criterion is not negligible (see e.g. Chan *et al*., 1991, or Chan and Lakonishok, 2004).

Small caps ("S") are identified by ordering stocks by their market capitalization and selecting those under the 50 % quantile. Small-cap growth stocks ("SG") and small-cap value stocks ("SV") are singled out by ordering small-cap stocks first by their P/B ratios and then dividing them by their accumulated market capitalization. This is the procedure advanced by Fabozzi (1998, p. 60).

Once the portfolio is optimized using some suitable allocation rule such as expected utility maximization or index tracking and created, the investor faces a decision whether he should keep the portfolio intact over the investment horizon or he should rebalance it whenever its return-risk profile is eroded. Rebalancing yields numerous benefits. First, in comparison to the buy-and-hold strategy it reduces volatility and has little or no unfavourable effect upon mean returns (see Dichtl *et al*., 2013). Second, it decreases risk concentration and downside risk (see Bouchey *et al*., 2012). The other side of rebalancing is that it induces transaction costs that off-set the input of rebalancing to preserving or improving performance over the investment horizon. Dichtl *et al*. (2013) divided rebalancing strategies into two chief groups: periodic and interval rebalancing. Periodic rebalancing means regular reallocation of assets with respect to pre-determined weights set at the very outset of the investment horizon. One approach to interval rebalancing is to set a non-trade region around target weights defined by means of a suitable threshold and to undertake a revision only if the portfolio deviates from these weights. For example, traditionally a certain proportion is invested into stocks and the rest into bonds. Say that these weights at the moment of portfolio creation are $v$ and $1 - v$, respectively, and say that a threshold $\theta$ is introduced (such that $v \in [0,1]$ and $\theta \in (0,1)$ being relatively small). Over time as the market value of the portfolio develops, the proportions $v$ and $1 - v$ change and the threshold $\theta$ controls the timing of an intervention. Usually at regularly spaced time intervals the portfolio is monitored and checked whether the actual proportions do not deviate from the intended proportions by more than $\pm\theta$. Whenever this is the case, the portfolio weights are optimized and reset to $v$ and $1 - v$ for stock and bonds, respectively.

The ensuing technical exposition preserves the notation for the proportions to be invested into "SG" and "SV" stocks to be $v$ and $1 – v$, respectively. For simplicity, it is assumed that the same number $m$ of equities is chosen in each category and that the weights in both classes of assets are determined separately. Denote the respective $(m \times 1)$ vectors of weights for "SG" and "SV" stocks by $\boldsymbol{\omega}_1$ and $\boldsymbol{\omega}_2$. Both vectors are required to satisfy $\boldsymbol{\omega}_1'\mathbf{1} = 1$ and $\boldsymbol{\omega}_2'\mathbf{1} = 1$, wherein $\mathbf{1}$ is an $(m \times 1)$ vector of ones. The budget allocated intto "SG" stocks is then $v \cdot \boldsymbol{\omega}_1$ and into "SV" stocks $(1 – v) \cdot \boldsymbol{\omega}_2$. The nominal portfolio size is $k = 2m$ since the portfolio is to be composed of $m$ "SG" and $m$ "SV" stocks whenever a non-trivial case $v \in (0,1)$ occurs. To ensure comparability and hold the portfolio nominal size intact, in the trivial case $v \in \{0,1\}$ $k$ is reset to $2m$. Throughout this process, the weights $\boldsymbol{\omega}_1$ and $\boldsymbol{\omega}_2$ are optimized independently using the formulation of quadratic tracking for the $m$ "SG" stocks and the $m$ "SV" stocks, respectively. The task of quadratic tracking is detailed e.g. in Boďa and Kanderová (2016, p. 48) and presupposes that a benchmark index is available. This function is fulfilled by the S&P 500 Index as is clarified in the next section.

Denote the moment of portfolio construction at the end of the in-sample period by subscript $\tau$, denote the prices of individual assets at time $\tau$ by symbols $P_{\tau,1}, ..., P_{\tau,k}$ and the price of the benchmark as $P_{\tau,B}$. If the initial investment is $\Psi_\tau$, the following portfolio holdings are suggested: $h_{\tau,1} = \Psi_\tau \cdot \omega_1 / P_{\tau,1}, ..., h_{\tau,k} = \Psi_\tau \cdot \omega_k / P_{\tau,k}$. At the same time, a fictional investment into the benchmark is done and the holding $h_{\tau,B} = \Psi_\tau / P_{\tau,B}$ is made. In the previous formulas the notation $\omega_1, ..., \omega_k$ symbolizes individual weights of the total $k$ stocks. Of course, these weights respect the proportions $v$ and $1 – v$. The symbol $\Psi$ will also denote the value of the tracking portfolio at any time denoted carefully in the subscript. Adding “B” in the subscript after the time instance will indicate that the value of the benchmark investment is had in mind. Finally, assume that there is a percentage rate of transaction costs $\varphi \in [0,1)$ that applies to the value of investment changes. Symbols that were introduced for a particular time extend naturally in their validity also for some future times. In consistency with the previous outline, there are several possibilities how to maintain this portfolio by the investor until the end of the investment horizon. The first option is the buy-and-hold strategy and is sort of liberal, whereas the other two options consist in rebalancing and are concerned with whether the weights of polar classes of stocks deviate from the predetermined proportions $v$ and $1 – v$, or not.

- The investor may choose not to revaluate the composition of the portfolio at all and opt for the buy-and-hold strategy. In such a case, transaction costs are incurred only at the moment of portfolio creation in the amount

$$\varphi \sum_{i=1}^{i=k} |h_{\tau,i}| \times P_{\tau,i}, \tag{1}$$

  which reduces into $\varphi \cdot \Psi$ when there is a ban on short sales (or when all holdings are positive).

- Another possibility is to rebalance the portfolio at regular time intervals of length, say, $\Delta\tau$ $(\Delta\tau > 0)$, no matter what the situation on the market is and how the tracking portfolio copies the index. In this case, at the next time $\tau + \Delta\tau$, the task of quadratic tracking is re-solved with updated historical data separately for big-cap / growth and small-cap / value stocks, yielding new vectors of weights $\omega_{\tau+\Delta\tau,1}$ and $\omega_{\tau+\Delta\tau,2}$. This updating is done on a sliding basis, keeping the length of historical observations unaltered. New holdings $h_{\tau+\Delta\tau,1},\ldots, h_{\tau+\Delta\tau,k}$ are thus produced using the proportions $v$ and $1 - v$, and the portfolio is revised accordingly. In addition to the initial transaction costs resulting from the first portfolio construction given by (2), at the moment of revision, $\tau + \Delta\tau$, rebalancing transaction costs arise in the amount

$$\varphi\sum_{i=1}^{i=k}\left| h_{\tau+\Delta\tau,i}-h_{\tau,i}\right|\times P_{\tau+\Delta\tau,i}\,. \quad (2)$$

This, of course, goes on a sliding basis at rebalancing times $\tau + \Delta\tau$, $\tau + 2\Delta\tau$, ... until the end of the investment horizon.

- Finally, another possibility is to set a threshold and to monitor discrepancy between the value of the tracking portfolio and the value of the investment into the benchmark. For this, some maximum tolerance threshold $\theta$ (with $\theta > 0$) must be set. The monitoring is not performed on a continuous basis, but usually as with periodic rebalancing at regularly spaced instances $\tau + \Delta\tau$, $\tau + 2\Delta\tau$ for some $\Delta\tau > 0$. Whenever at such an instance the actual proportions of big-cap / growth and small-cap / value stocks deviate in absolute magnitude from the pre-determined values $v$ and $1 - v$ by more than $\theta$, it is an impetus for an intervention and the portfolio is rebalanced. With this intervention portfolio, additional transaction costs are associated in the same manner as explained about the formula (2).

There is one grave simplification with these strategies in comparison to their practical implementation since they should take into consideration also the fact that, at revision times, transaction costs must be paid and they should decrease the value of the portfolio. It is assumed here in the paper instead that there exists a separate account, from which these transaction costs are covered. Only the final value of the tracking portfolio is confronted with the volume of transaction costs (in an inflation-free world), and the net value of the investment is computed by subtracting the transaction costs total from the portfolio value.

## 3 Empirical Configuration and Results

The study takes the S&P 500 Index as benchmark for a non-institutional investor who desires to form a small portfolio of S&P 500 constituents since the S&P 500 is trusted to represent well the patterns and sentiments of the US market. In order to control for the amount of transaction costs affecting ultimate performance, the investor is willing only to form a tracking portfolio of no more than 40 stocks. To this end, he uses 24 historical monthly logarithmic returns for a period of two years (the in-sample period) to identify the weights of portfolios that mimic the underlying S&P 500 in the sense of quadratic tracking. Using the procedure described in the preceding section, the investor first identifies in the universe of S&P 500 constituents small caps and afterwards classifies them into growth ("SG") and ("SV") value stocks. He then sets up portfolios of different nominal sizes counting 5 + 5, 10 + 10, 15 + 15 and 20 + 20 stocks of polar categories and of varying proportions $v \in \{0, 0.25, 0.50, 0.75, 1\}$ of allocation into "SG" and "SV" stocks. When a zero sum is invested into "SG" stocks (i.e. when $v = 0$), then "SV" stocks count 10, 20, 30 and 40 stocks, and vice versa. All portfolios are formed on the last day of the in-sample period that coincides with year-end. Afterwards, the portfolios are held and monitored in the course of the next two years (the out-of-sample period or investment horizon) and possibly held without change or rebalanced in conformity with the strategy applied.

A total of four samples are employed and are referred to as “periods”. Each of these samples spans a period of four years, with the first two years representing the in-sample period of 24 monthly returns for portfolio selection and the last two years standing for the out-of-sample horizon of active investing and rebalancing. The samples start in 2011 (the start of the first in-sample period) and end in 2017 (the end of the last out-of-sample period), which is the reason they are denoted as "20112014" to "20142017". At the end of each in-sample period, the S&P 500 was screened for its constituents and the effective number of constituents was somewhat smaller than 500 (owing to a lack of data or changes in the index over time). In consequence, the effective universe of S&P 500 constituents ranged from 450 (with period “20122015”) to 458 (with periods “20112014” and “20142017”).

For each sample at the end of the in-sample period portfolios blending "SG" and "SV" stocks are identified and created using as many as five mixing proportions and four nominal sizes. These portfolios are optimized under a ban on short sales and made by investing the initial budget of US $ 10,000 with the rate of transaction costs set to $\varphi$ = 0.4 %. These portfolios are then held intact over the out-of-sample period, which amounts to applying the buy-and-hold strategy, or rebalanced. Four periodic rebalancing strategies are considered differentiated by whether revisions are undertaken periodically every month (1M), every quarter (3M), every half-year (6M) and every year (12M/1Y). Moreover, these periodic revisions are complemented by threshold rebalancing strategies with four different choices for threshold $\theta$ given as $\theta = \{0.005, 0.01, 0.015, 0.02\}$. Note that when a portfolio is rebalanced under a certain value for threshold $\theta$, it is also rebalanced for any smaller threshold. In total, the experiment resulted in a total of $4 \times 5 \times 4 \times (1 + 4 + 4) = 720$ blending portfolios. The multiples here are sample – mixing proportion – nominal size – rebalancing strategy, respectively.

It is worthwhile noting that at the end of the out-of-sample period no portfolio was actually liquidated and so transaction costs were spared. Only the terminal value of the portfolio was ascertained and adjusted by the total amount of transaction costs. Three measures of portfolio performance were allowed for in the assessment: mean return, volatility and net cumulative return, all being expressed in annualized form (as p.a.). Net cumulative return differs from mean return by being calculated as a compound annual growth rate inclusive of transaction costs.

In computations and preparing graphical presentations, the software R version 3.4.1 (R Core Team, 2017) was employed with several of its libraries, `quantmod`, `quadprog`, `timeSeries` and `PerformanceAnalytics`.

The experiment produced an exhaustive computational output, most of which is not reported for its substantial size. For brevity and clarity of demonstration, only partial results are presented by combining a graphical format in Figures 1 and 2 and a tabular format in Table 1. Figures 1 and 2 are drawn for the annualized mean returns and volatilities of blending portfolios and display them with the use of arrow-headed spikes whose positive/negative orientation and length answer to the sign (of mean returns only) and size (of both mean returns and volatilities). These spike plots are prepared for each sample, portfolio nominal size and weight on "SG" stocks. The spikes are normalized so that the highest annual mean returns and volatilities for every combination of period, portfolio nominal size and weight are with equally-long arrows. The value to which other values of a particular combination are normalized is displayed on the left-hand side above the vertical arrow that acts as a norm. Negative mean returns are plotted downwards, whereas positive mean returns and volatilities head upwards. Colours of the spikes comply with different rebalancing strategies, but periodic rebalancing and threshold strategies are not further detailed.

In particular, Figure 1 is suggestive of a few regularities that may be differenced especially with respect to the period and mixing proportion. First of all, in most situations, there are not apparent differences in mean returns between different blending portfolios as follows from almost equally long upright arrows – at least on a visual basis. It seems that in periods "20112014" and "20142017" all blending portfolios regardless of the weight on "SG" caps and the number of assets recorded almost identical mean returns, with on and off and non-systematic disturbances from this uniform pattern. That being said, slightly smaller mean returns are typical usually for periodically rebalanced portfolios in period "20112014" and for threshold rebalanced portfolios in period "20142017". Less regular patterns are readable for the other two periods that are distressed by an occurrence of negative mean returns achieved. In both periods, "20122015" as well as "20132016", the most unfavourable returns (i.e. those negative or small positive) with altering patterns for non-rebalancing, periodic rebalancing and threshold rebalancing emerge for portfolios that put the full budget effectively into either "SG" caps (i.e. with the weight on "SG" caps 100 %) or "SV" caps (i.e. with the weight on "SG" caps 0 %). Nonetheless, it is not only these extreme (in fact non-blended) portfolios that are plagued by an existence of negative returns or worse dependability, but variations in performance (in terms of mean returns) are detectable for example for blending portfolios with the weight on "SG" caps 75 % in period "20122015" or those in period "20132016" whose weight on "SG" caps is 25 %. Overall, it appears that it is safest to focus on equally-balanced blending portfolios (where the weight on "SG" caps is 50 %) as these seem universally preferable for any portfolio size or period. As regards the type of rebalancing strategy to be recommendable, in spite of certain irregularities, periodically rebalanced portfolios seem more reliable.

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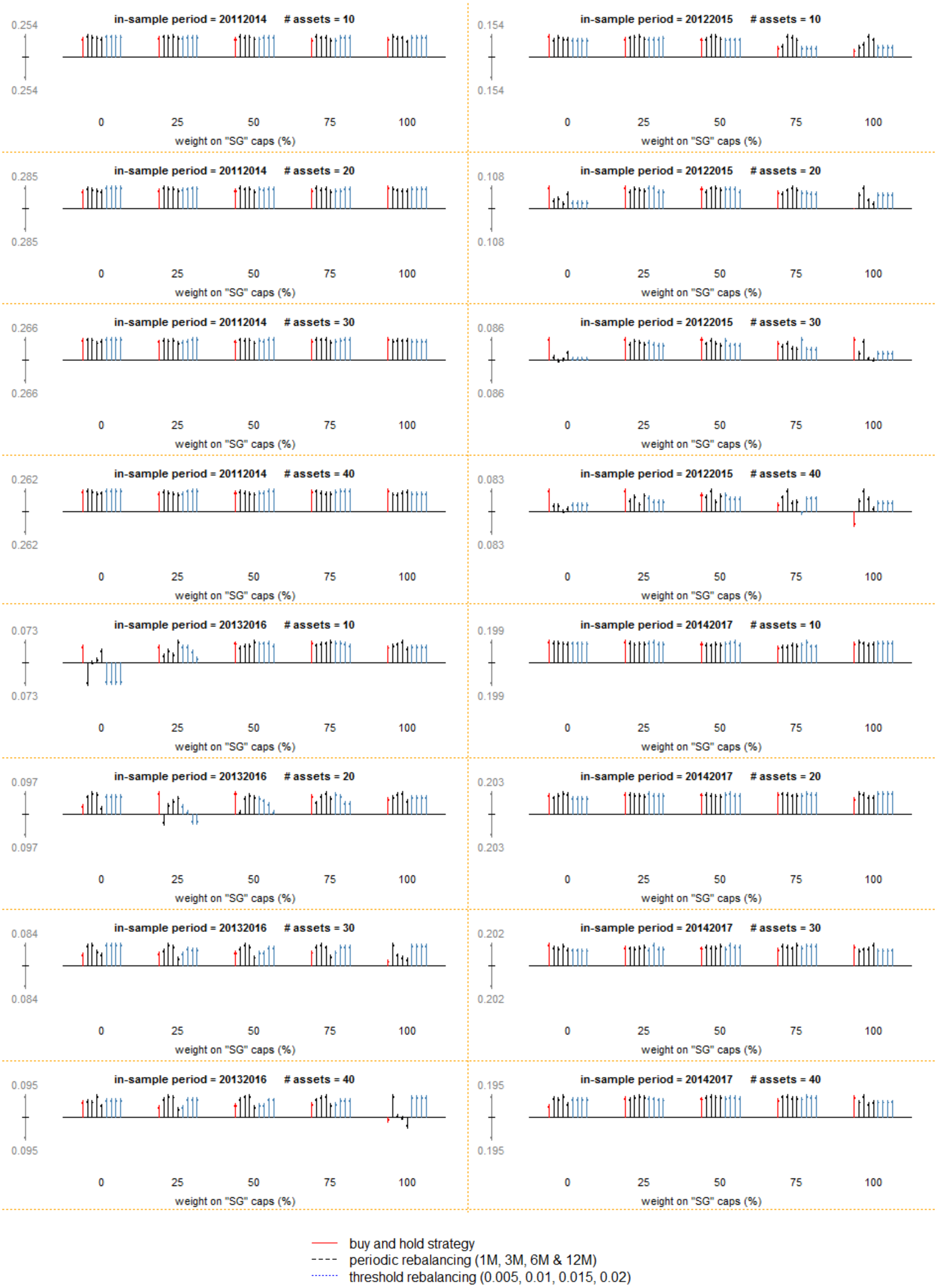
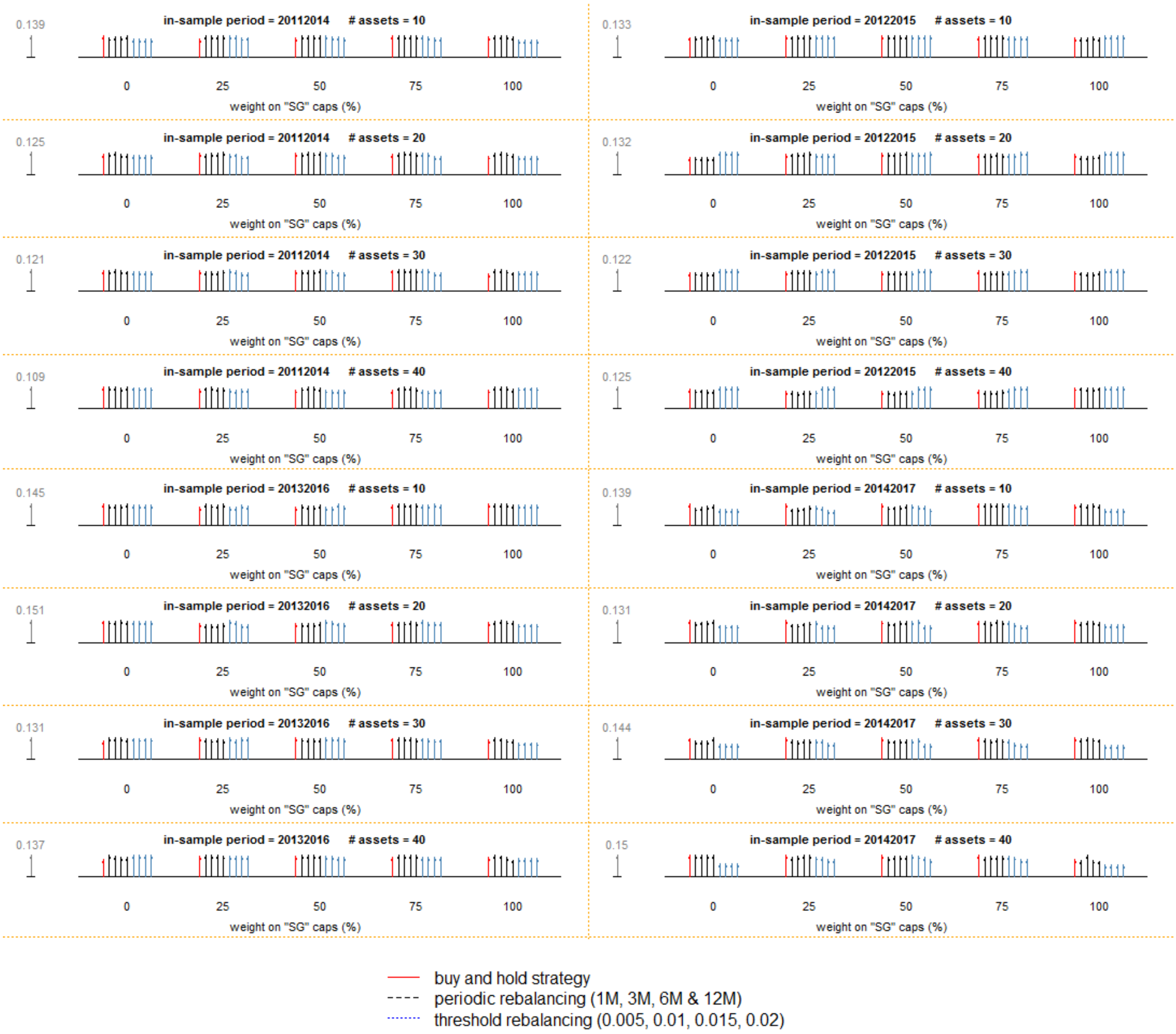
## Figure 1: Annual mean returns of blended portfolios




*Source: The authors*

**Figure 2: Annual volatilities of blended portfolios**




*Source: The authors*

Figure 2 indicates that there are also characteristic patterns for the volatility of blending portfolios and low volatility is mostly associated with threshold rebalancing. In spite of some exceptions, the smallest the smallest volatilities of blending portfolios are most frequent for those that arise with the use of a threshold rebalancing strategy. Typically, there are no significant differences in the volatilities of blending portfolios in terms of the rebalancing strategy, but when these differences arise, portfolios in periods "20112014 and "20142017" rebalanced with a threshold display comparatively lower volatilities. Admittedly, the deviations from this patter are detectable for the other two periods, prevalently for period "20122015".

In conjunction with the observations made at Figure 1, there seems to be a trade-off between mean return and volatility in respect of the rebalancing strategy. At large, period rebalancing for "SG" and "SV" blending portfolios lead to higher mean returns and greater volatilities, but threshold rebalancing is governed by an opposite pattern.

In addition to the previous analysis, the factors of performance of portfolios blending "SG" and "SV" stocks were examined from the standpoint of traditional regression techniques, in a somewhat mechanical manner. Three traditional methods of regression model selections were employed: LASSO, optimization of the Bayesian information criterion (BIC) and the small-sample corrected Akaike information criterion (AICC).The search was performed for all 720 blending portfolios separately for mean return, volatility and net cumulative return (whilst all of them were expressed as percentages per annum). The search accounted for all explanatory factors, i.e. weight on "SG" stocks, nominal portfolio size (i.e. # assets), rebalancing approach and period. With the exception of nominal portfolio size, all the explanatory factors were represented through dummy variables, which is the reason why the scrutinized models included no intercept. The fitted regression models identified as optimal by the individual three criteria are reported in Table 1 alongside with adjusted coefficients of determination (R-squared) affording quick assessments of the quality of the fits.

**Table 1: Explanatory factors of portfolio performance identified in a regression context**

| **Variable** | **Mean return (% p.a.)** | | | **Volatility (% p.a.)** | | | **Net cumulative return (% p.a.)** | | |
|---|---|---|---|---|---|---|---|---|---|
| | LASSO | BIC | AICC | LASSO | BIC | AICC | LASSO | BIC | AICC |
| Weight 0 on "SG" stocks | 2.06 | 2.00 | | 0.75 | 0.72 | 0.72 | 2.44 | | |
| Weight 0.25 on "SG" stocks | | | -2.13 | 0.02 | | | | -2.61 | -2.61 |
| Weight 0.50 on "SG" stocks | 2.90 | 2.85 | 1.01 | 0.35 | 0.32 | 0.32 | 3.69 | 1.28 | 1.28 |
| Weight 0.75 on "SG" stocks | 1.72 | 1.67 | | | | | 2.37 | | |
| Weight 1 on "SG" stocks | 0.34 | | -1.54 | 0.07 | | | 0.85 | -1.56 | -1.56 |
| # assets | 0.10 | | | -0.05 | -0.05 | -0.05 | 0.06 | | |
| Buy-and-hold strategy | | | | 0.56 | | | 0.43 | | 0.61 |
| 1M-rebalanced | | | | 0.30 | | -0.32 | | | |
| 3M-rebalanced | 0.02 | | | 0.27 | | -0.36 | | | |
| 6M-rebalanced | | | | | -0.53 | -0.62 | | | |
| 1Y-rebalanced | | | | -0.08 | -0.61 | -0.71 | | | |
| Rebalanced at 0.005 | 0.03 | | | 0.57 | | | | | |
| Rebalanced at 0.01 | | | -0.80 | 0.67 | | | | | |
| Rebalanced at 0.015 | 0.33 | | | 0.64 | | | 0.53 | | 0.71 |
| Rebalanced at 0.02 | | | | 0.67 | | | 0.33 | | |
| Period "20112014" | 17.64 | 19.45 | 21.37 | 10.48 | 11.03 | 11.13 | 18.10 | 21.74 | 21.60 |
| Period "20122015" | 2.08 | 3.88 | 5.80 | 11.10 | 11.65 | 11.75 | 1.18 | 4.82 | 4.68 |
| Period "20132016" | 1.64 | 3.44 | 5.36 | 12.21 | 12.76 | 12.86 | 0.84 | 4.49 | 4.34 |
| Period "20142017" | 12.86 | 14.66 | 16.58 | 10.16 | 10.71 | 10.81 | 12.61 | 16.26 | 16.11 |
| **Adjusted R-squared** | **0.95** | **0.95** | **0.95** | **0.99** | **0.99** | **0.99** | **0.94** | **0.94** | **0.94** |

**Note:** Since the variables weight on "SG" stocks, strategy (buy-and hold strategy, periodic rebalancing, threshold rebalancing) and period are all categorical variables, during their transformation to dummy variables the intercept was neglected to prevent the issue of perfect collinearity.

*Source: The authors*

The results in Table 1 can only be interpreted in comparative terms for there are visible disparities between the regression fits and it makes little sense to stick to a particular value of a regression coefficient. The results are confirmative that there exists a trade-off between (mean / cumulative) return and volatility since for the equal weight 50 % assigned to both "SG" caps and "SV" caps all characteristics are comparatively largest. Equally blended portfolios tend to bear comparatively and on average higher mean and cumulative returns, but also volatilities. Portfolio size is another factor that contributes to the general performance in a trade-off manner. Higher numbers of assets seem to increase (mean / cumulative) return, but also to decrease volatility, which is merely understandable as this is an effect of diversification. In addition, it appears that periodically rebalanced portfolios have smaller volatilities, whereas threshold rebalanced portfolios tend to have both (mean / cumulative) returns much higher. Finally, considering the absolute magnitude of the regression coefficients associated with the period, it is obvious that the period is the most effective factor (out of the other factors coded through dummy variables). In addition, the periods differ in how they presented themselves upon the performance of blending portfolios. In periods "20112014" and "20142017" the blending portfolios reported comparatively the largest mean / cumulative returns (especially the former one), whilst the largest volatility is found for period "20132016". Nevertheless, there are not so substantial differences in volatilities across the periods as they are discovered for mean / cumulative returns. These patterns are obviously related to trending patterns exhibited by the US stock market (see Boďa and Kanderová, 2017, pp. 1856-1857).

## 4 Concluding remarks

The paper centered upon the needs of a small investor who has a strong preference for small-cap stocks and is perhaps indifferent with respect to their fundamental status, being thus willing to invest in both growth and value (small-cap) stocks. The basal idea of the present research is that blending small-cap growth stocks and small-cap value stocks may be beneficial and merged with a rebalancing strategy. The set-up of the research is empirical and the usefulness of the idea is explored in a case study focusing upon the US stock market. A number of investing scenarios are considered that follow from considering a total of four subsequent data samples, four nominal portfolio sizes and nine rebalancing strategies (out of which one is the trivial case of non-rebalancing, four are periodic rebalancing strategies and four are threshold rebalancing strategies). For each of these configurations, the investor invests into small-cap components of the S&P 500 Index in an attempt to track its performance profile under the formulation of quadratic tracking. The resulting portfolio is formed as a compromise between growth and value stocks of the S&P 500's small-cap universe with blending weights 0 % and 100 %, 25 % and 75 %, 50 % and 50 %, 75 % and 25 %, 100 % and 0 % for growth and value stocks, respectively.

Despite the obvious limitation of the study lying in its empirical and selective nature, several findings are established resulting also in advice for a small investor who is considering investing into small-cap equities:

1. There is an obvious trade-off between return and volatility. The rebalancing strategies considered in this study in the context of investing into small-cap assets prove themselves as factors that improve just one aspect of the return-risk profile.

In consequence, the investor must choose whether he will favor return or risk. It seems that both factors cannot be controlled for at a time.

2. Period rebalancing blending growth and value caps tends to higher mean returns and greater volatilities. This approach is more suitable for risk loving investors.
3. Threshold rebalancing blending growth and value caps has a tendency to produce smaller mean returns and smaller volatilities. This approach is more apt for risk averse investors.
4. Portfolio size acts as another relevant factor of controlling simultaneously for return and risk in small-cap investing. More populous blending portfolios tend to have higher returns and smaller volatility.
5. Most importantly, blending portfolios putting equal weights of 50 % upon small-cap growth and value assets appear most reliable since their returns are then comparatively highest and volatilities are not inflated and are similar to blending portfolios created at different weights.

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