

# THRESHOLD VS EQUAL WEIGHT REBALANCING

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## ABSTRACT

Bristol Gate currently systematically rebalances portfolio positions to equal weights on a quarterly basis. A comprehensive study on “threshold rebalancing” was performed to investigate the impact of the thresholds on the number of transactions and performance of portfolios. In this study, “threshold rebalancing” was defined as a strategy where only stocks with weights outside of a pre-defined envelop were rebalanced to the target weight (the target weight is ~4.54% (1/22) for an equal weight portfolio composed of 22 securities).

Based on the performed study and for the suggested threshold, there was no statistical evidence that the threshold rebalancing strategy would hamper portfolio performance. Indeed, the suggested threshold of +/-1% (100 bps) improved returns while reducing the number of transactions by about 60%, thereby improving efficiency. The threshold of 1% indicates that the equal weight positions of 4.54% can grow to 5.54% or shrink to 3.54% with no need to take any action.

## EXPERIMENT & RESULTS

The experimental analysis was conducted for the US universe with a dual objective of identifying a threshold that reduced the number of transactions and at a minimum, did not hurt portfolio performance. The frequency of rebalancing was assumed to be quarterly, consistent with the current rebalancing strategy. The target weight was set to  $1/22 = 4.54\%$  which was the equal weight for a portfolio composed of 22 securities.

A Monte Carlo Simulation akin to Bristol Gate’s process was conducted. Conditions imposed during simulations were:

- 1) The year-end dividend growers in US universe were considered based on the perfect foresight,
- 2) 22 securities were randomly selected from the Top Quartile screen,
- 3) Turnover was managed such that 8 (or 9) securities were annually changed (about 2 names quarterly). This is the historical annual name turnover of Bristol Gate’s portfolios.

The threshold candidates were selected to be (approximately)<sup>1</sup>:

- 0 to 100bps with 10bps increments and,

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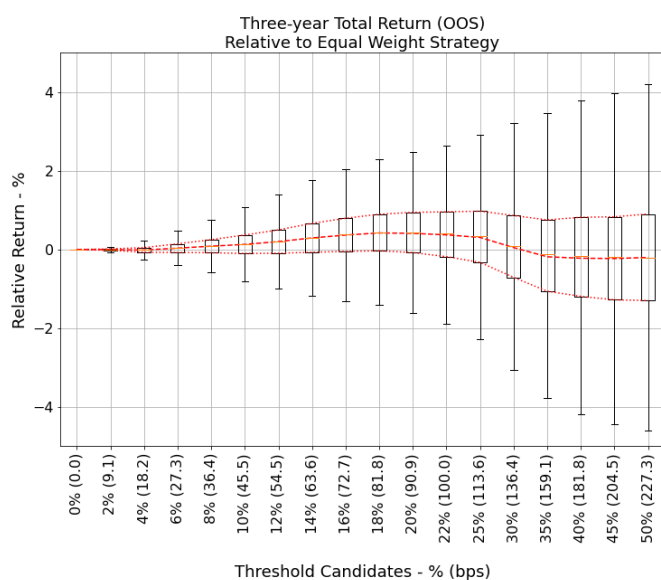
<sup>1</sup> To be precise, the threshold candidates are 0% to 22% with 2% increments and 25% to 50% with 5% increments. 2.2% increment is about 10bps for the target weight of 4.54%

- 100bps to 225bps with 25bps increments.

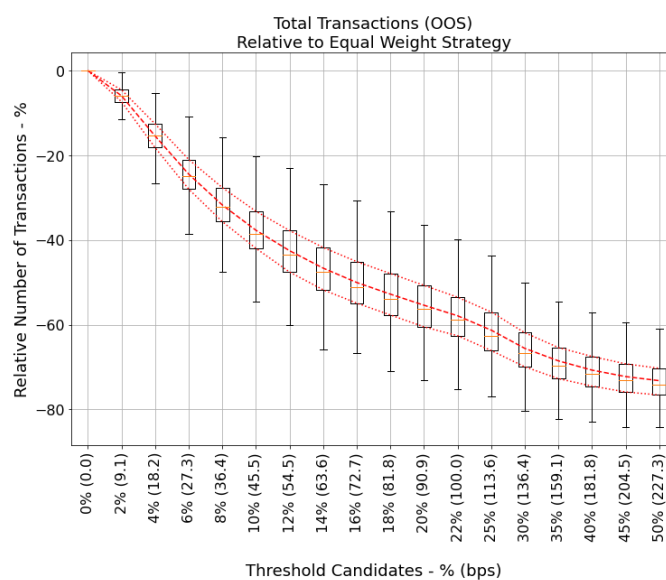
A trade-off along with robustness analysis, using In-Sample and Out-of-Sample periods, were utilized. Three-year returns were considered to compare the performance. This assumption is justifiable because the three-year window coincides with the typical Bristol Gate investment horizon and approximate average holding period. For the sake of brevity, the results of the Out-of-Sample period are only presented in this report as shown in Figure 1. This graph compares the three-year total return and number of transactions of the “threshold rebalancing” strategy with that of the current Bristol Gate practice (the “equal weight” strategy). The **number of transactions** was defined as the number of stocks that were traded on rebalancing dates. Please note that this was different from the number of shares traded; for example, at a rebalancing date, only two securities may need to reset back to equal weight while the number of shares traded can be thousands to millions depending on the AUM.

From this graph, it can be concluded that:

- The performance of the portfolio can improve up to a given threshold, or equally beyond a certain threshold, performance deteriorated.
- The higher the threshold, the lower the number of transactions as there was more freedom for the weights’ swings.



(a)



(b)

**Figure 1: (a) Three-year total return, (b) change in the number of transactions**  
Reported values in (a) and (b) are relative to the equal weight strategy for various threshold candidates

As an example, consider the 100bps deviation which equates to 22% in Figure 1. For the 100bps deviation, the number of stocks traded (**number of transactions**) was reduced by a median of ~60% (or ~40% of the names should be changed), which was equivalent to only trading 8 (or 9) stocks compared to the entire portfolio of 22 names for the “equal weight” strategy.

In addition, a formal statistical test was conducted to assure the hypothesis that the threshold rebalancing strategy (on average) outperforms its counterpart “equal weight” strategy over the three-year horizon<sup>2</sup>. A p-value of 5% was selected during the statistical study<sup>3</sup>. A summary of the results is shown in Table 1. The “Yes” in the table indicates that the “threshold rebalancing” strategy had higher excess return than the “equal weight” while the “No” means there was not enough statistical evidence to claim any superiority.

**Table 1: Threshold rebalancing strategy created higher return (on average) compared to equal weight strategy.**

**The average return is relative to the equal weight strategy**

Threshold	%	2%	4%	6%	8%	10%	12%	14%	16%	18%	20%	22%	25%	30%	35%	40%	45%	50%
	bps	9.1	18.2	27.3	36.4	45.5	54.5	63.6	72.7	81.8	90.9	100.0	113.6	136.4	159.1	181.8	204.5	227.3
<b>HR*</b>		No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No

\*HR : Statistical evidence of Higher Return?

## CONCLUSIONS

Based on the above performed studies, the evidence suggests deviating from precise equal weight will reduce the number of transactions without having a negative impact on three-year performance. Indeed, on average, weight deviation up to a certain threshold can lead to a higher return. The suggested threshold for the weight deviation was set to be **100 bps**, which was obtained by comprehensive and conclusive robustness and trade-off analysis that appropriately balanced the dual objectives of reducing transactions without negatively impacting returns. Therefore, only stocks with weights less than **3.54%** or higher than **5.54%** should be rebalanced to the equal weight. Moving to these thresholds reduced the number of transactions by approximately 40-75% in our testing, with a median reduction of approximately 60%. We expect similar results in real world application.

<sup>2</sup> For the tests, excess returns of threshold rebalancing strategies relative to their equal weight peers were used.

<sup>3</sup> The 5% significance level means out of 100 portfolios less than 5 showed negative relative return; which is an indication of a highly unlikely event in our analysis.

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