Target Strategy: a practical application to ETFs and ETCs

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Abstract

During the last 20 years, many asset/fund managers proposed different absolute return strategies to gain a positive return in any financial market condition. These kind of financial products were created without a comparison benchmark, but only with a floor return given by Euribor. The Euribor plus products became very popular during the period 2000/2007 but few of them were able to obtain good returns during the following years 2008/2011. The main problem was that no one had a methodology for tracking the target return they described in the prospectus. In this study we propose a new absolute return strategy based on a quantitative methodology which exploit a risk-adjusted performance indicator (Diaman Ratio) and the logic of Konno and Yamazaki model in order to offer, at the risk-averse investor, a tool that allow him to get a target return in a defined time period whichever will be the beginning of the investment horizon. An application to ETFs and ETCs will be analyzed.

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1. Introduction

Portfolio fund management can be split into:

- passive: the manager seeks to replicate the benchmark;
- active: the manager tries to "beat" the benchmark.

The benchmark is the "guide portfolio" identified in the initial stage of investment, it has a twofold objective: the first concerns the transparency of the investment (since defining your target market, we inform the investor on the risk/return profile), the second regards the actions of the fund manager which will be compared with the performance achieved by the benchmark. The passive style is for ones who believe that the market is efficient even if not in a perfect way, the rule is to compose the portfolio in order to track the performance of the benchmark and then buy stocks with weights corresponding to those of the benchmark. The replicating portfolio will be maintained for medium/long periods without rebalancing in expectation of a similar return of the whole market and exposed at the same risk. Active management, instead, is followed by those managers who think there are under and overvalued securities in the market, because the gap between market price and intrinsic value is not maintained for a long time there will be frequent trading in an attempt to anticipate the movements of the stock. The replicating portfolio, in this case, will have a different composition in respect to the benchmark. This is the case we analyze in this work. In section 2 we will briefly discuss some of risk measures based on the replication of a benchmark; in section 3 the Konno and Yamazaki model will be treated. Section 4 will be devoted to the explanation of a particular risk measure which take into account the trend persistence. In section 5 we will explain a new absolute return strategy based on Konno and Yamazaki logic and Diaman Ratio criterion. In section 6 we will conclude with a case study.

2. Risk measures based on the replication of a benchmark

Fund managers have to take a series of decisions about the trade-off between the precision to replicate the benchmark and transaction costs: the total replication of the index will lead to high transaction costs but low operating costs; however partial replication introduce a tracking error: the goal is to minimize the deviations of portfolio returns (R_t) from the returns of the benchmark ($R_{t,bench}$). The tracking error is defined as the linear deviation between the returns of the managed portfolio and the returns of the benchmark. In order to reduce the tracking error, in literature has been proposed different models, each of which will lead to different portfolio compositions with different risk profiles, it means that the model should be chosen according to the investment objectives of the investor. Roll[1] proposed a model that minimize the variance of the tracking error. If R_{bench} is the vector of the returns of the benchmark, R the matrix of the returns of n assets and x the portfolio weights to be determined, then the general problem is:

$$\varepsilon = R_{bench} - Rx$$

where ε is the vector of deviations between the returns of the benchmark and the returns of the replicating portfolio. The sum of squared deviations, $\varepsilon'\varepsilon$, is called tracking error variance. The weights of the assets, x, are determined in such a way to minimize the variance of the tracking error in the following way [2]:

$$\min\ \varepsilon'\varepsilon = \min\left(R_{bench} - Rx\right)'\left(R_{bench} - Rx\right)$$

this equation is a quadratic optimization problem, where the vector of weights is:

$$x = \left(R'R\right)^{-1} R' R_{bench}$$

The Roll's model minimizes the squared deviations between the benchmark and the replicating portfolio.

Other models in the literature take into account the absolute deviations between the benchmark and the replicating portfolio, these are:

1. Mean Absolute Deviation (MAD)

$$TE_{MAD} = \min \frac{1}{T} \sum_{t=1}^{T} \left| R_t x - R_{t,bench} \right|$$

   It minimizes the sum of all the differences taken in absolute value[1]

2. Mean Absolute Downside Deviation (MADD)

$$TE_{MADD} = \min \frac{1}{T} \sum_{t=1}^{T} \left| \left[R_t x - R_{t,bench} \right]^{-} \right|$$

   where $[R_t x - R_{t,bench}]^{-} = \min([R_t x - R_{t,bench}], 0)$. It minimizes the sum of negative deviations of the replicating portfolio from the benchmark.

3. Minimax (MINMAX)

$$TE_{MINMAX} = \min \frac{1}{T} \sum_{t=1}^{T} \max\left(\left| \left[R_t x - R_{t,bench} \right] \right| \right)$$

   It minimizes the maximum absolute deviation between portfolio returns and benchmark returns.

4. Downside MiniMax (DMINMAX)

$$TE_{DMINMAX} = \min \frac{1}{T} \sum_{t=1}^{T} \max\left(\left| \left[R_t x - R_{t,bench} \right]^{-} \right| \right)$$

   It minimizes the maximum negative deviation between the replicating portfolio and the benchmark.

[1] If deviations were not taken in absolute value may offset each other resulting in a perfect replication of the performance of the benchmark, even if only fictitious.

3. Konno and Yamazaki model

The portfolio theory (Markowitz [3]) aims to identify the range of the best risk-return combinations according to the mean-variance criterion. From the contribution of Markowitz investors realized how important it was measure and manage the risk of a portfolio in order to maximize the expected utility of risk-averse individuals. In the literature, in the following years, additional models have been proposed for portfolio selection that took into account risk measures alternative to the variance. Konno and Yamazaki [4] presented a new model that no longer used the variance of the returns, but the Mean Absolute Deviation (MAD) as a measure of risk, which is the average of the absolute deviations from the average of the returns. The formalization of this new model is:

$$\min MAD(x) = E\left|\sum_{i=1}^{n} r_i x_i - E\left[\sum_{i=1}^{n} r_i x_i\right]\right| \tag{1}$$

s.t.

$$\sum_{i=1}^{n} \mu_i x_i \geq R \tag{2}$$

$$\sum_{i=1}^{n} x_i = 1 \tag{3}$$

$$lb \leq x_i \leq ub \; i = 1, \ldots, n \tag{4}$$

It is a non-linear optimization problem as in the objective function (1) there is the absolute value[2], while constraints (2), (3) and (4) are linear. More precisely, the constraint (2) relates to the expected profitability of the optimal portfolio, which shall not be less than the threshold R (where R is the target percentage return). The constraints (3) and (4) relates to the securities' weights: constraint (3) concern the budget as it restricts the total investment at the available capital, while constraint (4) restricts the amount to be invested in each asset: if $0 \leq x_1 \leq 1$ then in the first asset is not permitted short sales and one cannot invest more than the total available capital (leverage isn't allowed), if instead $lb \leq 0$ short sales are permitted and if $ub \geq 1$ one can invest more capital than the available by borrowing the amount in excess.

4. The Diaman Ratio

Diaman Ratio [7] is a useful indicator to measure risk-adjusted performance. It is proposed as an alternative to mean-variance approach, given the limits of the latter in fund selection. Diaman Ratio can be interpreted as an indicator of returns' persistence: it analyzes the strength of the trend (expected return)

[2] It's possible linearize the objective function by using slack variable as in [2], [5], [6], in this way we can save computational time.

and the ability of a financial instrument to move itself around the same trends (risk). It takes into account the sequence of returns over time and it is based on a definition of risk which is consistent with some consolidated results of behavioral finance. Say $P = (p_1, \ldots, p_n)$ the time series of weekly logarithmic price of a financial instrument and $t = (0, 1/f, 2/f, \ldots, (n-1)/f)$ the time series of the time, where $f = 52$ and n is the length of the time series, Diaman Ratio is calculated as follows:

$$DR = \beta * R^2$$

where:

- β is the estimated value of the regression's parameter: $P_i = \beta * t_i + \alpha + \xi_i$
- R^2 is the coefficient of determination associated with the regression.

Diaman Ratio is obtained from a regression of the prices with respect to time, it is able to estimate both the positive and negative slopes but has difficulties in the presence of direction changes and non-linear time series.

5. Target Strategy

Target Strategy aims to provide a positive return in all market environments (uptrend, downtrend and sideways market) given a certain investment time horizon. The model's structure could be divided into two steps:

- Selection of the best n assets according to the Diaman Ratio criterion;
- Optimization of the filtered assets using the logic of Konno and Yamazaki model.

The filter used exploit the decomposition of the Diaman Ratio as follow:

1. Selection of those assets that have a β between betamin and betamax (betamin and betamax are lower and upper bound for the regression's parameter);
2. Ranking based on the coefficient of determination of assets selected in the previous step (the first asset in the standings is the one having the highest R^2);
3. Selection of the first n assets according to the classification.

The obtained n assets will be optimized exploiting the logic of Konno and Yamazaki model: a benchmark with a steady growth is simulated and the optimization process try to minimize the difference between the return of the managed portfolio (V) and the benchmark ($Vtarget$). At each time step t we compare the portfolio value with the benchmark, if:

- $V_t \geq Vtarget_t =>$ we move forward the time period of the benchmark by starting a new investment horizon (moving horizon);

- $V_t < Vtarget_t$=> we calculate the performance required in order to obtain, in the following period, a portfolio value equal to the one of the benchmark; this new performance will be put as a constraint on the growth rate of the managed portfolio in the subsequent optimization (moving beta).

In order to reduce transaction costs is carried a double optimization, only those assets that in the first optimization had a weight greater than a specified threshold will be taken in consideration in the second optimization. In the second optimization the lower bounds of the remained assets will be equal to the threshold.

6. Case study: a practical application to ETFs and ETCs

In the following case study the Target strategy will be implemented by using ETFs and ETCs. The goal of the strategy is to offer at the hypothetical risk-averse investor a tool that allows him to get an annual return of 5% over a period of 5 years, whichever will be the beginning of the investment horizon. We used the weekly last prices adjusted for dividends of 314 ETFs and 125 ETCs (the period range runs from 07/01/2000 to 29/11/2013), if the ETF/ETC had not enough historical time series it was hooked to the Index it tracks; if the ETF/ETC was delisted the time series stops. The strategy implemented is characterized as follows:

- Initial budget amounts to € 10 ml;
- Self-financing portfolio (it is not allowed to invest an amount exceeding the available capital)
- Short selling isn't allowed;
- Maximum number of assets in the portfolio equal to 30;
- Upper and lower bound of risky assets equal respectively to 8% and 3%;
- Upper and lower bound of cash equal respectively to 100% and 0%;
- Sum of weights equal to available capital;
- Betamin equal to 8%, Betamax equal to 30%;
- Number of weeks for the calculation of β, R^2 and MAD equal to 10;
- Transaction costs amounts to € 70 per execution;
- Management fee equal to 2%;
- Risk free rate equal to 1%;
- Performance target to replicate equal to 5%.

Figure 1: **Portfolio Target Strategy.**

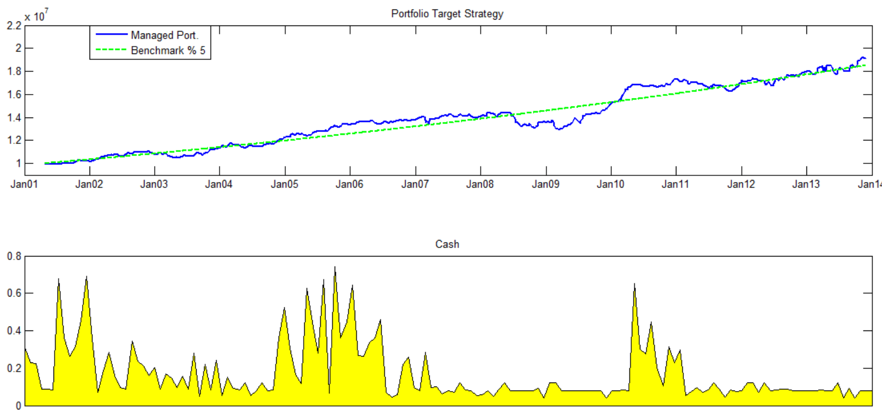


Table 1: **Performance evaluation**

Global Performance	91.97%
Annualized Performance	5.36%
Volatility	5.09%
MaxDD	-10.59%
MaxDD Duration (week)	82
Ulcer Index	0.0273
Minimum weekly return	-3.54%
Maximum weekly return	3.33%
Mean weekly return	0.10%

The portfolio is built every last trading Friday of the month in question and remained unchanged throughout the following month.

The Figure 1 shows the resulting portfolio value: the blue line represents the portfolio that follows the target strategy while the pink one is the simulated benchmark. The graph below shows the percentage invested in cash.

The managed portfolio achieved an annualized total return of 5.36%, as required by the benchmark. The following table summarizes the performance of the target strategy.

The portfolio had a maximum drawdown of 10.59% (Figure 2), coinciding with the start of the financial crisis, although the maximum recovery time had been a year and a half (82 weeks), a satisfactory time taking into account the investment horizon (initially set at 5 years).

To better understand the effectiveness of the strategy we provide below the frequency histograms (Figure 3-4) which report how many times the managed portfolio achieved an annual return of 5%. In order to do this we used weekly rolling windows of amplitude of 3 and 5 years.

Figure 2: **Drawdowns**

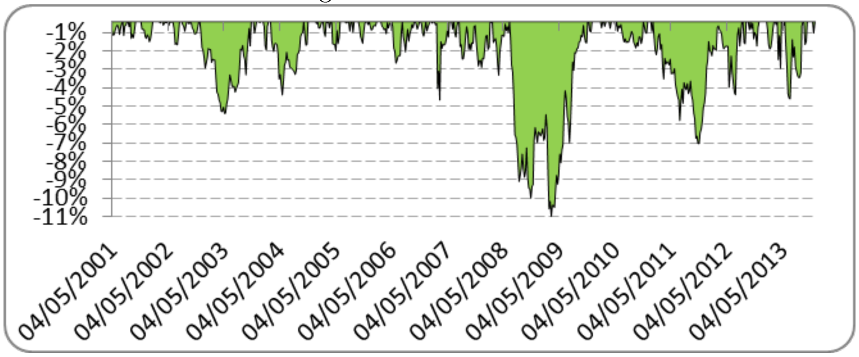


Figure 3: **Rolling windows 3 years**

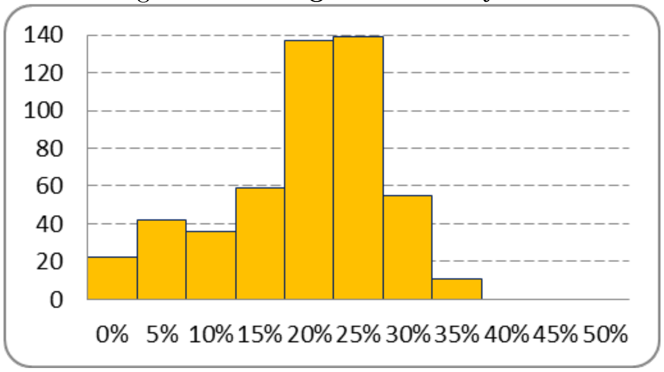
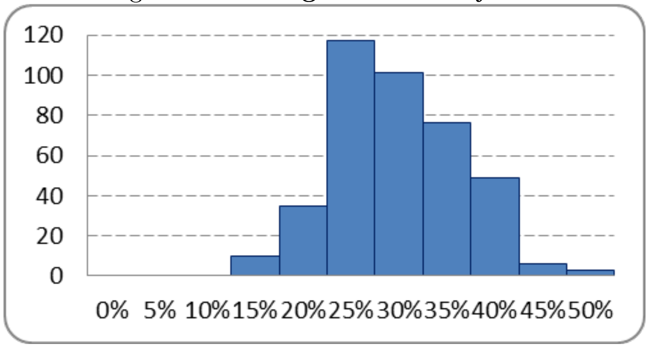


Figure 4: **Rolling windows 5 years**



From the graphs we see that having a time horizon of three years is more likely to yield a return from 20% to 25%, but if we have a period of 5 years the performance is likely to vary from 25% to 35%[3]. It is noticeable that in both cases the initial capital invested is not eroded.

7. Conclusion

In this paper, we investigate a well-known portfolio optimization model (MAD) and a new risk indicator (Diaman Ratio) that measures risk-adjusted performance. We build an innovative absolute return strategy by exploiting the framework of MAD and the predictive power of Diaman Ratio. A case study has been provided by using ETFs and ETCs. The experimental results implied that target strategy is profitable for risk-averse investors who want a target return in a considerable time. Future research should concentrate on optimizing the filter parameters (lower and upper bounds for β) and the number of weeks for the calculation of β, R^2 and MAD.

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[3] The cumulative annual return of 5% at 3 and 5 years is 15.76% and 27.63% respectively.