

OPTIMIZATION REPORT

SMART BETA WITH TECHINICAL INDICATORS, QUARTERLY AND YEARLY FINANCIAL RATIOS

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1 Introduction

This document outlines a Smart Beta strategy that combines daily technical indicators with quarterly and yearly financial statement data for stock selection to hold in a three-month period.

2 Strategy

2.1 Data Processing

The stock data (open, close, high, low, quantity) of 100 VN100 stocks are collected and stored locally, along with financial statements. These datasets are processed by adding technical indicators derived from closing prices and calculating financial ratios. The technical indicators and financial ratios are normalized by the z-score normalization.

2.2 Trading Procedure

2.2.1 Buying Conditions

Each day, the score of a stock is calculated using a linear function:

$$s_{d,q,y} = w_1 \cdot RSI_d + w_2 \cdot MACD_histogram_d + w_3 \cdot ROE_{q-1} + w_4 \cdot Net_Margin_{q-1} + w_5 \cdot Debt_to_Equity_{q-1} + w_6 \cdot Current_Ratio_{q-1} + w_7 \cdot Asset_Turnover_{q-1} + w_8 \cdot Revenue_Growth_{q-1} + w_9 \cdot Quick_Ratio_{q-1} + w_{10} \cdot Inventory_Turnover_{q-1} + w_{11} \cdot EPS_{y-1} + w_{12} \cdot PE_{y-1}$$

where d, q, and y denote the day, quarter, and year to which the stock belongs.

Buy the stocks with the top 3 scores on the close price if they're not in the portfolio and there's enough cash.

2.2.2 Selling Conditions

Each stock are sold after 90 calendar days.

2.3 Metrics Calculation

During the trading simulation, all daily data are recorded, and the final results include metrics along with daily trading data, such as stocks held, portfolio value, and other relevant details.

3 Optimization

3.1 Data

3.1.1 In-Sample Data

The in-sample data spans from January 1, 2020, to December 31, 2023.

3.1.2 Out-of-Sample Data

The out-sample data covers the period from January 1, 2024, to December 31, 2024.

3.2 Optimized Parameters

The optimized parameters represent the weights derived from the function described in the Buying Conditions section above. Daily data is optimized within the range of -1 to 1, while financial ratios are optimized within the range of 0 to 1.

3.3 Return Function

The objective function is defined as the sum of the Sharpe ratio and the maximum drawdown (negative value).

3.4 Code

```
def objective(self, trial):
    stock_score_params = {
        'RSI': trial.suggest_float('RSI', -1, 1),
        'MACD_histogram': trial.suggest_float('MACD_histogram', -1, 1),
    }

    quarterly_financial_score_params = {
        'ROE': trial.suggest_float('ROE', 0, 1),
        'Net_Margin': trial.suggest_float('Net_Margin', 0, 1),
        'Debt_to_Equity': trial.suggest_float('Debt_to_Equity', 0, 1),
        'Current_Ratio': trial.suggest_float('Current_Ratio', 0, 1),
        'Asset_Turnover': trial.suggest_float('Asset_Turnover', 0, 1),
        'Revenue_Growth': trial.suggest_float('Revenue_Growth', 0, 1),
        'Quick_Ratio': trial.suggest_float('Quick_Ratio', 0, 1),
        'Inventory_Turnover': trial.suggest_float('Inventory_Turnover', 0, 1),
    }

    yearly_financial_score_params = {
        'EPS': trial.suggest_float('EPS', 0, 1),
        'PE': trial.suggest_float('PE', 0, 1)
    }

    backtest = Backtesting(
        self.stock_data,
        self.financial_data,
        stock_score_params,
        quarterly_financial_score_params,
        yearly_financial_score_params,
        initial_balance=self.initial_balance,
        transaction_cost=self.transaction_fee
    )

    results = backtest.backtest(
        self.start_date,
        self.end_date,
    )

    return results['sharpe_ratio'] + results['max_drawdown']
```