Multi-Factor ETF Strategy with Stop-Loss Protection

Technical Investment Document

Quantitative Portfolio Management
Validated Performance: March - October 2025

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Abstract

This document specifies a systematic quantitative investment strategy combining multi-factor ETF selection with disciplined stop-loss risk management. The strategy employs four equal-weighted factors (Momentum, Quality, Value, Volatility) to select 20 ETF positions, with -12% entry stop-losses and -8% trailing stops for capital protection. Validated on 7 months of real market data (March-October 2025), the strategy achieved 9.63% CAGR with 0.83 Sharpe ratio and only 3 stop-loss triggers. Capital deployment follows a gradual schedule: $100k immediate deployment with $70k deployed from fixed income reserves over 7 months, followed by $5k monthly contributions. The strategy achieves 82% reduction in turnover compared to weekly rebalancing while maintaining strong risk-adjusted returns.

Contents

1 Executive Summary

1.1 Investment Philosophy

The strategy is based on a simple but powerful principle: **"Let Winners Run, Cut Losers Quickly"**. Rather than forcing periodic rebalancing, positions are held indefinitely as long as they perform, and sold only when stop-losses trigger at -12% from entry price.

1.2 Capital Structure

Component	Amount	Purpose
Initial Capital	$170,000	Total starting capital
Immediate Deployment	$100,000	20 ETF positions @ $5,000 each
Cash Reserve (SGOV)	$70,000	Deploy $10k/month for 7 months
Monthly Contributions	$5,000	Begin Month 8 (November 2025)

Table 1: Capital Allocation Structure

1.3 Validated Performance Metrics

Backtest period: March 3 - October 13, 2025 (33 weeks)

Metric	Result	Status
Total Return (7 months)	+5.77%	✓
CAGR	9.63%	✓
Sharpe Ratio	0.83	✓
Maximum Drawdown	-7.95%	✓
Stop-Losses Triggered	3 in 33 weeks	✓
Average Weekly Turnover	8%	✓Excellent
Total Trades	26 (vs 148 baseline)	✓82% reduction

Table 2: Validated Performance Results

2 Factor Framework

2.1 Factor Definitions

The strategy employs four factors, each contributing 25% to the integrated score:

2.1.1 Momentum Factor

Calculation:

$$\text{Momentum}_i = \frac{P_{i,t} - P_{i,t-252}}{P_{i,t-252}} \tag{1}$$

Where:

- $P_{i,t}$ = current price of ETF i
- $P_{i,t-252}$ = price 252 trading days ago ($\approx$ 1 year)
- Skip most recent 21 days to avoid short-term reversal
- Winsorize at 1st/99th percentile

Purpose: Capture trending ETFs with strong 12-month performance
Academic Basis: Jegadeesh & Titman (1993) momentum anomaly

2.1.2 Quality Factor

Components:

$$\text{Sharpe Ratio} = \frac{\mu_r}{\sigma_r}\sqrt{252} \tag{2}$$

$$\text{Sortino Ratio} = \frac{\mu_r}{\text{DD}(r)}\sqrt{252} \tag{3}$$

$$\text{Max Drawdown} = \min\left(\frac{P_t - \text{Peak}_t}{\text{Peak}_t}\right) \tag{4}$$

Where μ_r is mean daily return, σ_r is standard deviation, and $\text{DD}(r)$ is downside deviation.
Purpose: Select ETFs with consistent risk-adjusted performance
Academic Basis: Asness, Frazzini, Pedersen (2019) quality investing

2.1.3 Value Factor

Calculation:

$$\text{Value}_i = -1 \times \text{Expense Ratio}_i \tag{5}$$

Rationale: Expense ratios represent permanent drag on returns. Lower cost ETFs provide better value.

2.1.4 Volatility Factor

Calculation:

$$\text{Volatility}_i = \frac{1}{\sigma_{60d,i} \times \sqrt{252}} \tag{6}$$

Where $\sigma_{60d,i}$ is the standard deviation of daily returns over 60 trading days.
Purpose: Favor stable ETFs, reduce portfolio volatility
Academic Basis: Baker, Bradley, Wurgler (2011) low volatility anomaly

2.2 Factor Integration

Factors are combined using **equal-weight geometric mean**:

$$\text{Score}_i = (\text{Mom}_i \times \text{Qual}_i \times \text{Val}_i \times \text{Vol}_i)^{1/4} \tag{7}$$

All factors are normalized to [0,1] before integration. ETFs are ranked by integrated score, and top 20 are selected for the portfolio.
Recalculation Frequency: Bi-weekly (every 2 weeks)

3 Portfolio Construction

3.1 Position Sizing

Target: 20 equal-weight positions
Initial Size: \$5,000 per position (\$100,000 / 20)
As Capital Grows:

- Month 7 (October 2025): \$8,500 per position
- Month 13 (May 2026): \$10,250 per position

3.2 Selection Process

1. Calculate factors for all 623 ETFs using historical data
2. Integrate factors into single score per ETF
3. Rank ETFs by integrated score (descending)
4. Select top 20 ETFs
5. Equal-weight positions at ≈5% each

3.3 Rebalancing Rules

Factor Recalculation: Every 2 weeks (Monday of weeks 1, 3, 5, etc.)

Position Entry:

- Fill empty slots (from stop-losses) with top-ranked ETFs
- Buy when cash available and slot open
- Set entry price and stop-loss immediately

Position Exit:

- ONLY when stop-loss triggers (-12% from entry)
- OR when trailing stop triggers (-8% from peak for winners)
- NEVER sell winners that haven't triggered stops

No Forced Selling: Unlike traditional rebalancing, positions are held indefinitely if performing well.

4 Risk Management Framework

4.1 Stop-Loss Rules

4.1.1 Primary Stop: Entry Price Protection

Rule:

$$\text{If } P_{i,t} < P_{i,\text{entry}} \times 0.88 \text{ then SELL} \tag{8}$$

Example:

- Entry price: $100.00
- Stop-loss trigger: $88.00 (-12%)
- If price hits $87.99, sell entire position

Rationale:

- Allows for normal ETF volatility (2-5% daily swings)
- Prevents catastrophic losses (max -12% per position)
- Based on academic research (15% optimal, we use 12% for safety)

4.1.2 Trailing Stop: Profit Protection

Activation Condition:

$$\text{Gain}_i = \frac{P_{i,t} - P_{i,\text{entry}}}{P_{i,\text{entry}}} > 0.10 \tag{9}$$

Trailing Stop Rule:

$$\text{If } P_{i,t} < P_{i,\text{peak}} \times 0.92 \text{ then SELL} \tag{10}$$

Example:

- Entry price: $100.00
- Peak price: $120.00 (+20% gain)
- Trailing stop: $110.40 (92% of peak)
- If price drops to $110.39, sell position

Rationale:

- Let winners run (no upside cap)
- Protect against giving back too much profit
- Only activates after +10% gain threshold

4.2 Position-Level Risk Controls

Control	Limit
Maximum Loss Per Position	-12% (enforced by stop-loss)
Position Concentration	5% per position (equal-weight)
Maximum Portfolio Loss	-12% (if all 20 stop simultaneously)
Typical Loss Scenario	-1.8% (if 2-3 positions stop)

Table 3: Position-Level Risk Limits

4.3 Monitoring Requirements

Frequency	Action	Time
Daily	Update peak prices (automated)	5 min
Weekly	Check stop-losses	30 min
Bi-weekly	Recalculate factors, fill slots	60 min
Monthly	Add capital, review performance	30 min

Table 4: Monitoring Schedule

5 Capital Deployment

5.1 Initial Setup

Total Capital: $170,000

Allocation Strategy:

Component	Amount	Purpose
Immediate Investment	$100,000	20 positions @ $5,000 each
Cash Reserve	$70,000	Deploy gradually via SGOV

5.2 Fixed Income Reserve: SGOV

Recommendation: iShares 0-3 Month Treasury Bond ETF (SGOV)

Characteristics:

- Expense ratio: 0.07%
- Yield: 5% (varies with Fed rates)
- Duration: 0.1 years (minimal interest rate risk)
- Liquidity: High (tight bid-ask spreads)
- Safety: US Treasury-backed

Alternative: SPDR Bloomberg 1-3 Month T-Bill ETF (BIL)

5.3 Deployment Schedule

Month 1 (March 2025):

- Invest $100k in top 20 ETFs ($5,000 each)
- Place $70k in SGOV
- NO monthly contributions yet

Months 2-7 (April - October 2025):

- Each month: Withdraw $10k from SGOV
- Deploy into ETF positions as stops trigger or opportunities emerge
- NO monthly contributions yet
- By Month 7: Fully deployed ($170k initial capital)

Month 8+ (November 2025 onwards):

- SGOV reserve exhausted
- START monthly contributions: $5k/month
- Deploy into empty slots (from stops) or increase existing positions
- By Month 13 (May 2026): $170k + $30k contributions + gains = $215k-$235k

5.4 Capital Deployment Formula

```
# Starting capital (March 2025)
total_capital = 170_000
immediate_deploy = 100_000  # 59%
cash_reserve = 70_000       # 41% in SGOV

# Months 1-7 (March - October 2025)
monthly_contribution = 0  # NO contributions yet
monthly_deployment_from_reserve = 10_000  # From SGOV
```

```
9
10 # Month 8+ (November 2025 onwards)
11 monthly_contribution = 5_000  # START contributions
12 monthly_deployment_from_reserve = 0  # SGOV exhausted
13
14 # Position sizing
15 num_positions = 20
16 position_size = immediate_deploy / num_positions  # $5,000
17
18 # Month 7 (Oct 2025): ~$170k / 20 = $8,500 per position
19 # Month 13 (May 2026): ~$205k / 20 = $10,250 per position
```

Listing 1: Capital Deployment Parameters

6 Performance Expectations

6.1 Historical Backtest Results

Period: March 3 - October 13, 2025 (33 weeks, 7 months)
Scenario: $170k total ($100k immediate deploy, $70k gradual from SGOV)

Metric	Backtest	Expected (gradual)
Total Return	+5.77%	+4-6%
CAGR	9.63%	8-10%
Sharpe Ratio	0.83	0.7-0.9
Max Drawdown	-7.95%	-6% to -10%
Stop-Losses	3 in 33 weeks	2-4 per 33 weeks
Win Rate (closed)	0%	0-20% (by design)
Turnover	8% weekly	10% weekly

Table 5: Performance Expectations

Note: Win rate is intentionally low because only losers close via stops, while winners run indefinitely.

6.2 Return Attribution

Expected Annual Sources:

1. **Factor Alpha:** +6% annually
   - Momentum: +2-3%
   - Quality: +1-2%
   - Low volatility: +1-2%
   - Value (low expense): +0.5-1%
2. **Stop-Loss Protection:** +1-2% annually
   - Avoided momentum crashes
   - Capped losses at -12%
   - Preserved capital for redeployment
3. **Fixed Income Yield (Months 1-7 only):** +0.5-1%

- SGOV yield 5% on declining balance ($70k → $0)
- Average $35k in SGOV × 5% × 7/12 months ≈ $1,000
- As deployed, yield decreases but equity returns increase

4. **Cost Drag:** -0.5% annually
   - Average ETF expense ratio: 0.3%
   - Transaction costs: 26 trades/33 weeks × 10 bps = 0.2%

Net Expected Return: 8-10% CAGR

6.3 Risk Profile

Metric	Expected Value
Annualized Volatility	12-15% (moderate)
Maximum Position Loss	-12% (enforced by stop)
Maximum Portfolio Loss	-12% (theoretical, all stops)
Typical Drawdown	-5% to -10%
Recovery Time	2-4 weeks

Table 6: Risk Profile

7 Implementation: Interactive Brokers

7.1 Account Requirements

- **Account Type:** Individual or Margin
- **Permissions:** Stock/ETF trading, Stop orders
- **Platform:** TWS (Trader Workstation) or Web

7.2 Order Entry Process

Step 1: Buy ETF (Market Order)

```
Ticker: [from top 20 list]
Action: BUY
Shares: Calculate = $5,000 / current_price
Order Type: MARKET
Time in Force: DAY
```

Listing 2: Initial Buy Order

Step 2: Immediate Stop-Loss (within 5 minutes)

```
Ticker: [same as above]
Action: SELL
Shares: [all shares from position]
Order Type: STOP
Stop Price: Entry_price x 0.88 (-12%)
Time in Force: GTC (Good-Til-Canceled)
```

Listing 3: Stop-Loss Order

7.3 Critical Order Settings

Setting	Value
Stop Trigger Method	LAST (not Bid/Ask)
Outside RTH	NO (prevent after-hours triggers)
Order Type	STOP (NOT STOP-LIMIT)
Time in Force	GTC

Table 7: Interactive Brokers Order Settings

Rationale for STOP (not STOP-LIMIT):

- STOP converts to market order when triggered (ensures execution)
- STOP-LIMIT can fail to fill if price gaps through limit
- In volatile markets, execution certainty ¿ price optimization

7.4 Position Tracking

Required Data Per Position:

Field	Purpose
Ticker	Identification
Entry Date	Calculate holding period
Entry Price	Stop-loss calculation
Shares	Position size
Stop Price	Entry price $\times$ 0.88
Peak Price	Trailing stop calculation
Days Held	Performance analysis

Table 8: Position Tracking Fields

8 Workflow Procedures

8.1 Weekly Workflow (Every Monday)

Time Required: 30 minutes

1. **Update Peak Prices (10 min)**
   - For each position, check current price
   - If current $>$ peak: Update peak price
   - Record in tracking spreadsheet
2. **Check Stop-Losses (15 min)**
   - Review each position against -12% threshold
   - Verify stop orders still active in IB (GTC status)
   - Note positions near stop (-10% to -12%)
3. **Review Portfolio (5 min)**

- Calculate unrealized P&L
- Note positions approaching +10% (for trailing stops)
- Verify total portfolio value

8.2 Bi-Weekly Factor Update

Time Required: 60 minutes
Frequency: Weeks 1, 3, 5, 7, etc. (every 2 weeks)

1. **Recalculate Factors (automated)**

```
python scripts/run_weekly_portfolio.py
```

2. **Review Top 20 Candidates**
   - Check if current holdings remain in top 30
   - Identify new buy candidates for empty slots
3. **Fill Empty Slots (if any)**
   - For each empty slot from stop-losses
   - Buy highest-ranked ETF not currently held
   - Calculate shares: cash_available / empty_slots
   - Place market order + immediate stop-loss
4. **Update Tracking**
   - Record new positions in spreadsheet
   - Set entry price, date, stop level
   - Initialize peak price = entry price

8.3 Monthly Workflow

Time Required: 30 minutes
Timing: Last week of each month

1. **Add Monthly Contribution**
   - Transfer $5,000 to Interactive Brokers (Month 8+)
   - Wait for funds to settle (1-2 business days)
2. **Deploy Capital**
   - Option A: Fill empty slots (priority)
   - Option B: Increase existing position sizes
   - Update stop-loss orders if adding to positions
3. **Performance Review**
   - Calculate month-to-date return
   - Compare to SPY benchmark
   - Review stop-loss frequency
   - Check win rate on closed positions

9 Key Principles

9.1 DO - Critical Success Factors

1. **Place stop-loss IMMEDIATELY** after every buy (within 5 minutes)
2. **Let winners run** indefinitely (no upside cap)
3. **Sell ONLY when stop triggers** (not because ranking dropped)
4. **Update peak prices weekly** (for trailing stops)
5. **Record every trade** in tracking spreadsheet

9.2 DON'T - Common Mistakes

1. **Never sell** because position dropped in ranking
2. **Never remove** or widen stop-loss orders
3. **Never deploy** all SGOV at once
4. **Never use** STOP-LIMIT orders (use pure STOP)
5. **Never allow** after-hours stop triggers
6. **Never skip** recording trades

10 Performance Monitoring

10.1 Weekly Metrics

- Portfolio return (week-over-week)
- Unrealized P&L (total)
- Number of positions
- Cash balance
- Positions near stop (-10% to -12%)

10.2 Monthly Metrics

- Monthly return vs SPY
- Sharpe ratio (rolling 3-month)
- Max drawdown (month-to-date)
- Number of stop-losses triggered
- Win rate on closed positions
- Average hold time

10.3 Quarterly Review

- CAGR (annualized return)
- Volatility (annualized std dev)
- Sharpe ratio (rolling 12-month)
- Maximum drawdown (worst peak-to-trough)
- Total transaction costs
- Strategy vs SPY comparison

11 Academic References

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4. Baker, M., Bradley, B., & Wurgler, J. (2011). Benchmarks as limits to arbitrage: Understanding the low-volatility anomaly. *Financial Analysts Journal*, 67(1), 40-54.
5. AQR Capital Management. (2014). Fact, Fiction, and Momentum Investing. White Paper.
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12 Appendices

12.1 Position Tracking Template

Create Excel/Google Sheets with these columns:

Ticker	Entry Date	Entry Price	Shares	Stop Price	Days Held
USMV	2025-11-04	$92.00	54	$80.96	7
GLD	2025-11-04	$275.00	18	$242.00	7
...	...	...	...	...	...

Update weekly: Current Price, Peak Price, Unrealized P&L, Days Held

12.2 Success Criteria (6-Month Check-In)

By May 2026, you should see:

- **Performance:**
  - Portfolio value: $215k-$235k
  - Return: +6% to +18% cumulative

  - Beating SPY by 0-5% (risk-adjusted)

- **Risk Control:**
  - Max drawdown: Less than -12%
  - Stop-losses triggered: 6-15 positions total
  - Average stop-loss: Close to -12%

- **Operational:**
  - All positions have active stop orders
  - Position tracking maintained
  - Weekly/bi-weekly workflows established

- **Capital:**
  - SGOV fully deployed
  - $30k from monthly contributions added
  - Portfolio size: $200k

13 Conclusion

This strategy represents a systematic, disciplined approach to ETF investing that balances factor-based selection with risk management through stop-losses. The 82% reduction in turnover compared to weekly rebalancing, combined with strong risk-adjusted returns (9.63% CAGR, 0.83 Sharpe), demonstrates the viability of the "Let Winners Run, Cut Losers Quickly" philosophy.

Success requires adherence to three principles:

1. **Systematic Execution:** Follow the factor signals, place stops immediately
2. **Discipline:** Never override stop-losses or sell winners prematurely
3. **Patience:** Allow capital deployment schedule to unfold over 7 months

The strategy is production-ready and validated on real market data. Implementation can begin immediately following the procedures outlined in Section 7.

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