

STAT 649

Time Series Momentum

Trading Strategy

Group 1: Xin Tan, Olivia Qu, Shiyue Wang, Wenlu Dong, Iris Wu

Outline



- Time Series Momentum
- Relative Strength Index
- Moving Average Convergence/Divergence
- Empirical Result
- Comparison

Time Series Momentum (TSMOM)



Common strategy of trading

- Buy stocks that have performed well in the past
- Sell stocks that have performed poorly in the past

Observation

- Generates significant positive returns over 3-12 month period
- Return dissipates in the following 2 years
- Consistent pattern from 1965 to 2022

Time Series Momentum (TSMOM)



How to use best past information predict future?

- How long ago shall we focus on? 6 month, 12 months, or 18 months?
- How long shall we hold the position?
- Show we act differently in different markets?

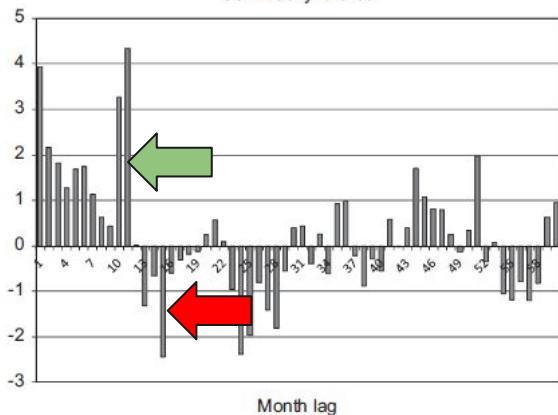
How long ago shall we focus on?

Regress monthly excess return on own lagged excess return

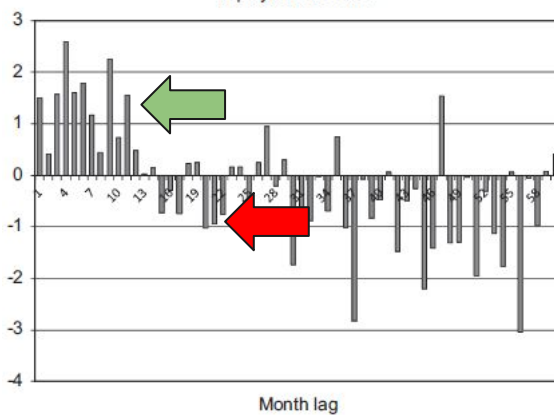
Positive signs for first 12-m indicate significant return continuation or trend

Negative signs for the longer time indicate trend reversals (1 year followed)

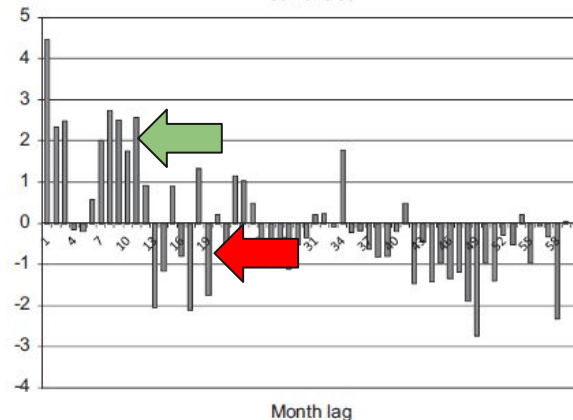
Commodity futures



Equity index futures



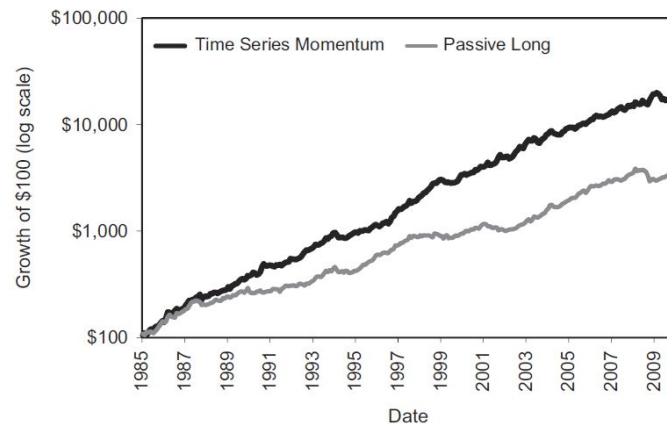
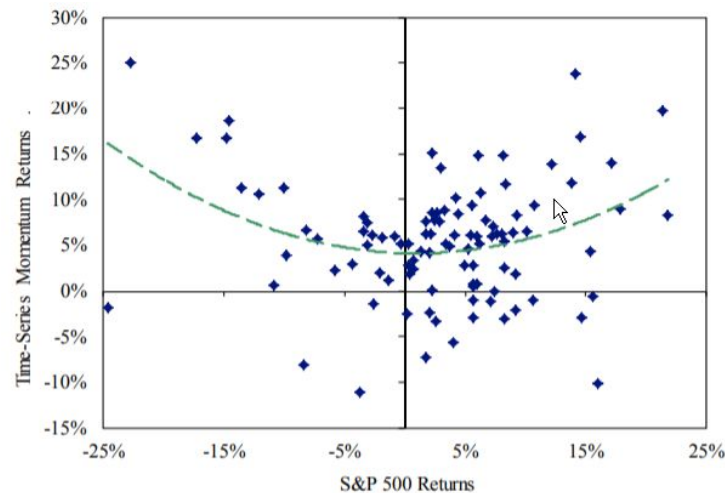
Currencies



Time Series Momentum (TSMOM)

- Learn the trend from past 12 month return
- Long when trend is up
- Short when trend is down
- Adjust for volatility for each asset
- Hold for 1 month

$$r_{t,t+1}^{TSMOM,s} = \text{sign}(r_{t-12,t}^s) \frac{40\%}{\sigma_t^s} r_{t,t+1}^s$$



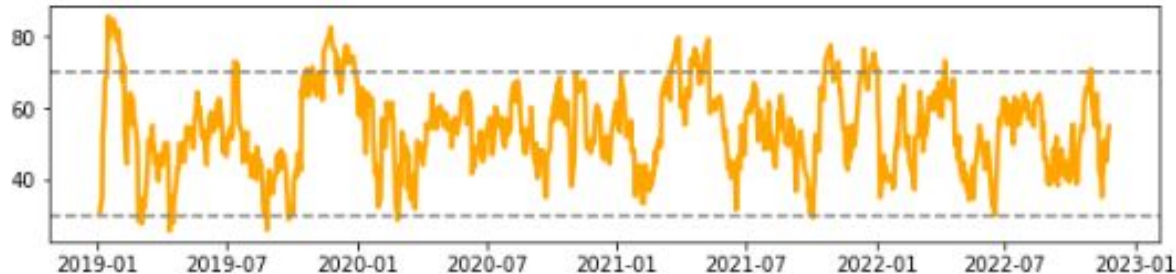
Relative Strength Index (RSI)

$$RS = \frac{\text{average gain}}{\text{average loss}}$$

$$RSI_{\text{step one}} = 100 - \frac{100}{1 + RS}$$

$$RSI_{\text{step two}} = 100 - \frac{100}{1 + \frac{\text{previous average gain} \times 13 + \text{current gain}}{\text{previous average loss} \times 13 + \text{current loss}}}$$

Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14
%	-2.77	4.79	8.60	-0.18	6.02	1.23	-16.7	9.64	8.68	-0.80	4.88	-1.83	-3.96	-9.09



- Rang: (0,100)
- RSI > 70 :
means “overbought”
Sell
- RSI < 30 :
means “oversold”
Buy

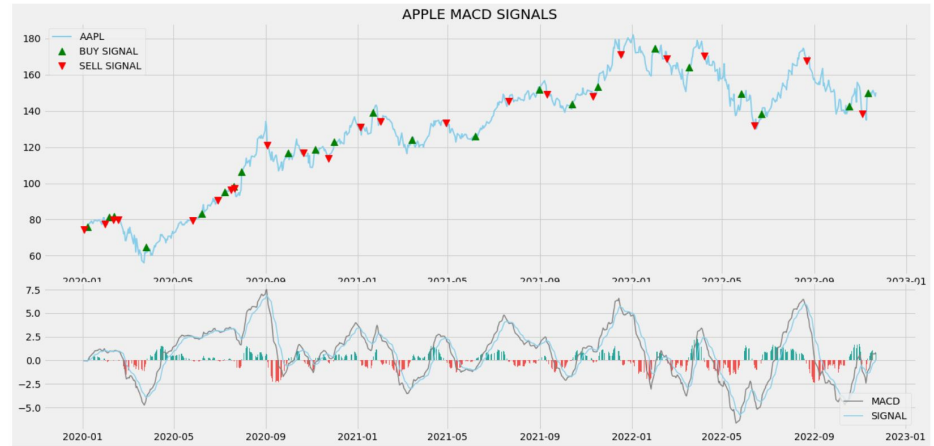
Moving Average Convergence/Divergence (MACD)

MACD Line = Fast Length EMA – Slow Length EMA

Default: Fast length: 12 Slow length: 26

Signal Line: 9

- Crossover
- MACD Line crosses above Signal line
- Buy
- MACD Line crosses below Signal line
- Sell



Backtesting

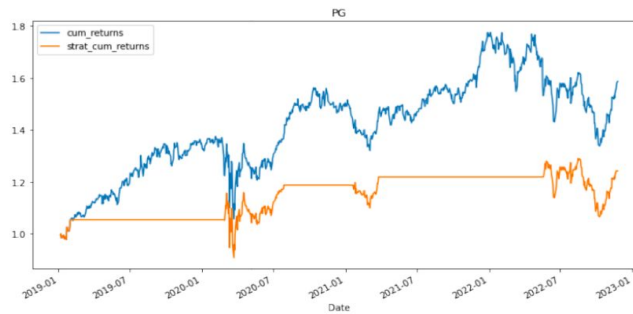
Table 6: Stock Price Profit & Percentage by Strategy

	TSMOM		TSMOM with Vol.		RSI		MACD	
Symbol	Profit	Profit %	Profit	Profit %	Profit	Profit %	Profit	Profit %
SPGI	110923.48	110%	70199.33	70%	63037.24	63%	91972.11	91%
VZ	-8001.02	-9%	-4776.32	-5%	-22584.03	-23%	-29390.32	-30%
TSLA	1238871.44	1238%	719223.89	719%	549050.54	549%	795074.16	795%
PG	-6992.98	-7%	31038.54	31%	28134.06	28%	16986.28	16%
DIS	-34215.99	-35%	-19465.41	-20%	-36657.19	-37%	36970.21	36%
SYN	-88389.55	-89%	-69915.2	-70%	59040.82	59%	12869.13	12%
AAPL	-73496.62	-74%	191504.73	191%	169113.23	169%	335928.41	335%
XOM	98624.34	98%	64363.18	64%	24562.85	24%	61718.58	61%
BRK-B	-38996.87	-39%	-28544.79	-29%	15666.3	15%	79014.85	79%
UNH	-10191.28	-11%	100569.19	100%	140208.64	140%	67490.44	67%
Total	1188134.95	118%	1054197.14	105.00%	989572.46	98%	1468633.85	146%

Table 9: Futures Profit & Percentage by Strategy

	TSMOM		TSMOM with Vol.		RSI		MACD	
Futures	Profit	Profit %	Profit	Profit %	Profit	Profit %	Profit	Profit %
Corn	61696	61%	-10695	-11%	42477.75	42%	27615	27%
Gold	4972.52	4%	-2036.79	-3%	21328.99	21%	20897.76	20%
Crude Oil	42511.89	42%	112899.88	112%	74486.62	74%	-116892.38	-117%
Natural Gas	-146539.33	-147%	171707.27	171%	64530.58	64%	31068.87	31%
Copper	137984.05	137%	-148122.15	-149%	-11704.05	-12%	128829.52	128%
Soybean Oil	106890.59	106%	124036.28	124%	34884.68	34%	184212.15	184%
S&P 500	21384	21%	33670	33%	24492	24%	52588.4	52%
Nasdaq 100	71325.8	71%	81308.5	81%	24709.5	24%	58777.76	58%
US 10 Year T-Note	29295.21	29%	22205.48	22%	-19592.22	-20%	-177.61	-1%
EUR-USD	3691.95	3%	2589.29	2%	-9405.85	-10%	-7861.44	-8%
Total	333212.68	33%	387562.76	38%	246138.7	24%	379058.03	37%

Comparison: MACD V.S RSI



For companies who had the continuing growth trend but frequent fluctuations in a short time, the strategy returns, no matter under RSI or MACD, were lower than the normal return

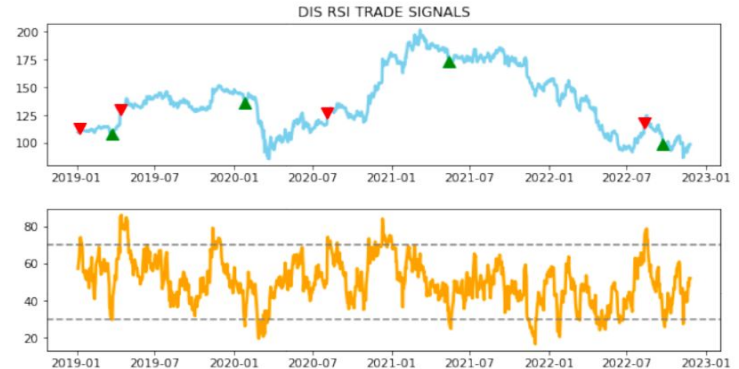
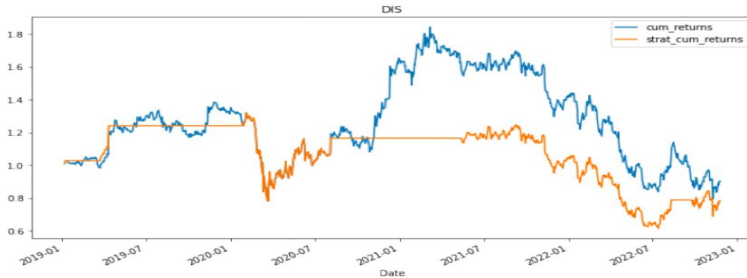
MACD

- A medium and long-term indicator
- Late response will be an advantage when the stock falls suddenly but rebounds immediately



RSI

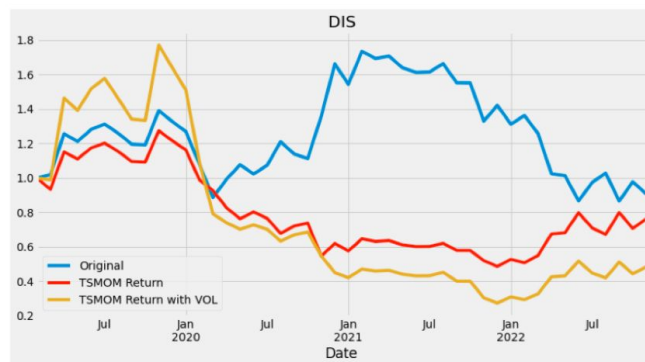
- The sensitivity of the RSI indicators is not enough
- Adjust thresholds



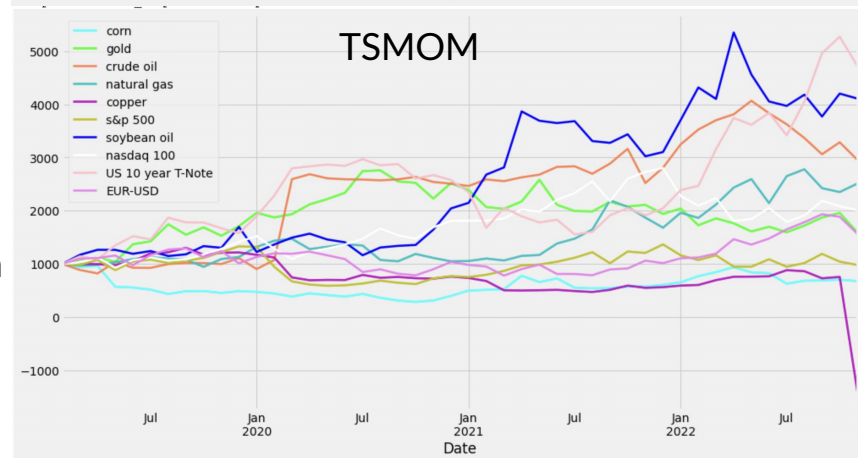
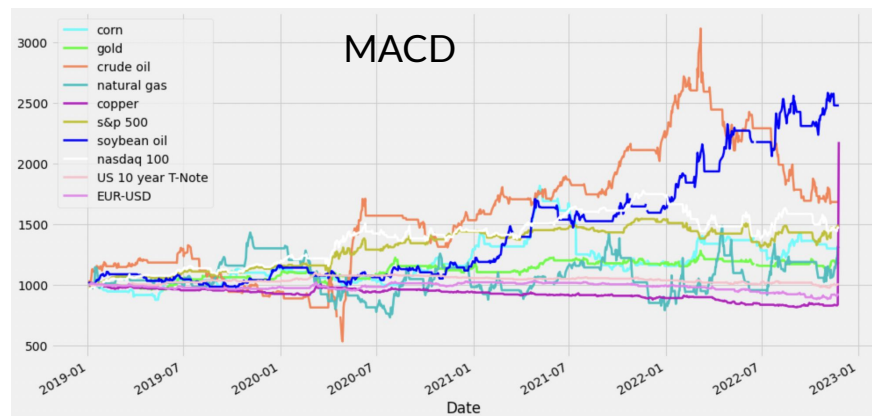
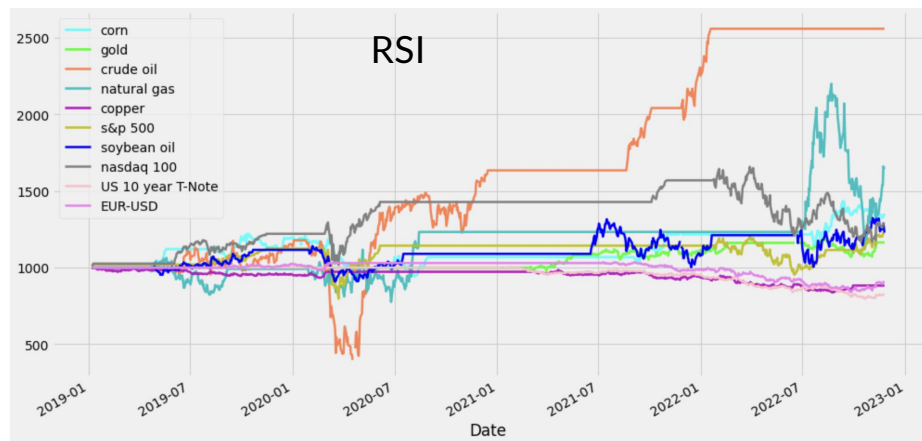
Comparison: Simple TSMOM V.S TSMOM with VOL



- For dramatically ups in the short term, TSMOM strategy will not react quickly enough
- A good downside protection in a short time
- The strategy return would go downside in the long term even when the market had turned into good condition because the late response
- For portfolio, the overall performance under TSMOM with volatility strategy would be stabler than that under the simple TSMOM strategy



Comparison



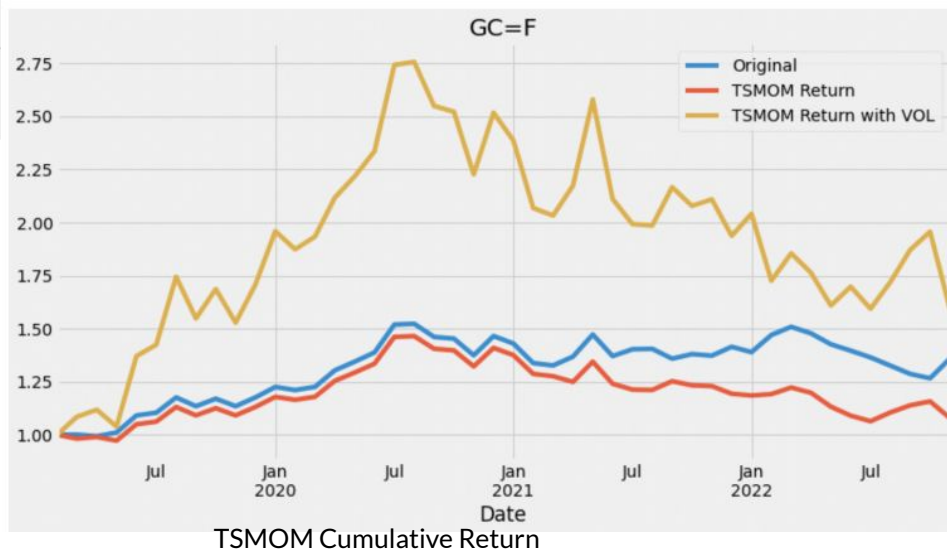
- **TSMOM:** Cumulative return of EUR-USD future has a significant decrease and lose 1000 after Aug 2022
- **MACD:** Profit increase dramatically
- **RSI:** Cumulative return is relatively steady

Conclusion & Recommendation

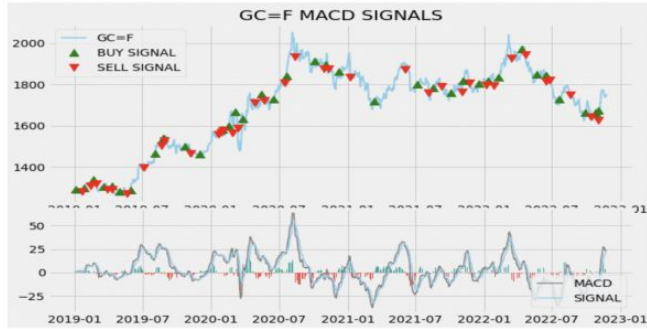


Close price significantly increased from Mar.2020 to Aug.2020, when the Covid-19 pandemic continued to spread across the world and the gold future price increase a lot

TSMOM strategy decide to long all the futures
TSMOM strategy has a dramatic increase than the original return



Conclusion & Recommendation



(a) Gold MACD



(b) Gold MACD Cumulative Return



(c) Gold RSI



(d) Gold RSI cumulative return

- MACD strategy's signals change a lot while RSI strategy prefer to keep the current Futures
- As a result, the RSI return is less than the original return while the MACD strategy made more money than the RSI

Dynamic Weighted RSI Investment

$\text{new weights}_{\text{step one}} = \text{previous weights}(1 + \text{weights change percentage})$

$$\text{new weights}_{\text{step two}}^i = \frac{\text{new weights}_{\text{step one}}^i}{\sum_{i=1}^n (\text{new weights}_{\text{step one}}^i)}$$



Dynamic Weighted RSI Investment

	SPGI	VZ	TSLA	PG	SYN	DIS	AAPL	XOM	BRK-B	UNH
2019	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2020	0.09	0.09	0.1	0.09	0.1	0.1	0.13	0.09	0.1	0.11
2021	0.09	0.09	0.1	0.09	0.1	0.1	0.13	0.09	0.1	0.11
2022	0.07	0.09	0.1	0.09	0.12	0.1	0.12	0.09	0.09	0.14



▲ Buy
▼ Sell

Thank You !