Ichimoku Kinko Hyo Time-Span Settings: A Comparison of Momentum Predictability

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I.   Abstract

The Ichimoku Kinko Hyo is a popular technical analysis indicator. Recently, the crypto trading sphere has popularized an 'extended settings' version of the indicator that changes the formulas for calculating the moving averages. Portfolio and single trade tests were performed on some of the most popular trade indicators of the Ichimoku, and results were compared across the two settings, with a buy and hold strategy also included for a control. Different asset classes were chosen for these trades, including an equity (SPY), a foreign exchange pair (USD/JPY), a cryptocurrency (BTC), and a commodity (Gold). Results were mixed, and may indicate that relying on a given setting for a specific asset is not advised without first back testing the setting on that asset to see real returns.

II. Introduction

The Ichimoku Kinko Hyo (translated: *Once Glance Equilibrium Chart*) is a popular trend analysis tool utilized in candle stick trading strategies. Figure 1 displays an example of the Ichimoku Kinko Hyo indicator.

Figure 1

The goal of this research is not to test the Ichimoku Kinko Hyo (to follow, the Ichimoku or just 'the cloud') trading strategy against a baseline, such as the S&P500 or total market index, as this has been done previously (see literature review). Instead, the goal of this study is to compare the effectiveness of the traditional Ichimoku settings vs the now popular "extended" time settings. For ease of reading, this paper will henceforward refer to these two as "traditional" settings for the standard time frames of the Ichimoku, and the "extended" settings for the more modern time settings.

III. Literature Review

Momentum based strategies have a strong body of literature behind them with their bedrock existing with the Asness 1995 paper. At its core, the Ichimoku indicator is a momentum indicator based on multiple simple moving averages, allowing one to quickly (at a glance, as the name would imply) make decisions about changes in trend. Studies about trading strategies regarding Ichimoku have been applied to multiple markets, including energy stocks (Gurrib, Kamalov, and Elshareif 2020), foreign and domestic stocks (Kai Jie Shawn, Yanyali, and Savidge 2015) and FX markets (Deng and Sakurai 2014).

However, no research as of yet has attempted to utilize the extended settings of the Ichimoku, popularized by traders in the cryptocurrency space who extended the time frames to deal with markets that never had closes, as they traded 24 hours a day and 7 days a week. This paper will hope to remedy this, testing multiple benchmarks of the trading system on both the cryptocurrency market itself and markets with more traditional trading hours, such as stocks, commodities (here gold), and foreign exchange (FX, here USD/JPY).

IV. Data & Methodology

Data

The data was collected from various Kaggle contributors (See *Appendix A*), and includes 4 sets of data. This includes the relevant daily prices for the SPY (from 1/29/1993 to 07/27/2023, n = 7678), the JPY/USD exchange rate (from 1/3/2000 to 3/4/2024, n = 6306), for gold (from 8/20/2013 to 8/17/2023, n = 2538), and for Bitcoin (from 9/18 2014 to 1/20/2024, n

= 3412). The data has been broken into a daily range, the price open, close, high, low, and then has added the below measurements of the various Ichimoku indicators.

Figure 2 contains summary statistics for each asset at its opening, close, high, and low value, as well as a table of the mean and standard deviations of each asset in the following table.
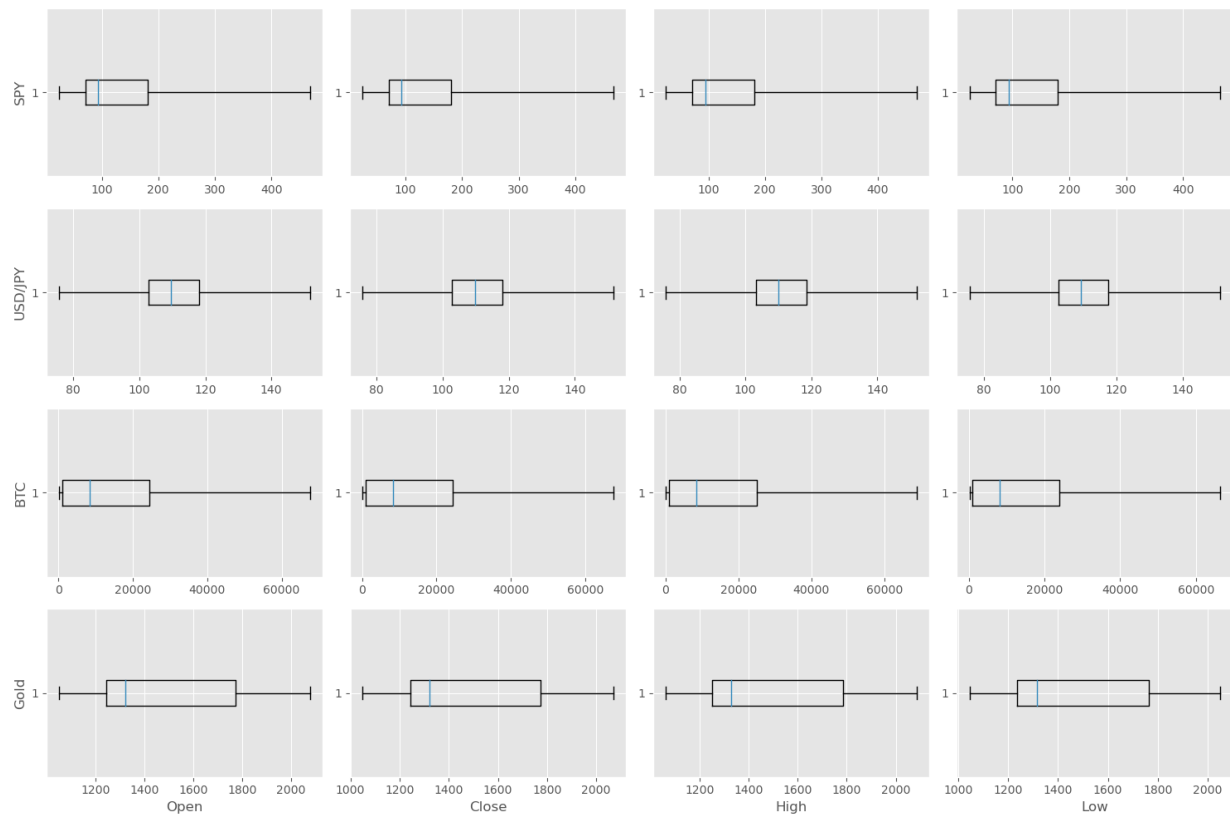
	Open	Close	High	Low
SPY	138.91(108.21)	138.92(108.24)	139.75(108.83)	138.00(107.56)
USD/JPY	109.47(15.14)	109.89(15.14)	109.89(15.20)	109.01(15.08)
BTC	14755(16297.74)	14766.00(16299.50)	15099.65(16687.79)	14384(15860.34)
Gold	1467.46(283.13)	1467.44(282.89)	1477.04(285.23)	1457.63(280.37)

Figure 2 Format of Table Mean(Std)

The Ichimoku levels are calculated using various moving averages (See *Figure 4* under Methodology for a labeled chart). The formulas listed below are how they are calculated.

For the traditional, they work as follows:

$$Tenkan-sen\ (Conversion\ line) = \frac{9\ period\ high + 9\ period\ low}{2}$$

$$Kijun-sen\ (Base\ line) = \frac{26\ period\ high + 26\ period\ low}{2}$$

$$Senkou\ Span\ A\ (Leading\ span\ A) = \frac{Conversion\ line + Base\ line}{2}$$

$$Senkou\ Span\ B\ (Leading\ span\ B) = \frac{52\ period\ high + 52\ period\ low}{2}$$

For the extended time frame, the equations are altered such that:

$$Tenkan-sen\ (Conversion\ line) = \frac{20\ period\ high + 20\ period\ low}{2}$$

$$Kijun-sen\ (Base\ line) = \frac{60\ period\ high + 60\ period\ low}{2}$$

$$Senkou\ Span\ A\ (Leading\ span\ A) = \frac{Conversion\ line + Base\ line}{2}$$

$$Senkou\ Span\ B\ (Leading\ span\ B) = \frac{120\ period\ high + 120\ period\ low}{2}$$

These levels are displayed on the chart of asset in the following ways: The Tenkan-sen is by default a blue-colored line. The Kijun-sen is by default a cherry-colored line. Senkou Span A and Senkou Span B make up 'the cloud.' When Senkou Span A is above Senkou Span B, the cloud is said to be 'bullish' and is colored green. When Senkou Span B is above Senkou Span A,

the cloud is said to be 'bearish' and is colored red. Notably, Senkou Span A and B are not displayed on the chart at the time interval for which they are calculated, but are instead projected 26 periods ahead in the traditional settings and 30 periods ahead in the extended settings.

Methodology

The Ichimoku cloud offers several strategies that can be employed as signals to take either a bearish or bullish position, and then to exit that position. In this paper, we'll be testing the success rates of several of them, and constructing a portfolio of each of our individual assets from the time the data starts until it ends to see if following a given strategy can lead to better returns either on the traditional or extended settings of the Ichimoku indicator.

Ichimoku trading and monitoring is done utilizing candle stick charts. Candlestick charts have been a mainstay in technical analysis research (Etschberger et al. 2006). Figure 3 contains the anatomy of a candlestick.
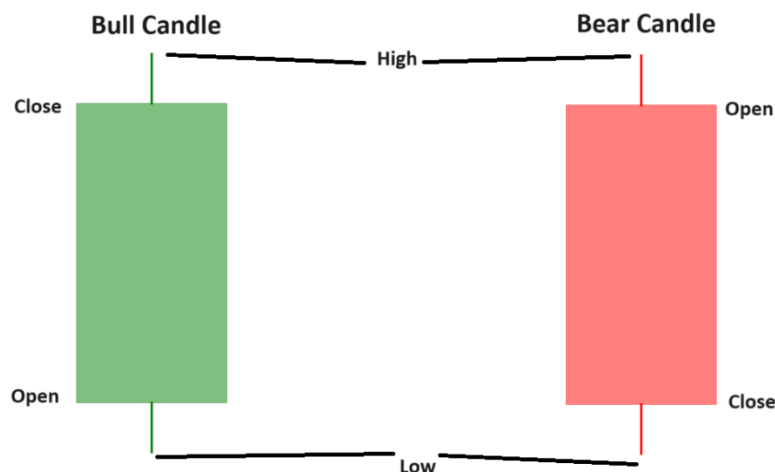

Figure 3

A candlestick covers a timeframe, and displays information including the opening price, closing price, the highest price during that timeframe, and the lowest price. The Ichimoku takes its signals on when to enter or exist positions based on the price close on a given timeframe.

The Ichimoku itself is made up of several moving averages as listed above. Figure 4 displays them labeled on the chart
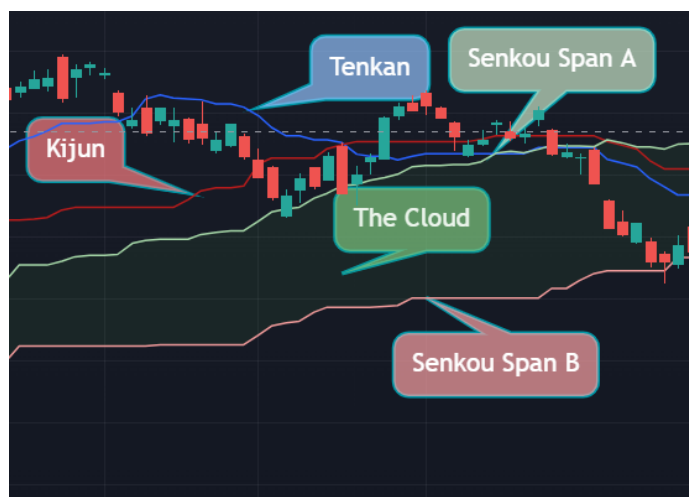
Figure 4

These moving averages are deployed to give traders various signals about the overall trend of a given asset, and several trading strategies have been built on them over the years as a signal of when to enter and cut a position for individual traders, or when to be long or short the asset for fund managers.

Trade and Portfolio Strategies

The first strategy we will be testing will be the 'Edge-to-Edge' trading strategy. This can be utilized as both a single trade strategy as well as an overall portfolio management strategy.

The edge-to-edge trade occurs when the price of the asset closes inside the cloud (that is, it crosses the Senkou Span A). The trade strategy is to target the Senkou Span B as your price target, either with a long position if the price is moving up through the cloud with an expectation that upward trend will continue or a short position if the price is moving down through it, expecting again that the trend will continue. Figure 5.1 displays a short edge to edge event, and Figure 5.2 displays a long edge to edge event.

Figure 5.1

Figure 5.2

The edge-to-edge trade is invalidated if the price closes back outside the cloud. When the edge-to-edge trade set up fails, the trader is recommended to cut the losing position. Figure 5.3 displays a failed short edge-to-edge trade.
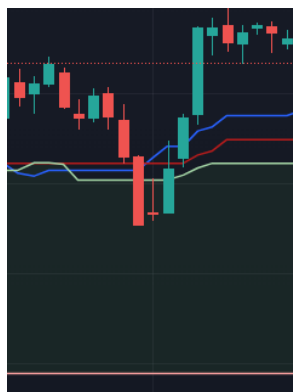

Figure 5.3

The conditions for such trades were mapped across all assets on both traditional and extended settings to measure the hit-rate for such a trade. Figure 5.4 displays the success and failure rates for each asset and Ichimoku setting for long positions, and Figure 5.5 displays the same for short positions.
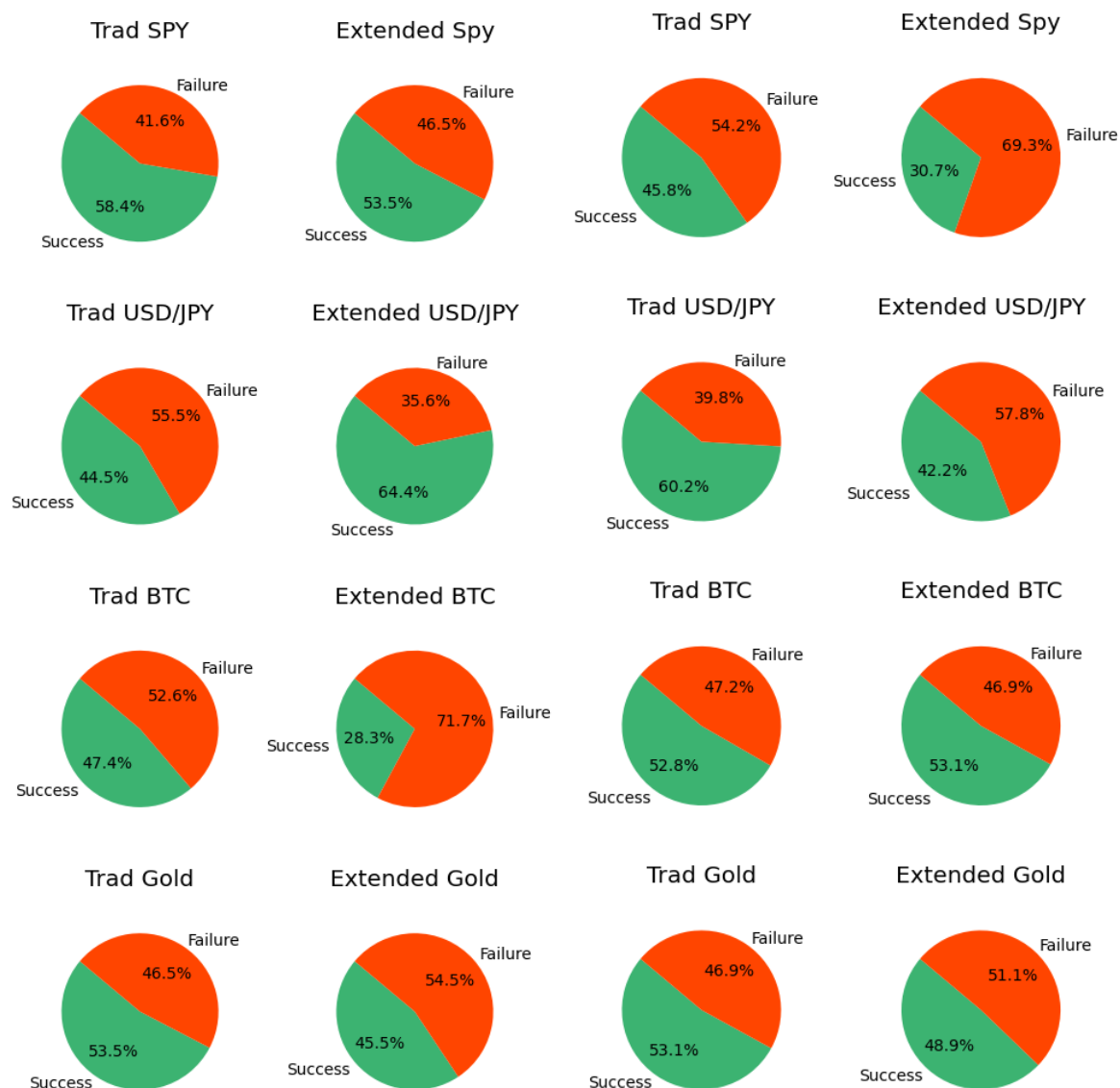
Trad SPY

Failure 41.6%
Success 58.4%

Extended Spy

Failure 46.5%
Success 53.5%

Trad SPY

Failure 54.2%
Success 45.8%

Extended Spy

Failure 69.3%
Success 30.7%

Trad USD/JPY

Failure 55.5%
Success 44.5%

Extended USD/JPY

Failure 35.6%
Success 64.4%

Trad USD/JPY

Failure 39.8%
Success 60.2%

Extended USD/JPY

Failure 57.8%
Success 42.2%

Trad BTC

Failure 52.6%
Success 47.4%

Extended BTC

Failure 71.7%
Success 28.3%

Trad BTC

Failure 47.2%
Success 52.8%

Extended BTC

Failure 46.9%
Success 53.1%

Trad Gold

Failure 46.5%
Success 53.5%

Extended Gold

Failure 54.5%
Success 45.5%

Trad Gold

Failure 46.9%
Success 53.1%

Extended Gold

Failure 51.1%
Success 48.9%

Figure 5.4   *Figure 5.5*

For the portfolio strategy, the test involved entering and exiting a trade based on the long and short signals over the life of the asset. When a long edge to edge presented itself, the entire portfolio

would be bet on it, and when a short edge to edge presented itself, we would short with the entire

portfolio. The results are presented in Table 1 for all assets on each setting:

Table 1

Asset	Percent Gain/Loss	Number Trades	Successful Trades
Trad Spy	344.00%	444	241 (54.3)
Ext Spy	38.77%	236	100 (42.4)
Trad USD/JPY	63.83%	210	119 (56.7)
Ext USD/JPY	51.90%	130	72 (55.4)
Trad BTC	5747.38%	206	108 (52.4)
Ext BTC	235.81%	90	38 (42.2)
Trad Gold	85.42%	169	98 (58.0)
Ext Gold	23.60%	85	40 (47.1)

Successful Trades present total success and (percent success)

The second strategy we implemented was another single trade strategy test referred to

as a 'Kijun-Bounce.' This strategy treats the price coming down to the Kijun, or base line, as a

temporary reversion to the mean. If the asset had previously been in an uptrend, comes to the

level of the kijun line, and then begins to move back up, this may be an opportunity to take a

long position. Figure 6.1 displays an example of a Kijun-Bounce.

Figure 6.1

This was tested two ways. Method one was to measure the average percent change in

the price of the underlying asset 7, 15, and 30 days after the price came down to the Kijun and

then closed above it. Next, we tested for granger causality of the event as opposed to typical

price movements measured 7, 15, and 30 days from a given price (See Results section for

causality).

Table 2 displays the average percent change of a given asset after the "Kijun Bounce"

occurred.

Table 2

Asset	7 Day Avg	15 Day Avg	30 Day Avg
Traditional SPY (n = 360)	0.04%	0.54%	1.31%
Extended SPY (n = 198)	0.10%	0.88%	1.51%
Traditional USD/JPY (n = 252)	-0.37%	-0.31%	-0.07%
Extended USD/JPY (n = 168)	-0.19%	-0.11%	-0.26%
Traditional BTC (n = 122)	1.34%	2.87%	7.86%
Extended BTC (n = 50)	-1.46%	2.09%	7.62%
Traditional Gold (n = 95)	0.16%	0.67%	0.17%
Extended Gold (n = 49)	0.04%	-0.29%	0.15%

Our third and final strategy is the 'Kumo Twist.' When the leading span A and leading

span B cross, this is called a kumo twist, or cloud twist, as the color of the cloud changes. This

signal presents a simple indication that the trend has shifted in the price of the asset, and tells

the portfolio manager to either go long or short the asset. Figure 7.1 displays a bullish kumo

twist, and Figure 7.2 displays a bearish kumo twist.

Figure 7.1   *Figure 6.2*

Here, we entered a long position as long as the cloud was bullish (Senkou Span A was over Senkou Span B), and went short the asset if the cloud was bearish (Senkou Span B was over Senkou Span A). Table 3 shows the results of such trades on each series of settings.

Table 3

Asset	Total Longs	Total Shorts	Percent Return
Trad SPY	84	83	44.44%
Ext SPY	40	39	231.59%
Trad USD/JPY	85	84	-26.54%
Ext USD/JPY	37	36	83.79%
Trad BTC	43	44	11827.28%
Ext BTC	15	14	10466.30%
Trad Gold	31	31	7.21%
Ext Gold	15	15	-20.74%

V. Results

Benchmark

To benchmark our results, the value you would have gained by simply employing a buy and hold strategy were checked for each asset. Table 4 displays those returns.

Asset	Return
SPY	1724.24%
USD (in terms of JPY)	46.94%
BTC	9010.82%
Gold	39.07%

While the focus of this paper is in comparing the traditional and extended setting Ichimoku indicator, having these numbers in mind will point to the overall performance of any given portfolio strategy as we discuss the results.

Single Trade Strategies

To measure whether the edge-to-edge trade as a single trade idea had any predictive power in success, a logit was run on the event using the following equation:

$$\ln(y) = \beta_0 + \beta_1 x$$

Where y is the probability that an entry above the leading span A (event defined as x) caused the model to then make it to the other side. Statistical significance found for a given asset on a given setting will provide information on whether this is a reasonable strategy to be employed by a trader when utilizing the Ichimoku, and which, if either, of the settings they should favor. Figure 8 shows the results of this regression

	Dependent variable: Probabilty of Success
	(1)
const	-0.010
	(0.193)
Span A Cross	-0.000
	(0.001)
Observations	16
R^2	0.004
Adjusted R^2	-0.067
Residual Std. Error	0.416 (df=14)
F Statistic	0.058 (df=1; 14)
Note:	*p<0.1; **p<0.05; ***p<0.01

Figure 8

As might have been clear from our success and failure rates reported earlier, no statistical significance exists between closing on the other side of leading span A and then the price reaching leading span B before closing back on the other side of leading span A.

To measure the effect our Kijun Bounce strategy had on predicting price movements, we plan to test for Granger causality employing a hypothesis test on the closing price of the asset 7, 15, and 30 days later with whether a Kijun bounce event had occurred. Granger Causality was tested using the statsmodels package on Python (Seabold, Skipper, and Josef Perktold 2010). Table 5 contains the p-values for the likelihood tests for each, which compares the null hypothesis of no Granger causality to the alternative of Granger causality.

*Table 5 ** Indicates a statistically significant value at the 95 Confidence Interval*

Asset	P-Value of Likelihood Test (7, 15, and 30 day lag)
Trad SPY	.33, .34, .19
Ext Spy	.48, .10, **.04****
Trad USD/JPY	**.00****, .01****, .06
Ext USD/JPY	**.00****, .08, .19
Trad BTC	.51, .09, **.05****
Ext BTC	.08, .17, .14
Trad Gold	.41, .69, **.04****
Ext Gold	.14, .51, .83

It seems the effectiveness of the Kijun Bounce strategy varies asset to asset. For the FX pair,

there is some statistical significance for Granger causality in the short run (the 7 and 15 day

marks for traditional settings, and the 7 day for the extended). Likewise, the traditional settings

appear to have some serial correlation over time for the longest period, 30 days, for BTC and

Gold, while the extended settings do with the SPY.

Portfolio Strategies

Our portfolio strategy also contained mixed results. The edge-to-edge portfolio, which

only took trades longing or shorting edge to edge trades and otherwise remaining out of the

market, favored the traditional settings, which outperformed the extended settings over the

lifetime of all 4 assets. In addition, it was able to beat the buy and hold strategy for USD/JPY

and gold. The extended settings were able to beat the buy and hold strategy for USD/JPY as

well, though it underperformed the traditional settings. Because of previous findings on the

statistical power of any given trade, it may be difficult to interpret any causality in these results.

Further inquiry into whether other indicators not explored in this paper (for example, a 'TK Cross', or Tenkan Kijun cross) might add knowledge on whether the edge-to-edge trade is more or less likely to succeed.

For the Kumo Twist strategy, which went long whenever the cloud was bullish and went short whenever the cloud was bearish, the results were mixed. The extended settings outperformed for the SPY and USD/JPY. The traditional settings outperformed for BTC and Gold. Notably, the extended settings were able to beat buy and hold for both USD/JPY and BTC, while the traditional settings were able to beat buy and hold for just BTC.

VI. Conclusion

Table 6 includes the final results for which settings out performed for a given strategy, and whether that outperformed the buy and hold strategy for total portfolio strategies

Table 6 * indicates a total portfolio strategy outperformed the benchmark of Buy and Hold

Strategy	SPY	USD/JPY	BTC	Gold
Kijun Bounce	Ext	Trad	Trad	Trad
Edge-to-Edge Portfolio	Trad	**Trad***	Trad	**Trad***
Kumo Twist Portfolio	Ext	**Ext***	**Trad***	Trad

Overall results are mixed. For the SPY and USD/JPY pair, the preferred settings appear to depend on which trade is selected. For BTC and Gold, the traditional settings of the Ichimoku indicator out performed with every trade strategy tested, including some outperformance (For

the Kumo Twist trade for BTC and for the edge to edge portfolio for Gold). Notably, the traditional settings, which were designed with equities in mind, and the extended settings, which were designed with the crypto markets in mind, did not demonstrably outperform (or in the case of cryptocurrency, out perform in any measure) for their aligned asset.

Limitations

Costs of entering and exiting positions were not taken into account when comparing the trading strategy versus the buy and hold strategy for each asset. Likewise, timelines and amount of time held varied between each type of asset, which could lead to additional noise which was not controlled for. Future comparisons would be recommended to take into account trade totals cost when calculating a likelihood of better returns. Likewise, the only time level tested was the daily, which is typically a bit noisier than higher time frames. Likely, the weekly levels would have resulted in fewer taken trades, and thus could have radically different results. Finally, while multiple asset classes were tested, only small slices of each one was tested, and results could vary widely. For example, Gold taking the place of our commodity likely trades much differently than would something like oil or wood. Specific testing would be highly recommended before anyone attempted to apply this indicator to a given asset on either settings.

Future Research

As mentioned in the limitations, inclusions and tests on a larger variety of asset and asset types may reveal strength in these settings, as would the inclusion of differing timeframes.

Likewise, many popular trading strategies of the Ichimoku indicator were excluded here to keep the research focused. Including results on these trade set ups, as well as confluence between multiple signals on when and when not to take positions, may be telling on the indicators ability to provide information that allows a trader or portfolio manager to get an edge on the market in certain situations.

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Appendix A: Data Sources

SPY Prices: https://www.kaggle.com/datasets/gkitchen/s-and-p-500-spy

FX Prices: https://www.kaggle.com/datasets/itsmecevi/forex-usdjpy-daily-tick-price-daily-update (Note: Null values from this set were filled in with information from the Chicago Board Options Exchange, and only the data from 1/3/2000 forward was used to reduce the need of this while keeping a sufficient sample)

Gold Prices: https://www.kaggle.com/datasets/kapturovalexander/gold-and-silver-prices-2013-2023

BTC Prices: https://www.kaggle.com/datasets/kapturovalexander/bitcoin-and-ethereum-prices-from-start-to-2023 (Note: Null values from this set were filled in with information from the Bitstamp Exchange prices, which was a single date, Jan 20th in 2024)