

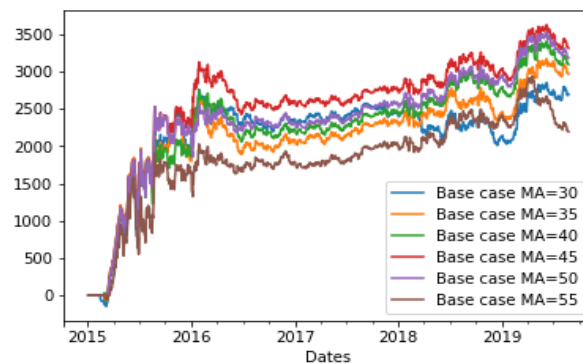
## Enhanced MA trend-following strategy on Shanghai composite index

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In this paper, we researched and analyzed how to enhance a simple trend-following stock index trading strategy subject on Chinese Shanghai composite index ranging from 2015 to 2019. The base case trend-following strategy defined as simple moving average breakthrough as signal to go long/short. Then we apply a simple filter on top of the moving average strategy with USDCNY currency and USDJPY currency. In the end, we provided statistic summary of base case strategy and enhanced strategy. Historical data on Chinese Shanghai composite index and currency values can be found in "data.xlsx".

- Base case strategy, moving average trend-following strategy
  - Based on breakthrough on MA = {30,35,40,45,50,55} as signal to go long/short. Each time trade only 1 unit of stock index with no leverage. Accumulate performance from Jan.2015 to Jun.2019. Suppose starting value (2015-01-01) is 0. \*Trading costs is not considered.

Performance result as below:



Picture 1, Base case performance plot

Base Case Statistics Summary										
Type	End Value	Maximum Drawdown	Maximum Upside Value	Performance Std.	Total Trading Days	Total Holding Period	Longest Long Period	Longest Short Period	Shortest Long Period	Shortest Short Period
MA=30	2,693	899	2,997	626	1,182	1,111	71	39	1	1
MA=35	2,963	899	3,243	648	1,177	1,116	81	40	2	1
MA=40	3,090	899	3,477	723	1,172	1,117	74	83	1	1
MA=45	3,309	899	3,677	786	1,167	1,113	73	83	1	1
MA=50	3,177	899	3,504	741	1,162	1,118	112	85	1	1
MA=55	2,189	1,032	2,899	604	1,157	1,115	110	86	1	1

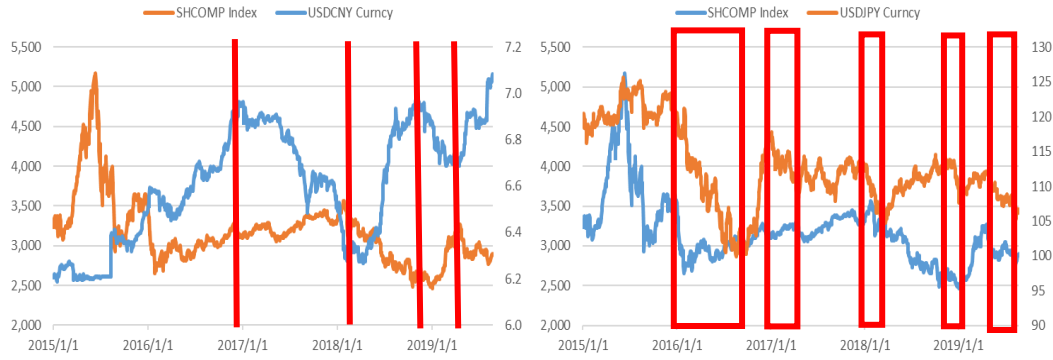
Table 1, Base case performance statistics

As shown above, based on simple moving average strategies is not bad for Shanghai composite index, the total performance is positive and the maximum drawn is much smaller than the maximum upside value. But the total holding period compared to total trading days is so large which indicates that the strategy almost holding either long or short everyday. This holding could potential generate large trading cost which is not considered here. Also large holding period means much easy to get some bad trades. In the following section, we will provide a simple way to filter some easy recognized bad trades.

- Filter selection and economic reasons

In this section we introduce filters, USDCNY currency value and USDJPY currency value, as the additional conditions for trade signal generation.

The basic idea for those two filters selected as following: As we investigate historical data, the base currency value is always positive related to its stock market index. The reason behind this comes from the international money theory: as investors seeing investment opportunity in a foreign country, money flows into that country which caused its base currency appreciated, here we measured in USD. After the money inflow, hot money seeks place to residence, and stock market which provides a good liquidity can be a good choice. As the trend continues, appreciation in stock value combined with an appreciation in base currency provide investors double returns and that complete a positive feedback loop. See below chart for USDCNY currency and Shanghai composite index side-by-side plot. The reason to include JPY currency as a short-term market sentiment measure comes from the currency in haven. When there is a market shock JPY always give a good protection as gold.



Picture 2, Shanghai Composite index and USDCNY plot

Picture 3, Shanghai Composite index and USDJPY plot

As shown in the plots, JPY currency responses to market shock by short term intense appreciation, in the red boxed area. Hence, we measure CNY currency as a long-term trend indicator say MA=40 for long/short signal. But for JPY, we would like to use a short-term trend indicator say MA=15 for shock signal. Below is the detailed enhanced trend-following strategy:

- Enhanced trend-following strategy
  - For each base case MA trend-following strategies, we use additional signal indicators as USDCNY currency and USDJPY currency, if base case shows a long signal we check CNY and JPY currency's trend, if both of them in the correct direction we go long. The same thing happens with short side. The exit condition still based on the base case exit signals.

Below are performance results comparisons for all different MA trend-following strategies:



Picture 4-9, Base case performance vs enhanced performance plots

Enhanced Strategy Statistics Summary										
Type	End Value	Maximum Drawdown	Maximum Upside Value	Performance Std.	Total Trading Days	Total Holding Period	Longest Long Period	Longest Short Period	Shortest Long Period	Shortest Short Period
MA=30	3,547	899	3,692	838	1,182	705	70	40	1	1
MA=35	3,634	899	3,798	852	1,177	774	70	41	1	1
MA=40	3,249	899	3,493	770	1,172	807	72	84	1	1
MA=45	3,304	899	3,549	785	1,167	793	70	84	1	1
MA=50	3,220	899	3,511	771	1,162	815	113	86	1	1
MA=55	2,601	786	3,219	669	1,157	847	111	86	2	1
Enhanced Strategy Statistics Changes										
Type	End Value	Maximum Drawdown	Maximum Upside Value	Performance Std.	Total Trading Days	Total Holding Period	Longest Long Period	Longest Short Period	Shortest Long Period	Shortest Short Period
MA=30	854	0	695	212	0	-406	-1	1	0	0
MA=35	671	0	555	204	0	-342	-11	1	-1	0
MA=40	159	0	16	47	0	-310	-2	1	0	0
MA=45	-5	0	-128	-1	0	-320	-3	1	0	0
MA=50	43	0	7	30	0	-303	1	1	0	0
MA=55	412	-246	320	65	0	-268	1	0	1	0

Table 2, Enhanced Strategies performance statistics

After adding additional filters, the total holding period significantly dropped about 40% from base case strategy also the total performance results improved across the board. The most significant improvement comes from the MA=30 trend-following strategy, which shows a total performance increase from 2,693 (base case) to 3,547 (enhanced), over 30% improvements! And the total holding period drops from 1111 to 705, over 30% drops!

To rule out potential data scooping issue, our selection on filters is the same, USDCNY MA=40 and USDJPY MA=15, for all these strategies. This proves us that taking CNY and JPY currency trend into consideration of Shanghai composite index trading is helpful and this is a good signal indicator.