Heikin-Ashi (Average Bar)
Its Attributes & Application to Japanese Market

Feng Han, CFA, CMT
FIL Investments (Japan)
Oct. 10th, 2014
Agenda

I. What is HA?

II. The Strengths and Weaknesses of HA

III. The Opportunities of Making HA a Stronger Tool
Japanese are Good at Designs/Creations including in the Studies of Technical Analysis

NIKKEI 225 in Candles with Ichimoku Kinkou Chart
Heikin-Ashi, A Less Known Under-researched Japanese TA Tool

**NIKKEI 225 in Candles**

**NIKKEI 225 in HA**

What is it? Should we use it? What are the pros and cons? How to use it?

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
How is Heikin-Ashi Calculated?

<table>
<thead>
<tr>
<th>Price</th>
<th>Candle</th>
<th>HA</th>
<th>HA</th>
<th>Calculation</th>
</tr>
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<tbody>
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<th>Example</th>
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<td>Price</td>
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* assuming MO (t=-1) = 0.5, MC (t=-1) = 1.5

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Heikin Ashi represents 2 distinct underlying components:

A) A time weighted average of price  
B) An embedded Trend indicator

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98.44%

Heikin-Ashi’s MO is APPROXIMATELY a time weighted average of Price OHLC over the previous six time periods.

MO \( t=0 \) \( \approx \) 6M Moving Average of Price \( t=[-1 \sim -6] \)
MC \( t=0 \) \( \approx \) Price \( t=0 \)

A hollow body \( (MC \ t=0 > MO \ t=0 ) \) is Bullish
A filled body \( (MC \ t=0 < MO \ t=0 ) \) is Bearish

Heikin-Ashi is an Embedded Trend Indicator

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Heikin-Ashi Patterns & Their Implications: Only 3 Basic Patterns

1 & 2: hollow candle & filled candle

<table>
<thead>
<tr>
<th>Pattern</th>
<th>MO vs. PH &amp; PL</th>
<th>MC vs. MO</th>
<th>Trend Implication</th>
<th>Trading Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>big hollow body</td>
<td>MO &lt;= Low Price (PL)</td>
<td>MC way above MO</td>
<td>strong uptrend</td>
<td>stay with trend</td>
</tr>
<tr>
<td>big filled body</td>
<td>MO &gt;= High Price (PH)</td>
<td>MC way below MO</td>
<td>strong downtrend</td>
<td>stay with trend</td>
</tr>
</tbody>
</table>

3: candle with shadows on both sides

<table>
<thead>
<tr>
<th>Pattern</th>
<th>MO vs. PH &amp; PL</th>
<th>MC vs. MO</th>
<th>Trend Implication</th>
<th>Trading Action</th>
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</thead>
<tbody>
<tr>
<td>hollow body with lower shadows</td>
<td>PH &gt; MO &gt; PL</td>
<td>MC still above MO, but PL below MO</td>
<td>still above ma, but uptrend gets weaker</td>
<td>watch out reversals</td>
</tr>
<tr>
<td>filled body with upper shadows</td>
<td>PH &gt; MO &gt; PL</td>
<td>MC still below MO, but PH above MO</td>
<td>still below ma, but downtrend gets weaker</td>
<td>watch out reversals</td>
</tr>
<tr>
<td>spin/doji</td>
<td>PH &gt; MO &gt; PL</td>
<td>MC very close to MO</td>
<td>price crossing over MA</td>
<td>watch out reversals</td>
</tr>
</tbody>
</table>
I. What is HA?

II. The Strengths and Weaknesses of HA

III. The Opportunities of Making HA a Stronger Tool
The Strengths of Heikin-Ashi

(1) Less is More: Trend & Reversal of Trend Become Clearer with Heikin-Ashi

Why? Color change ≈ Price Crossing over MAs
The Strength of Trend Very Obvious:
The Bigger The Body, The Stronger The Trend

Why? The bigger the body, the more powerful the move away from the moving average

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
(3) HA as A Warning Signal upon Emergence of Shadows on Both Sides

Why? Trend is getting weaker, and price is approaching the moving average
(4) HA Delta* as a Price Extremes Detector (Overbought/Oversold)

Why? HA Delta = MC – Mo, a momentum indicator similar to moving average deviations.
Performance of HA as a Trend Indicator Using Color Changes as Buy/Sell Signals

Back testing Methodology

- Cover and go long on Buy signals at next open price; close and go short on Sell signals at next open price
- Period: 20 years from 07/31/1994~07/31/2014

Good long term performance, yet interim drawdown could be significant. Why?

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
The Weaknesses of Heikin-Ashi

(1) Too Many Noises/Whipsaws, Especially during Range Markets

NIKKEI 225 in Candles

NIKKEI 225 in HA

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Why? MO $t=0 \approx 6$M Moving Average of Price $t=\{-1 \sim -6\}$
I. What is HA?

II. The Strengths and Weaknesses of HA

III. The Opportunities of Making HA a Stronger Tool

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
The Opportunities for Heikin-Ashi Combined with Other Indicators

Problems | Strategies | Action Plans | Results?
--- | --- | --- | ---

**Smooth Further (Trend)**
- [1] MC / PC 7M MA
- [2] PC / MO 3M WAV
- [3] PC / AVERAGE
- [MO 3M MA, PC 6M MA]

**Oscillators (Momentum)**
- [1] Derivative of HADelta
- [2] HADelta Divergences

**Smooth Further (Trend)**

**Oscillators (Momentum)**

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Smoothing Methodologies to Reduce Noises/Whipsaws

(1) MC / PC 7M MA

(2) PC / MO 3M WAV

(3) PC/average(MO 3MWAV, PC 6MMA)

Back testing Methodology

- Cover and go long on Buy signals at next open price; close and go short on Sell signals at next open price
- Period: 20 years from 07/31/1994~07/31/2014

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
MC vs. PC’s 7M MA

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
(2) PC vs. MO’s 3M WAV

MODEL PERFORMANCE

BUY-SELL SIGNALS

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
(3) PC vs. Average of (MO’s 3M WAV, PC’s 6M MA)

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Flaws of PC vs. Average of (MO’s 3M WAV, PC 6M MA) Model: Delays

MODEL PERFORMANCE

NIKKEI 225

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Methodologies to Reduce Delays

- Noises
  - Smooth Further (Trend)
    - [1] MC / PC 7M MA
    - [2] PC / MO 3M WAV
    - [3] PC / AVERAGE
    - [MO 3M MA, PC 6M MA]

- Delays
  - Oscillators (Momentum)
    - [1] Derivative of HADelta
    - [2] HADelta Divergences

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
(1) HADelta Divergence to Rescue at the Market Turning Points

*N Requires subjective interpretation, not included in mechanical backtesting*

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
(2) Derivative of HADelta for Earlier Buy-Sell Signals

NIKKEI 225: Monthly HA

Modified HADelta*: 2M MA vs. 3M MA

* Modified Delta = PC/3M WAV of MO

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Performance Improved at Some Turning Points and during Range Markets

Derivative of HADelta MODEL PERFORMANCE

NIKKEI 225

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
There should be benefits of combining trend and momentum
How to Combine the Trend & Momentum Signals?

- **Trending or Not**
  - ADX > 20?

- **Use Trend Indicator**
- **Use Momentum Indicator**

**Nikkei Weekly ADX as of Month End**

**BUY/SELL SIGNALS**

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Significant Performance Enhancement

1 + 1 > 2

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Positive Return Achieved during the Range Markets

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Summary

I. What is HA?

• In essence HA is a weighted average of OHLC price over the previous 6 time period
• HA by itself can be used as a trend indicator
• There are only 3 basic HA patterns: hollow candle, filled candle and candle with shadows on both sides (the smaller the body, the closer to turning point)

II. The Strengths and Weaknesses of HA?

• Less is More: Trend, trend reversal as well as warning signals all easily identifiable without using other indicators.
• Noises at range markets and lagging at the turning point are the two major weak points

III. The Opportunities of Making HA a Stronger Tool

• Both further smoothing and inclusion of a momentum indicator like HA Delta and its derivative can improve the HA performance
• Combining the two indicators can SIGNIFANTLY enhance the HA performance

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Applications of HA in Other Markets and Asset Classes

I. S&P 500

Model Performance Using HA

Buy-and-Hold Performance

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
II. GOLD

Model Performance Using HA

Buy-and-Hold Performance

Source: FIL Tokyo, Bloomberg, Dan Valcu and Sylvain Vervoort
Model Performance Using HA

Buy-and-Hold Performance

III. YEN /U$
Forecasting the Japanese Stock Market with the BPV Ratio Indicator

10th October 2014
IFTA Conference London

Masaaki Yamada
Definition of BPV Ratio

\[ BPV\ Ratio(i, N) = \frac{\pi}{2} \times \frac{N}{N-1} \times \frac{\text{BipowerVariation}(i, N)}{\text{RealizedVolatility}(i, N)} \]

\[ \text{BipowerVariation}(i, N) = |x_i x_{i-1}| + |x_{i-1} x_{i-2}| + \cdots + |x_{i-N+2} x_{i-N+1}| \]

\[ \text{RealizedVolatility}(i, N) = x_i^2 + x_{i-1}^2 + \cdots + x_{i-N+1}^2 \]

\[ x_i = \ln \left( \frac{S_i}{S_{i-1}} \right) \]

\( S_i \) is Stock Price at \( t \).
Binomial tree  \( ud=1 \)
Example BPV Ratio Calculation

\[ |x_i| = |x_{i-1}| = a \quad i = 1, 2, \ldots \]

\[
BPV Ratio(i, N) = \frac{\pi}{2} \times \frac{N}{N-1} \times \frac{a \cdot a + a \cdot a + \cdots + a \cdot a}{a^2 + a^2 + \cdots + a^2} = \frac{\pi}{2}
\]

\[
BPV Ratio(4, 5) = \frac{\pi \cdot 5}{2} \cdot \frac{3 \times 0.01 + 0.02}{4 \times 0.01 + 0.04} = \frac{\pi \cdot 5}{2} \cdot \frac{0.05}{0.08} = \frac{\pi \cdot 25}{2} = \frac{\pi}{2} \cdot 0.78125
\]
BPV Ratio Quantifies the Distance
(The Binomial Tree, Price Movement)

Newswatcher

Buy or Sell Based on the Cashflow Information
Regardless of the Price Level

Momentum Trader

Buy or Sell Based on the Price Movement
No Cashflow Information
The Period of the Position Taking is predetermined
Case    Only Newswatcher in the Market

\[ Price \]

Informational efficient price

\[ \text{Time} \]

\[ A \]

\[ B \]
The Momentum Trader Joins the Market
Market Prices and BPV Ratios

![Graph showing changes in price and BPV ratio over time with threshold H indicated.]
3614 BPV Ratios  363 entry points
(from 2000/1 to 2014/9/18)
Threshold=0.933881 median from 2000/1 to 2013/12
Correlation and Statistics

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<td>0.116</td>
<td>0.117</td>
<td>0.103</td>
</tr>
<tr>
<td>Ann Risk</td>
<td>0.080</td>
<td>0.110</td>
<td>0.134</td>
<td>0.148</td>
<td>0.165</td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>0.566</td>
<td>0.870</td>
<td>0.867</td>
<td>0.788</td>
<td>0.627</td>
</tr>
</tbody>
</table>

2001/1/1-2014/9/18

Threshold H = 0.933881 Median from 2001/1 to 2013/12
Daily Back Test to Nikkei225 2000-2014

Accumulated Logarithmic return

- Line 1
- Line 2
- Line 3
- Line 4
- Line 5
Existence or Absence of Newswatcher

[Diagram showing the existence or absence of Newswatcher over time with two lines representing different metrics (PRICE and BPV Ratio) and two threshold levels indicating when the Newswatcher is present or absent.]
Filtered BPV Ratio by Kalman Filter
Price History from 2005 to 2007

Threshold $H = 0.933366$
Median of the filtered BPV Ratio from 2001/1 to 2013/12
Price History from 2012 to 2014

Threshold $H = 0.933366$
Median of the filtered BPV Ratio from 2001/1 to 2013/12
My Forecast to Nikkei225

Rising Potential (the Gap)

Price movement to fill the Gap is “Rise in Red”

Repeat “Rise in Red” until the Gap is Eliminated.
Introduction to Cycle Analysis – Reference charts USDJPY and Topix Transportation Equipment Index (TPTRAN)
Period – Amplitude – Phase - Proportionality

![Graph showing period, amplitude, and phase](image-url)
Properties of Cycles
Repeating fluctuation of an observed variable described by a sine wave around a central value.

- **Trough** - cycle low point.
- **Peak** - cycle high point.
- **Period** - length in time units, trough to trough (x-axis).
- **Amplitude** - power / height in price units (y-axis).
- **Period / Amplitude** - proportional: the longer the cycle greater the amplitude.
- **Phase** - time elapsed since last trough OR offset between two cycles.
Velocity and Acceleration

**Velocity** - zero at peak / trough; maximum midway between

**Acceleration** - towards the centre.
Basic Principles
General theory of cycles.

- **Proportionality** – the longer the period, the greater the cycle’s power / amplitude.
- **Nominality** – a fixed family of cycles from very long to very short.
- **Harmonicity** – cycles are related to one another by a factor of two or three.
- **Synchronicity** – troughs tend to synchronise, peaks tend to be dispersed (in stocks).
- **Summation** – cycles combine by addition.
- **Commonality** – the principles apply to all freely traded financial instruments.
## Nominality

A family of cycles from very long to very short

<table>
<thead>
<tr>
<th>Calendar Days</th>
<th>Trading Days</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years</strong></td>
<td><strong>Months</strong></td>
</tr>
<tr>
<td>54</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
</tr>
<tr>
<td>9</td>
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<tr>
<td></td>
<td>54</td>
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<td></td>
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<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

56 | 14 | 7 | 55
Harmonicity

Cycles within the composite are harmonically related

Vibrating string showing 2\textsuperscript{nd}, 4\textsuperscript{th} and 8\textsuperscript{th} harmonics – different frequencies occur at integer multiples of base

Medium for cycles
Synchronicity

Synchronisation of troughs – Dispersion of peaks
**Summation I**

**Complex composite**

- Composite of 9, 18, 78, 156 day cycle components + flat underlying trend.

- Same composite + shallow underlying uptrend. Notice the components are swamped.

- Difficult to pick out the components even though known.
Summation II
Component cycles

- Component cycles: 9, 18, 78, 156 day cycles + flat underlying trend.

- Underlying trend = straightened out section of much longer cycle.
Phasing model
Goal of phasing analysis.

- Phase and average period of component cycles in composite.
- Status of each cycle: topping, bottoming, up, down, overdue
- Estimated time location of next cycle lows.
USDJPY weekly log

<table>
<thead>
<tr>
<th>Nom</th>
<th>Avg</th>
<th>Phase</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>54M</td>
<td>282W</td>
<td>152W</td>
<td>Topping</td>
</tr>
<tr>
<td>18M</td>
<td>94W</td>
<td>61W</td>
<td>Topping/Down</td>
</tr>
<tr>
<td>40W</td>
<td>40W</td>
<td>12W</td>
<td>Up</td>
</tr>
<tr>
<td>20W</td>
<td>23W</td>
<td>12W</td>
<td>Topping</td>
</tr>
</tbody>
</table>

Intermediate term:
Current 40W cycle should top mid Dec. Expect a short final counter trend push with next 20W in 1Q 2015 then
USDJPY daily log

Short term:
Look to be coming into 10W cycle low. Next leg up poss last pro trend rally (ie with rising 40W tailwind)

Charts - Updata; Data - Bloomberg
TPTRAN Index Weekly Log

Nom | Avg | Phase | Status
--- | --- | --- | ---
54M | 246W | 149W | Topping/Down
18M | 82W | 67W | Down
40W | 41W | 26W | Topping/Down
20W | 20W | 6W | Up

Intermediate term: Last push up in 20W then all cycles pointing down. TPTRAN anticipating yen.

Charts - Updata; Data - Bloomberg