Econ/Fin250a: Forecasting in Finance and Economics
Section 9: Financial Forecasting
Overview

Key concepts
Definitions/history
Moving average rules
Foreign exchange
Carry trade
High/low range forecasts
Data snooping
Present and future of Technical Analysis
Key concepts

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Present and future of Technical Analysis

Key concepts
Key concepts

- Introduce some simple techniques
- Evaluation tools
Definitions/history

Moving average rules

Foreign exchange

Carry trade

High/low range forecasts

Data snooping

Present and future of Technical Analysis
Definitions

- Financial forecasting based on price patterns
- Sometimes other information
Definitions

- Financial forecasting based on price patterns
- Sometimes other information
- **Quantitative**
  - Value investing
  - Moving average
  - Support/resistance
  - Channel rules
  - Volume indicators
Definitions

- Financial forecasting based on price patterns
- Sometimes other information

**Quantitative**
- Value investing
- Moving average
- Support/resistance
- Channel rules
- Volume indicators

**Qualitative**
- Head and shoulders
- Point and figure
- Candlestick charts
Classic value investing

- Investing based on grand ratios
- Graham/Dodd, Buffett, Shiller
- Many ratios help forecast market at relative long horizons (3-12 months)
  - CAPE, PE, Price/Div
  - Price/Book
  - Wealth/Consumption
  - Market/GDP
- We’ve used this method already (early problem sets)
History

▷ 1700’s
  ● Japan, Munehisa Homma
  ● Candelstick methods/ rice markets

▷ Early 1900’s
  ● U.S. stocks, Dow and Hamilton
  ● WSJ editors

▷ Nice books
  ● Deemer (2012)
Modern use varies across markets

- Foreign exchange (heavy)
- Commodities (heavy)
- Equity (less)
- High frequency equity (??)
- Modern directions (last 10 years)
  - More control to computer
  - Greater diversification (many markets)
Why study technical analysis

- Predictability/trading
- People use these rules
  - Are they rational?
  - Are they crazy?
- Importance of ad hoc forecasting rules
Should it work?

▷ Why should it not work

- Efficient market hypothesis
- Traders should eliminate simple patterns
Should it work?

- Why should it not work
  - Efficient market hypothesis
  - Traders should eliminate simple patterns

- Why it might work
  - Markets not efficient
  - Psychology important (behavioral finance)
  - Market efficiency complicated
    - Interaction of many strategy types
  - Private information revealed first in prices
  - Herding / importance of others
Moving average rules
Moving average rules (simplest)

\[ m_{t,L} = \frac{1}{L} \sum_{i=0}^{L-1} P_{t-i} \]  \hspace{1cm} (9.1.1)

\[ P_t \begin{cases} 
\geq m_{t,L} & \text{Buy} \\
< m_{t,L} & \text{Sell}
\end{cases} \] \hspace{1cm} (9.1.2)
Moving average rules (more complex)

Long and short moving averages:

\[
m_{t,L} = \frac{1}{L} \sum_{i=0}^{L-1} P_{t-i}
\]

(9.1.3)

\[
m_{t,S} = \frac{1}{S} \sum_{i=0}^{S-1} P_{t-i}
\]

(9.1.4)

\[
m_{t,S} \begin{cases} 
\geq m_{t,L} & \text{Buy} \\
< m_{t,L} & \text{Sell}
\end{cases}
\]

(9.1.5)
Bands \( (b) \)

Must be above or below by extra fraction, \( b \):

\[
m_{t,L} = \frac{1}{L} \sum_{i=0}^{L-1} P_{t-i}
\]

\[
m_{t,S} = \frac{1}{S} \sum_{i=0}^{S-1} P_{t-i}
\]

\[
m_{t,S} \begin{cases} 
\geq (1 + b)m_{t,L} & \text{Buy} \\
< (1 - b)m_{t,L} & \text{Sell}
\end{cases}
\]

(9.1.6)
Rule evaluation

- Statistical significance
- Zero cost strategy
- Breakeven transaction costs
- Risk
- Reminder: forecast objectives
Test 1: Buy-Sell difference

▷ Regress returns on signal
Futures like strategy:

\[ s_t \begin{cases} 1 & \text{Buy} \\ -1 & \text{Sell} \end{cases} \]  \hspace{1cm} (9.1.7)

\( s_t \) determined at time \( t \)

\[ x_{t+1} = s_t r_{t+1} \]  \hspace{1cm} (9.1.8)

\[ \bar{x} = \frac{1}{T} \sum_{t=1}^{T} x_t, \quad \sigma_x^2 = \text{var}(x_t) \]  \hspace{1cm} (9.1.9)

t-test on \( \bar{x} = 0 \)

\[ \frac{\bar{x}}{\sqrt{\sigma_x^2/T}} \]  \hspace{1cm} (9.1.10)
Annual:

\[ x_a = 250\bar{x}, \quad \sigma_{ax} = \sqrt{250}\sigma_x \]  \hspace{1cm} (9.1.11)

\[ SR = \frac{E(R) - R_f}{\sigma_R} \]  \hspace{1cm} (9.1.12)

\[ SR = \frac{x_a}{\sigma_{ax}} \]  \hspace{1cm} (9.1.13)

\[ SR = \frac{250\bar{x}}{\sqrt{250}\sigma_x} \]  \hspace{1cm} (9.1.14)
Foreign exchange
Foreign exchange strategies

- Technical trading in FX markets common
- Lots of trend following rules
- Also, carry trade strategies
- Strategies: Academic, stylized
Implementing a FX trading strategy

- Use MA rules as before
- Zero capital (cost) strategy
- Price above MA
  - Borrow in home market (U.S. dollars)
  - Purchase FX
  - Lend in foreign currency
- Price below MA
  - Borrow in foreign currency
  - Purchase U.S. dollars
  - Lend in home market
FX strategy: notation

\[ P_t = E_{t,\$/FX} \]  \hspace{1cm} (9.1.15)

\[ \frac{1}{P_t} = E_{t,FX/\$} \]  \hspace{1cm} (9.1.16)

\[ (1 + R_f) = \text{Home risk free rate (dollars)} \]  \hspace{1cm} (9.1.17)

\[ (1 + R_f^*) = \text{Foreign risk free rate} \]  \hspace{1cm} (9.1.18)
Long strategy (zero cost)

- Borrow \( \frac{1}{1 + R_f} \) in dollars
- Convert to \( \frac{(1/P_t)}{(1+R_f)} \) in FX
- Now receive \( \frac{(1/P_t)}{(1+R_f)}(1 + R^*_f) \) at \( t + 1 \) in FX
- Back to \( \frac{(P_{t+1}/P_t)}{(1+R_f)}(1 + R^*_f) \) at \( t + 1 \) in dollars
- Pay back borrowed dollars, $1

\[
\frac{P_{t+1}}{P_t} \frac{(1 + R^*_f)}{(1 + R_f)} - 1 
\]  
(9.1.19)
Short strategy (zero cost)

- Borrow $\frac{1/P_t}{(1+R_f)}$ in FX
- Convert to $\frac{1}{(1+R_f)}$ in dollars
- After time receive $\frac{(1+R_f)}{(1+R_f)} = 1$ in dollars
- Pay back $\frac{P_{t+1}}{P_t} \frac{(1+R_f^*)}{(1+R_f)}$ in dollar units

$$1 - \frac{P_{t+1}}{P_t} \frac{(1 + R_f^*)}{(1 + R_f)}$$ (9.1.20)
Two facts about logs and returns

$$
\log(P_{t+1}) - \log(P_t) = \log\left(1 + \frac{P_{t+1} - P_t}{P_t}\right) = \log(1 + R_{t+1}) = r_{t+1}
$$
(9.1.21)

$$
\log(P_t) - \log(P_{t+1}) = -\log\left(1 + \frac{P_{t+1} - P_t}{P_t}\right) = -\log(1 + R_{t+1}) = -r_{t+1}
$$
(9.1.22)
The final Long and Short log returns

\[ R_{t+1,L} = \frac{P_{t+1} (1 + R^*_f)}{P_t (1 + R_f)} - 1 \]

\[ r_{t+1,L} = \log(P_{t+1}) - \log(P_t) + \log(1 + R^*_f) - \log(1 + R_f) \]  
(9.1.23)

\[ R_{t+1,S} = 1 - \frac{P_{t+1} (1 + R^*_f)}{P_t (1 + R_f)} \]

\[ -r_{t+1,S} = \log(P_{t+1}) - \log(P_t) + \log(1 + R^*_f) - \log(1 + R_f) \]

\[ r_{t+1,S} = \log(P_t) - \log(P_{t+1}) - \log(1 + R^*_f) + \log(1 + R_f) \]  
(9.1.24)
Dynamic FX Strategy

\[
  s_t \begin{cases} 
    1 & \text{Buy} \\
    -1 & \text{Sell} 
  \end{cases} \quad (9.1.25)
\]

\(s_t\) determined at time \(t\)

\[x_{t+1} = s_t r_{t+1, L}\]  
(9.1.26)

\[
\bar{x} = \frac{1}{T} \sum_{t=1}^{T} x_t, \quad \sigma_x^2 = \text{var}(x_t) \quad (9.1.27)
\]

t-test and Sharpe ratio \(T_a = \text{periods per year}\)

\[
\frac{\bar{x}}{\sqrt{\sigma_x^2/T}}, \quad SR = \frac{T_a \bar{x}}{\sqrt{T_a \sigma_x}} \quad (9.1.28)
\]
Japanese Yen Example

- Stata: jytech.do, loadJP.do
- All data from FRED
- Data frequency: weekly (see loadJP.do)
  - 30 week moving average
  - 52 weeks per year
- Interest rates are 1 month Libor (again FRED)
Carry trade
Uncovered interest parity

\[ R_{t+1,L} = P_{t+1}(1 + R^*_f) \frac{1}{P_t} \left( \frac{1}{1 + R_f} \right) - 1 \]

\[ R_{t+1,L} = \frac{P_{t+1} (1 + R^*_f)}{P_t} \frac{1}{1 + R_f} - 1 \]

\[ r_{t+1,L} = \log(P_{t+1}) - \log(P_t) + \log(1 + R^*_f) - \log(1 + R_f) \]

This should not be predictable at time \( t \).
However, it often is. Key puzzle in international finance.
Basic carry trade strategy

- Long, high (relative to home) interest currencies.
- Short (borrow), low (relative to home) currencies.
- $R^*_f - R_f$ determines strategy position.
- See jytech.do again
FX summary

- Significant trends, very low frequency
- Some trends have become less strong
- Interesting results
- Key implementation issues
  - Actual strategy implementations
  - Diversify across many currencies
High/low range forecasts
There are many other technical rules

Many use other interesting series

- High/Low ranges
- Trading volume
- Market sentiment
- Open interest

See references at end of notes

Just look at High/low info quickly
High/Low range indicator

\[(P_{t,H}, P_{t,L}, P_{t,O}, P_{t,C}) = \text{High, Low, Open, Close} \quad (9.1.29)\]

\[I_t = \frac{P_{C,t} - P_{L,t}}{P_{H,t} - P_{L,t}} \quad (9.1.30)\]

\[R_{t+1} = \frac{P_{C,t+1} - P_{C,t}}{P_{C,t}} \quad (9.1.31)\]

\[R_{t+1} = \frac{P_{C,t+1} - P_{O,t+1}}{P_{O,t+1}} \quad (9.1.32)\]

- Forecast future returns
- Just simple initial diagnostic (OLS), then simple rule, \(I_t > 0.5\)
- This is not quite doable, why?
High/Low range indicator

- Stata: hlmsft.do, loadMSFT.do
- Data: yahoo finance and special tool, type `help fetchyahooquotes`
Data snooping
Data snooping

- Bias from looking at many rules
- Thinking only about the best rule
- This is very similar to in sample bias issues
- More difficult to test/adjust for
Present and future of Technical Analysis
Technology directions

- Fancy nonlinear/machine learning methods (this has been going for a long time)
- Diversified strategies
- High frequency trading
- Text information
- Social media
- Wide data techniques (many predictors)
- Quant versus technical trading??
Data directions/warnings

- Some rules are diminishing in usefulness
- Seem to be moving to higher frequencies
- No agreed on reason
Technical rule checklist

1. Basic statistical tests
2. Simple rule tests $s_t r_{t+1}$
3. Add more realism (t-costs, measure risk)
4. Fully implemented strategies
5. Simulate strategies
6. Snooping adjustments
Recent surveys


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