Are You Trading Mean Reversion or Oscillation?

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Don’t think *mean reverting*. Think *oscillating*.

- Traders like to say markets are “mean reverting.”
- Markets alternate between mean *diverting* and mean *reverting*.
- *Oscillating* markets create trading opportunities.
This is what mean reversion looks like.

\[ dX_t = \theta (\mu - X_t) dt + \sigma dW_t \]

Image courtesy of Wikipedia: https://en.wikipedia.org/wiki/Ornstein%E2%80%93Uhlenbeck_process
Does the ADF identify **tradable** markets?

- Augmented Dickey-Fuller test (ADF) is a common test for mean reversion.
- Tests for O-U process on previous slide.
- If market oscillates, repeated mean diversion forces conclusion that market is not mean reverting.
- Confuses traders (mistakenly) searching for mean reversion.
- *Not* a test for trading opportunities. Beware.
Can we create a statistical test for oscillation?

- Need a test for oscillation to replace *role* of ADF.
- Statistical definition and test for “oscillation” is tricky.
- Complicated by stochastic frequency and stochastic amplitude of real markets.
- Still looking.
- Peter Carl suggests econometric tests for leading indicators.
In the meantime, we can identify possible oscillations based on phase relationships.

- Regression of forward change on smoothed level and smoothed slope.
  \[ Fwd \Delta y_t = \beta_0 + \beta_1 \times level_t + \beta_2 \times slope_t + \epsilon_t \]
- Require \( \beta_1 < 0 \), indicating reversal in the future
- Require \( \beta_2 > 0 \), indicating reversal after peak/valley
- If requirements met, use \( R^2 \) to rank candidates.
We can search 100+ fundamental factors of 10,000’s of stocks, looking for cyclicity.

Coefficients:

|         | Estimate | Std. Error | t value | Pr(>|t|)    |
|---------|----------|------------|---------|------------|
| (Intercept) | 0.25159  | 0.04034    | 6.237   | 2.49e-09 ***|
| Level    | -0.43789 | 0.05973    | -7.331  | 5.11e-12 ***|
| Slope    | 1.61671  | 0.34769    | 4.650   | 5.93e-06 ***|

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Multiple R-squared:  0.2841, Adjusted R-squared:  0.2771

- 3-period MA to erase “micro oscillations” in the noise
- State-space model to extract smooth level and slope (shown)
- Perform regression
- Filter for
  - $\beta_1 < 0$
  - $\beta_2 > 0$
- Rank by $R^2$
Summary

• Get it right: You’re trading oscillation, not mean reversion.
• Don’t expect the ADF to identify trading opportunities.
• Still looking for a good statistical test to replace ADF.
• The level-slope regression test can rank possibilities, but human judgement is ultimately required.

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