Class 1: Predicting Stock Market Returns and Market Efficiency

Jun Pan

Shanghai Advanced Institute of Finance (SAIF)
Shanghai Jiao Tong University

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The market risk remains the most important and pervasive:
- Quant investing: market neutral, its alpha comes not from the market risk.
- Market timing: the consistent ability to get in at bottom, and out at peak.

What are the evidences?
- How good are investors at predicting the market?
- How do professional investors view market timing?
- Predictors related to business conditions: default spread, term premium, and financial ratios (dividend/price ratio).

Market efficiency:
- Price discovery and information.
- The force of arbitrage.
- The limits to arbitrage.
Realized vs. Expected Returns

Realized vs. Expected in an i.i.d. Model

- $R_t$: annual realized returns (%)
- $\mu$: annual expected returns (%)

Time Period: 1930-2010
Some Pick the Stock, Others Choose the Moment

Interpret the data as confirming his 80/20 rule: 80% of times fail over any reasonable period of time. He adds that the performance numbers got a boost from a bear market in the early 2000s. “Bear markets make market timers look genius because they have some money in cash,” says Mueller. Most mutual funds, for instance, stay nearly fully invested in stocks, so take a hit during bear markets.
Views on Market Timing

Excerpts from “Pioneering Portfolio Management” by David Swensen

- Careful investors consciously construct portfolios to reflect the expected contribution of each portfolio management tool.
- Market timing, according to Charles Ellis, represents a losing strategy: “There is no evidence of any large institutions having anything like consistent ability to get in when the market is low and get out when the market is high. Attempts to switch between stocks and bonds, or between stocks and cash, in anticipation of market moves have been unsuccessful much more often than they have been successful.”
- “Serious investors avoid timing markets.”
How Good are Professional Investors at Predicting the Market?

Table 5-3

Investor Confidence and Dow Price Returns, Sentiment = Bull/(Bull + Bear)

BULL and BEAR from Investors Intelligence Inc., New Rochelle, NY

<table>
<thead>
<tr>
<th>Sentiment</th>
<th>Frequency</th>
<th>Three Month</th>
<th>Six Month</th>
<th>Nine Month</th>
<th>Twelve Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 - 0.3</td>
<td>1.55%</td>
<td>16.52%</td>
<td>15.40%</td>
<td>22.79%</td>
<td>20.74%</td>
</tr>
<tr>
<td>0.3 - 0.4</td>
<td>11.30%</td>
<td>12.23%</td>
<td>13.87%</td>
<td>16.54%</td>
<td>15.81%</td>
</tr>
<tr>
<td>0.4 - 0.5</td>
<td>19.35%</td>
<td>16.85%</td>
<td>13.63%</td>
<td>12.07%</td>
<td>12.73%</td>
</tr>
<tr>
<td>0.5 - 0.6</td>
<td>27.90%</td>
<td>15.16%</td>
<td>14.06%</td>
<td>10.44%</td>
<td>8.82%</td>
</tr>
<tr>
<td>0.6 - 0.7</td>
<td>19.14%</td>
<td>14.03%</td>
<td>8.79%</td>
<td>8.71%</td>
<td>7.27%</td>
</tr>
<tr>
<td>0.7 - 0.8</td>
<td>14.76%</td>
<td>11.21%</td>
<td>7.24%</td>
<td>7.38%</td>
<td>7.01%</td>
</tr>
<tr>
<td>0.8 - 0.9</td>
<td>5.23%</td>
<td>-0.39%</td>
<td>0.23%</td>
<td>-3.32%</td>
<td>-1.79%</td>
</tr>
<tr>
<td>0.9 - 1.0</td>
<td>0.78%</td>
<td>0.35%</td>
<td>-3.87%</td>
<td>-9.17%</td>
<td>-10.18%</td>
</tr>
<tr>
<td>Overall</td>
<td>100.00%</td>
<td>13.46%</td>
<td>11.11%</td>
<td>9.99%</td>
<td>9.31%</td>
</tr>
</tbody>
</table>

Source: “Stocks for the Long Run” by Jeremy Siegel
Investor Expectations and Past Stock Returns

Investor Expectations and Equity Mutual Fund Flows

Source: "Expectations of Returns and Expected Returns" by Greenwood and Shleifer (2012)
Let $I_t$ be a candidate predictor, observable at time $t$:

$$R_{t+1} = a + b I_t + \epsilon_{t+1},$$

where $\epsilon_{t+1}$ is the *unpredictable* component of the stock return.

If $b$ is statistically significant, then we have a potentially useful predictor.

The best way to gauge the usefulness of a predictor is through the R-squared of the regression:

$$R^2 = \frac{\text{var}(b I_t)}{\text{var}(R_{t+1})}; \quad 1 - R^2 = \frac{\text{var}(\epsilon_{t+1})}{\text{var}(R_{t+1})}$$

Much effort has been spent on finding good predictors. Let’s take a look at some of them.
Can Past Returns Predict Future Returns?

\[ R_{t+1} = a + \rho R_t + \epsilon_{t+1} \]

<table>
<thead>
<tr>
<th></th>
<th>rho (%)</th>
<th>t-stat</th>
<th>R-sqr (%)</th>
<th>sample period</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P 500</td>
<td>11.3</td>
<td>2.28</td>
<td>1.27</td>
<td>1926-1960</td>
</tr>
<tr>
<td>CRSP Value Weight</td>
<td>12.1</td>
<td>2.46</td>
<td>1.47</td>
<td>1926-1960</td>
</tr>
<tr>
<td>CRSP Equal Weight</td>
<td>15.7</td>
<td>3.20</td>
<td>2.46</td>
<td>1926-1960</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>3.9</td>
<td>1.01</td>
<td>0.15</td>
<td>1960-2015</td>
</tr>
<tr>
<td>CRSP Value Weight</td>
<td>3.9</td>
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<td>0.15</td>
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</tr>
</tbody>
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- Rho (\(\rho\)) measures the *auto-correlation* in the monthly stock returns.
- In Econometrics, this model is called AR(1), with AR for auto-regressive.
- The average rho for individual stocks is *negative* but insignificant.
Predictive Returns at Daily Frequency

\[ R_{t+1} = a + \rho R_t + \epsilon_{t+1} \]

<table>
<thead>
<tr>
<th></th>
<th>rho (%)</th>
<th>t-stat</th>
<th>R-sqr (%)</th>
<th>sample period</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P 500</td>
<td>2.0</td>
<td>2.28</td>
<td>0.04</td>
<td>1962-2015</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>-3.3</td>
<td>-3.02</td>
<td>0.11</td>
<td>1982-2015</td>
</tr>
<tr>
<td>S&amp;P 500</td>
<td>-7.7</td>
<td>-4.93</td>
<td>0.60</td>
<td>2000-2015</td>
</tr>
<tr>
<td>Yen/Dollar</td>
<td>0.5</td>
<td>0.35</td>
<td>0.0022</td>
<td>1995-2016</td>
</tr>
<tr>
<td>Yen/Dollar</td>
<td>0.3</td>
<td>0.30</td>
<td>0.0010</td>
<td>1980-2016</td>
</tr>
<tr>
<td>Yen/Dollar</td>
<td>0.3</td>
<td>0.28</td>
<td>0.0007</td>
<td>1970-2016</td>
</tr>
</tbody>
</table>
Time-Varying Expected Returns

- Only in an i.i.d. world does predictability mean market inefficiency.
- Otherwise, having a predictive component in market returns does not necessarily mean that markets are inefficient.
- The predictive component could be interpreted as time-varying expected returns:

\[ \mu_t = E_t(R_{t+1}) = a + b I_t \]

- For example, time-varying business conditions or time-varying risk appetite could both be a cause for time-varying expected returns.
- Over longer horizons (e.g., business cycles), there is a closer connection between market returns and macroeconomic conditions.
NBER Dated Recessions (shaded areas)
Predictors Related to Business Conditions

- **Default Spreads:** differences in yields between defaultable bonds and treasury bonds with similar maturities. When the business condition is bad, the systematic default risk increases, widening the default spread.

- **Term Premiums:** differences in yields between long- and short-term treasury bonds. This is a forward-looking variable predictive of future inflation, and is found to be important in forecasting real economic activity.

- **Financial Ratios:** dividend-price ratio. Variables that are important in fundamental valuation. Could be proxies for systematic risks that are higher when times are poor, and lower when times are good.
Stock Return and Dividend-Price Ratio

The graph shows the relationship between dividend yield and stock return over time. The dividend yield is depicted in blue and the stock return in red. The x-axis represents years from 1920 to 2010, while the y-axes show dividend yield and stock return in percentage terms.
Use Dividend-Price Ratio to Predict Stock Returns

\[ R_{t+1} = a + b \left( \frac{D}{P} \right)_t + \epsilon_{t+1} \]

- **\( R_t \):** annual stock return realized in year \( t \).
- **\( (D/P)_t \):** dividend-price ratio realized in year \( t \).

<table>
<thead>
<tr>
<th>1927-2008</th>
<th>a</th>
<th>b</th>
</tr>
</thead>
<tbody>
<tr>
<td>estimate</td>
<td>-0.02</td>
<td>3.22</td>
</tr>
<tr>
<td>standard error</td>
<td>0.06</td>
<td>1.34</td>
</tr>
<tr>
<td>t-stat</td>
<td>-0.36</td>
<td>2.40</td>
</tr>
</tbody>
</table>

- **The R-squared of the regression:** 6.63%.
- **The sample standard deviation of \( D/P \):** 1.68%.
Realized vs. Expected Returns

![Graph showing realized vs. expected stock market returns over time](image)

- **Realized Stock Return**
- **Predicted Stock Returns**
- **i.i.d. Model**

**Chart Details:**
- **X-axis:** Time period (1920-2010)
- **Y-axis:** Realized returns

**Legend:**
- Red crosses: Realized Stock Return
- Blue circles: Predicted Stock Returns
- Green dots: i.i.d. Model
Market Efficiency

- Follow the information:
  - Orange juice and the weather in Orlando, Florida.
  - Speed of price discovery and the value of millisecond.

- The force of arbitrage and traditional convergence trades:
  - Equity: index futures and the cash market.
  - Fixed Income: old and new bonds on the Treasury yield curve.
  - FX: covered interest-rate parity.

- Limits to arbitrage.
  - Limited balance sheet capacity and access to funding.
  - Losing money on arbitrage.