Discussion of "No-Arbitrage Taylor Rules" by Ang, Dong and Piazzesi

Thomas Philippon
NYU

March 2005
Outline

- Technical comments

- What are affine models of the term structure?

- What can we learn from these models?
Technical comments

• Homoskedastic interest rate shocks?

• More lags could be useful

• Pricing errors should be for prices, not yields

• GDP growth not ideal for Taylor rule. Gap, or help wanted index would be better
What are affine models?

- No-Arbitrage $\rightarrow$ there exist an $m$ that prices all assets
  - but (almost) no restrictions on what $m$ should be

- Theory adds content only by restricting what $m$ is

$$m_{t+1} = \exp \left( -r_t - \frac{\lambda'_t \lambda_t}{2} - \lambda'_t \varepsilon_{t+1} \right)$$

$$\lambda_t = \lambda_0 + \lambda_1 X_t$$

- Pricing equation

$$P^n_t = E_t \left[ m_{t+1} P^{n-1}_{t+1} \right]$$
• Yields are affine

\[ r^*_t \equiv -\frac{\log (P^n_t)}{n} = \frac{A_n}{n} + \frac{B'_n}{n} Y_t \]

• \( A_n \) and \( B_n \) are restricted by No-Arbitrage

\[ B'_n = \delta' + B'_{n-1} (\Phi - \Sigma \lambda_1) , \]

\[ A_n = \delta_0 + A_{n-1} - B'_{n-1} \lambda_0 - \frac{B'_{n-1} \Sigma \Sigma' B_{n-1}}{2} . \]

• Compare to unrestricted OLS: cross-equation restrictions
<table>
<thead>
<tr>
<th>Variable</th>
<th>ir1</th>
<th>ir5</th>
<th>ir10</th>
<th>ir10</th>
<th>xr5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fed Fund Rate</td>
<td>0.883</td>
<td>0.782</td>
<td>0.648</td>
<td>0.642</td>
<td>0.495</td>
</tr>
<tr>
<td></td>
<td>36.85</td>
<td>24.93</td>
<td>19.61</td>
<td>22.67</td>
<td>2.75</td>
</tr>
<tr>
<td>Output Gap</td>
<td>-0.062</td>
<td>-0.262</td>
<td>-0.33</td>
<td>-0.113</td>
<td>-0.608</td>
</tr>
<tr>
<td></td>
<td>-2.89</td>
<td>-9.28</td>
<td>-10.98</td>
<td>-2.96</td>
<td>-3.79</td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.014</td>
<td>-0.076</td>
<td>-0.058</td>
<td>-0.032</td>
<td>-0.991</td>
</tr>
<tr>
<td></td>
<td>-0.42</td>
<td>-1.75</td>
<td>-1.32</td>
<td>-0.85</td>
<td>-4.02</td>
</tr>
<tr>
<td>Deficit/GDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.343</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.78</td>
</tr>
<tr>
<td>N</td>
<td>198</td>
<td>198</td>
<td>168</td>
<td>168</td>
<td>194</td>
</tr>
<tr>
<td>r2</td>
<td>0.934</td>
<td>0.869</td>
<td>0.842</td>
<td>0.885</td>
<td>0.119</td>
</tr>
</tbody>
</table>
• Holding returns are also affine

\[ x_{t \rightarrow t+\tau}^n \equiv \log \left( \frac{P_{t+\tau}^{n-\tau}}{P_t^n} \right) - \log \left( P_t^n \right) - \tau r_t \]

• State space should predict variations of expected excess returns over time

\[ E_t \left[ x_{t \rightarrow t+\tau}^n \right] = A_n - A_{n-\tau} - A_{\tau} + \left( B_n' - B_{n-\tau}' \Phi^{\tau} - B_{\tau}' \right) Y_t \]
Annual Excess Returns on 5-year Bonds

Figure 1:
<table>
<thead>
<tr>
<th>Variable</th>
<th>ir1</th>
<th>ir5</th>
<th>ir10</th>
<th>ir10</th>
<th>xr5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fed Fund Rate</td>
<td>0.883</td>
<td>0.782</td>
<td>0.648</td>
<td>0.642</td>
<td>0.495</td>
</tr>
<tr>
<td></td>
<td>36.85</td>
<td>24.93</td>
<td>19.61</td>
<td>22.67</td>
<td>2.75</td>
</tr>
<tr>
<td>Output Gap</td>
<td>-0.062</td>
<td>-0.262</td>
<td>-0.33</td>
<td>-0.113</td>
<td>-0.608</td>
</tr>
<tr>
<td></td>
<td>-2.89</td>
<td>-9.28</td>
<td>-10.98</td>
<td>-2.96</td>
<td>-3.79</td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.014</td>
<td>-0.076</td>
<td>-0.058</td>
<td>-0.032</td>
<td>-0.991</td>
</tr>
<tr>
<td></td>
<td>-0.42</td>
<td>-1.75</td>
<td>-1.32</td>
<td>-0.85</td>
<td>-4.02</td>
</tr>
<tr>
<td>Deficit/GDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.343</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.78</td>
</tr>
<tr>
<td>N</td>
<td>198</td>
<td>198</td>
<td>168</td>
<td>168</td>
<td>194</td>
</tr>
<tr>
<td>r2</td>
<td>0.934</td>
<td>0.869</td>
<td>0.842</td>
<td>0.885</td>
<td>0.119</td>
</tr>
</tbody>
</table>
In this paper

- Do affine restrictions help us identify Taylor rule / monetary shocks?

- Before reading the paper, I thought there were 2 possible scenarios
  - good case scenario
  - bad case scenario
Good case scenario

- NA will help us estimate forward Taylor rule and get rid of the price puzzle

\[
\begin{align*}
\pi_t &= \pi_{t-1} - \beta r_t + u_t + v_t \\
r_t &= \alpha E_t^C [\pi_{t+1}] + \gamma g_t + \varepsilon_t
\end{align*}
\]

and

\[
E_t^C [v_{t+1}] = v_{t+1}
\]

this creates bias and price puzzle when

- \(\beta\) is small

- \(\sigma_v >> \sigma_\varepsilon\)
• Can the yield curve help?
  
  – yes if and only if the term structure contains information about future inflation not captured by lagged macro variables

$$E_t^{yields} [v_{t+1}] \approx E_t^{CB} [v_{t+1}]$$

• Direct test: construct predicted inflation and estimate forward looking rule. Are \( \hat{\varepsilon}_t \) more or less correlated with Romer-Romer shocks if one uses yields in forecasting? Do yields help reduce the price puzzle?

  – Unfortunately, no

  – Consistent with the results of this paper
Bad case scenario

- Remove genuine policy shocks because of "measurement errors" or remove anticipated policy shocks

- Shocks from NA Taylor rule are much smaller that the RR shocks

Tentative conclusion. NA seems unlikely to help us identify monetary policy shocks better, especially compared to Romer-Romer approach (also conclusion reached by the authors)
What can we learn from affine models?

- Failure of good case scenario could just mean that Fed knows more than the private sector
  - But we can still use term structure to back out private sector expectations
  - Alternative to using forecast data
  - Estimate learning models, commitment, etc..
  - Practical question of how reliable risk premia estimates are
• We can use these models to test economic theories
  
  – What drives risk premia, what are the links between treasury and corporate bonds?

  – Welfare costs of bad monetary policy could be high risk premia on long bonds

  – Recent episode: long rates at 4.25%. Interpretation? Look at Forward Rate. Low risk premia or low expectation of future short rates?

  – Banks made a lot of money on carry-trades in past 2 years.
4-Year ahead Forward Rate

Year


f4  Inflation
Conclusion

- Information in bond yields can help us test economic theories
  - This paper provides many useful tools and results

- Not entirely clear to me they will help us estimate monetary policy shocks