The Predictive Power of the Yield Curve across Countries and Time

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The Yield Curve, Cross-Country

Source: *Economist*, various Issues.
Outline

- Theory
- Selective Literature Review
- Data
- As a predictor of growth
- As a predictor of recession
- Conclusion
Motivation

United States

Yield Spreads

Percentage Points

Updated and extended Figure 1. Data through April 2013
Selected European Countries

Historical Recessions and Yield Spread for France

Yield curve defined as 10-year Government bond minus 3-month Government note.

Historical Recessions and Yield Spread for Italy

Yield curve defined as 10-year Government bond minus 3-month Government note.

Historical Recessions and Yield Spread for Germany

Yield curve defined as 10-year Government bond minus 3-month Government note.

Historical Recessions and Yield Spread for United Kingdom

Yield curve defined as 10-year Government bond minus 3-month Government note.
Term structure

- Linkages between long and short-term rates
  - Expectations Hypothesis of the Term Structure
    - Long term yield is the average of the one period interest rates expected over life of long term bond.
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    - Allows for supply and demand conditions to differ across bond maturity.
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i^n_t = \left( i_t + i_{t+1} + \cdots + i_{t+n-1} \right) + l^n_t
\]
Inversion

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  - Monetary policy
  - Decreased credit demand
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- Suppose \( l^n_t \geq l^1_t \), when would we observe and inverted yield spread?
- Short-term rates tend to be lower during slow economic growth
  - Monetary policy
  - Decreased credit demand
- Investors expect future slow growth \( \Rightarrow \) Expected future short term rates decline \( \Rightarrow \) Current long term rates drop relative to short term rates.
Selected Literature

- U.S. yield curve signaling recession: late 1980s
  Harvey (1988, 1989), Stock and Watson (1989), Estrella and Hardouvelis (1991) ...
  - Literature expands outside the U.S.
  Harvey (1991), Davis and Henry (1994), Estrella and Mishkin (1997), Bonser-Neal and Morley (1997) ...
- Measures of Economic Growth
  - GDP
  - IP
  - Unemployment
Selected Literature

- Varying model specifications
  - Bi-variate
  - Multi-variate (disagreement over value of adding liquidity premium proxy)

Major takeaway from existing literature

- Spread contains significant in-sample explanatory power.
- Out-of-sample forecasting power is less convincing
- The relationship begins to deteriorate after 1985
Our Contribution

- Has the **deterioration continued** since 1985 continued?
  - Great Moderation
  - Great Recession

- Impact of the Euro on financial linkages since late 1990s?

- The effect of hitting the zero lower bound in policy rates: Japan, US.... followed by Euro Zone, UK...
Data

Country Selection Criteria

- Adequately represent the Euro Area
- Provide basis of comparison
- Liquid financial markets
- Large sample size
  - Great Moderation
  - Great Recession
  - Maximize number of observations
Data

Data set includes

- Canada
- France
- Germany
- Italy
- Japan
- The Netherlands
- Sweden
- The United Kingdom
- The United States
- Aggregate Euro Area (1990- )

- 10 year - 3 month
- IP vs GDP
- Recession Dates (NBER, ECRI)
- Data from 1970-2009 (some updates), split sample at 1997/1998
We begin with a simple bi-variate specification

\[ IPGrowth_{t,k} = \alpha + \beta \cdot \text{Spread}_t + \epsilon_{t+k} \]

\[ \text{Spread}_t \equiv i_t^{10\text{yr}} - i_t^{3\text{mo}} \]

- Growth over period \( t + k \) (monthly frequency)
- \( k = 12, \ k = 24 \)
OLS Results: 1 Year vs 2 Year Growth Horizon

Yield Spread Regression Coefficients

Predicted Annualized Growth

-0.5 0 0.5 1 1.5 2 2.5

Canada  France  Germany  Italy  Japan  Netherlands  Sweden  UK  US

12-month  24-month
As a Predictor of Growth

OLS Results: 1 Year vs 2 Year Growth Horizon

Goodness of Fit: R-squared

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Predictive Power of the Yield Curve
OLS Results: Early vs Late Sample

Yield Spread Regression Coefficients

Early vs Late Sample

Predicted Annual Growth

Canadian, France, Germany, Italy, Japan, Netherlands, Sweden, UK, US

As a Predictor of Growth

OLS Results: Early vs Late Sample

Goodness of Fit: R-squared

Canada
France
Germany
Italy
Japan
Netherlands
Sweden
UK
US

1970-1997
1998-2013

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Predictive Power of the Yield Curve
Out-of-Sample

- Data seem to fit the model fairly well: 1 year, full sample.
- Recursive regression approach to test forecasting ability
  - Same bivariate model specification (12-month IP growth)
  - First regression restricts sample to data available at 1979m12 to predict IP growth for 1980m1-1980m12
  - Next regression includes data from 1980m1 to predict 1980m2-1981m1, etc...
  - Compare against AR1 model (RMSE)
Rolling Out of Sample Results

Out of sample prediction vs actual: fr

Out of sample prediction vs actual: ge

Out of sample prediction vs actual: it

Out of sample prediction vs actual: sd
Rolling Out of Sample Results

Out of sample prediction vs actual: ca

Out of sample prediction vs actual: ja

Out of sample prediction vs actual: uk

Out of sample prediction vs actual: us
Out of Sample Forecasting: Comparison to AR1

Table 1: Historical Ex Post Simulation: RMSE

<table>
<thead>
<tr>
<th>Country</th>
<th>AR1</th>
<th>Spread</th>
<th>Spread (no cons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>5.413</td>
<td>5.025</td>
<td>4.933</td>
</tr>
<tr>
<td>France</td>
<td>4.120</td>
<td>4.725</td>
<td>4.495</td>
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<tr>
<td>Germany</td>
<td>5.059</td>
<td>4.636</td>
<td>4.538</td>
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<td>Italy</td>
<td>5.448</td>
<td>6.288</td>
<td>5.702</td>
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<tr>
<td>Japan</td>
<td>7.159</td>
<td>8.159</td>
<td>7.535</td>
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<tr>
<td>Netherlands</td>
<td>4.327</td>
<td>4.498</td>
<td>4.465</td>
</tr>
<tr>
<td>Sweden</td>
<td>6.917</td>
<td>7.119</td>
<td>7.042</td>
</tr>
<tr>
<td>UK</td>
<td>3.676</td>
<td>3.688</td>
<td>3.531</td>
</tr>
<tr>
<td>US</td>
<td>4.327</td>
<td>4.568</td>
<td>4.208</td>
</tr>
</tbody>
</table>
Time Varying Parameter Estimates

- Recursive regressions tend to stabilize as the sample size grows.
- Rolling window regressions allow us to observe changes in the relationship over time.
  - Same bivariate specification
  - First regression restricts sample to 1980m1 - 1979m12
  - Next regression 1970m2 -1980m1, etc...
Time Varying Parameter Estimates

What are we looking for? Relative deterioration in

- Euro Area Countries
  - Euro Monetary Union Effect
- U.S. or U.S. +
  - Global Savings Glut
- Japan, followed by US and UK
  - Zero lower bound, Quantitative easing.
As a Predictor of Growth

Time Varying Parameter Estimates

Rolling Regression Parameter Estimates
Select Euro Area Countries

France

Germany

Italy

Sweden

Select Euro Area Countries
Rolling Regression Parameter Estimates
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As a Predictor of Growth

Time Varying Parameter Estimates

Rolling Regression Parameter Estimates
Select Non-Euro Area Countries

Canada

Japan

United Kingdom

United States

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Predictive Power of the Yield Curve
In-sample results: yield spread has significant predictive power when forecasting IP growth over a one-year time horizon.

Predictive power for one-year growth dipped in the 1990s and 2000s.

Significant rebound in the late 2000s and 2010s.

Out of sample forecasting less convincing: only Canada and Germany did yield spread outperform AR1 (UK and US).

No simple story.

- Clearly possesses some forecasting power
- Perhaps strongest through the recent recession
- Weak during the great moderation
THANK YOU
Predicting Recessions

Probability of Recession in Next 12 Months: Canada

Probability of Recession in Next 12 Months: France

Probability of Recession in Next 12 Months: Germany

Probability of Recession in Next 12 Months: Italy

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Predictive Power of the Yield Curve
Predicting Recessions

- Probability of Recession in Next 12 Months: Japan
- Probability of Recession in Next 12 Months: Sweden
- Probability of Recession in Next 12 Months: U.K.
- Probability of Recession in Next 12 Months: U.S.