Macroeconomic Implications of Changes in the Term Premium

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Outline

Long-Term Interest Rates Very Low in 2004-5

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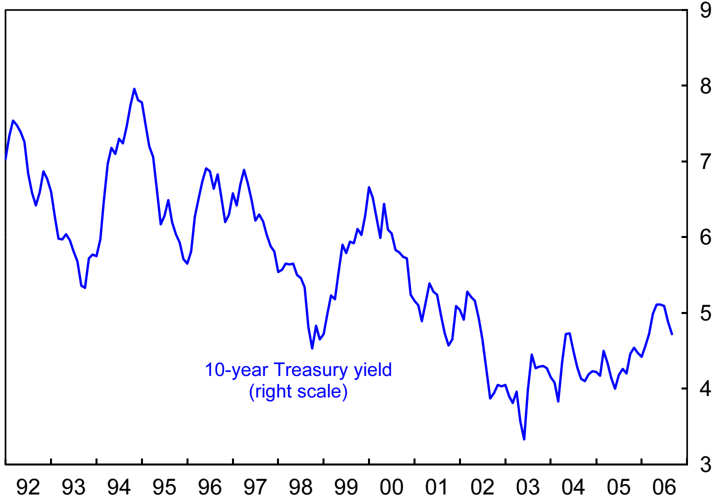
Yield on 10-Year US Treasury Securities and Federal Funds Rate



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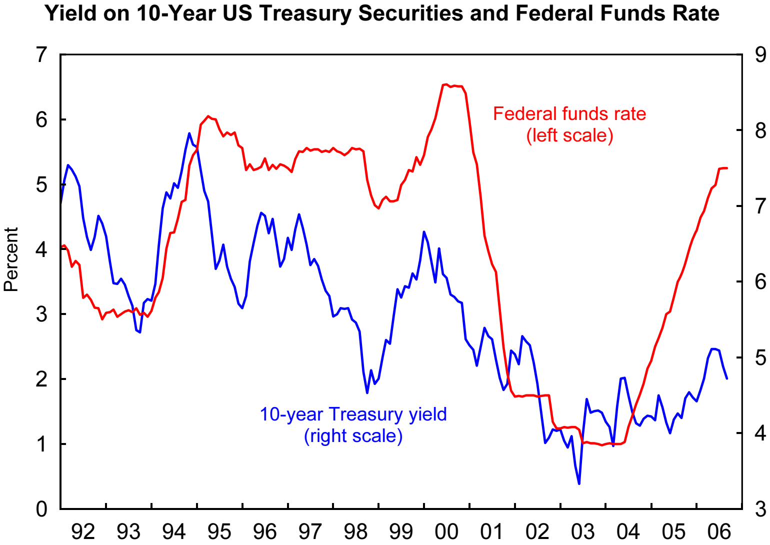

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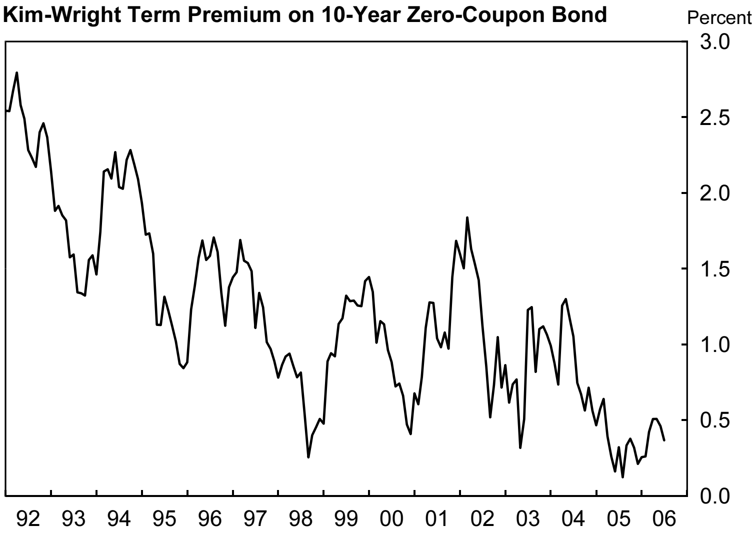

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How should monetary policy respond to a change in the term premium?

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The Chairman's View

To the extent that the decline in forward rates can be traced to a decline in the term premium,... the effect is financially stimulative and argues for greater monetary policy restraint, all else being equal. Specifically, if spending depends on long-term interest rates, special factors that lower the spread between short-term and long-term rates will stimulate aggregate demand. Thus, when the term premium declines, a higher short-term rate is required to obtain the long-term rate and the overall mix of financial conditions consistent with maximum sustainable employment and stable prices.

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- Term premium might be related to potential output rather than output gap

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- Reduced-Form Analysis
  - literature using yield curve spread to forecast GDP
  - compare popular term premium measures
  - study importance of term premium for forecasting GDP

Structural Analysis

2 Structural Analysis
- Review Asset Pricing
- Define Benchmark New Keynesian Model
- Graph Impulse Responses
- Discuss Limitations of the Structural Framework

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Notation: let $i_t \equiv i_t^{(1)}$

Benchmark New Keynesian Model

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Representative household with preferences:

$$\max E_t \sum_{t=0}^{\infty} \beta^t \left(\frac{(c_t - bC_{t-1})^{1-\gamma}}{1-\gamma} - \chi_0 \frac{l_t^{1+\chi}}{1+\chi} \right)$$

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Stochastic discount factor:

$$m_{t+1} = \frac{\beta(C_{t+1} - bC_t)^{-\gamma}}{(C_t - bC_{t-1})^{-\gamma}} \frac{P_t}{P_{t+1}}$$

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Parameters: $\beta = .99$, $b = .66$, $\gamma = 2$, $\chi = 1.5$

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Parameters $\theta = .2$, $\rho_A = .9$, $\sigma_A^2 = .01^2$

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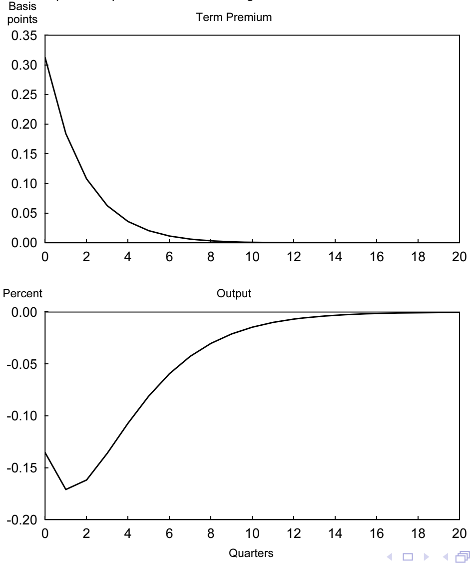
- perturbationAIM algorithm in Swanson, Anderson, Levin (2006) quickly computes *n*th order approximations

Impulse Responses

Figure 1

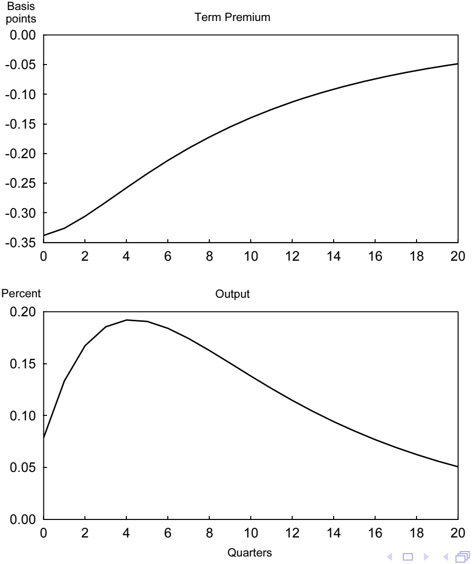
Impulse Responses to One Percentage Point Federal Funds Rate Shock



Impulse Responses

Figure 2

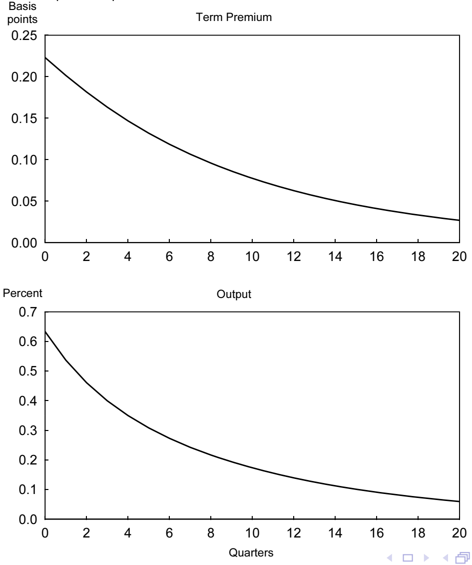
Impulse Responses to One Percent Technology Shock



Impulse Responses

Figure 3

Impulse Responses to One Percent Government Purchases Shock



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- Stochastic pricing kernel may not match standard utility functions used in macroeconomic models

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- Value function iteration is tractable only for very small models
- Medium-size New Keynesian models are required to match impulse responses of macroeconomic variables (CEE, ACEL)
- Large-scale models (GEM, SIGMA) becoming standard for macroeconomic policy analysis

Macro-Finance Analysis

3. Macro-Finance Analysis
   - VAR-based Macro-Finance Models
   - New Keynesian Macro-Finance Models

VAR-based Macro-Finance Models

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Ad hoc stochastic pricing kernel:

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

with

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

and ε_{t+1} conditionally log-normal

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- In Ang-Piazzesi and Bernanke-Reinhart-Sack (2005), term premium assumed to have *no* effect on economy

VAR-based Macro-Finance Models

Appealing framework that allows changes in macroeconomic variables to affect term premium

But ignores effect of term premium on macroeconomy:

- To maintain tractability, literature sharply restricts interaction between term premium and economic variables
- In Ang-Piazzesi and Bernanke-Reinhart-Sack (2005), term premium assumed to have *no* effect on economy
- In Ang-Piazzesi-Wei (2006), term premium assumed to have *same* effect on economy as changes in risk-neutral rate

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Reduced-Form Analysis

4 Reduced-Form Analysis
- The Yield Curve Slope and Forecasting GDP
- Five Measures of the Term Premium
- Importance of Term Premium for Forecasting GDP

The Yield Curve Slope and Forecasting GDP

A large literature uses slope of yield curve to forecast GDP:

$$(y_{t+4} - y_t) = \beta_0 + \beta_1(y_t - y_{t-4}) + \beta_2(i_t^{(n)} - i_t) + \varepsilon_t$$

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Estimates in literature consistently find $\beta_2 > 0$, highly significant

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- $\beta_3 > 0$, insignificant

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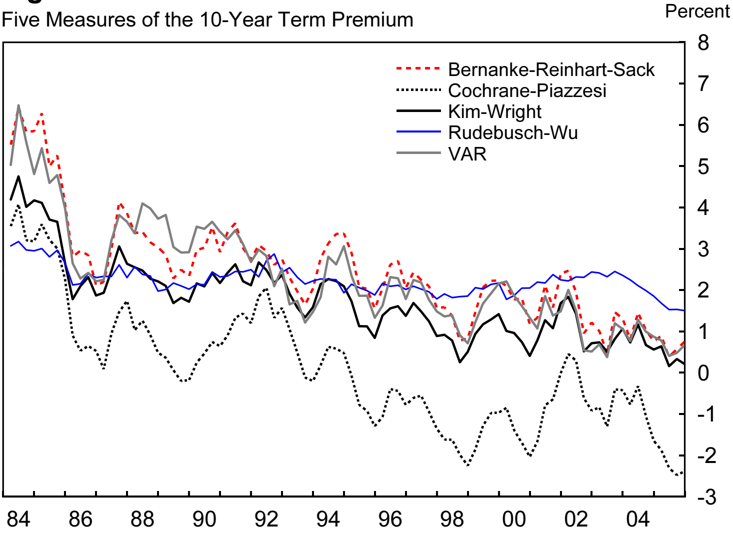
5. Cochrane-Piazzesi (2005)
   - excess return forecasting factor

Five Measures of the Term Premium

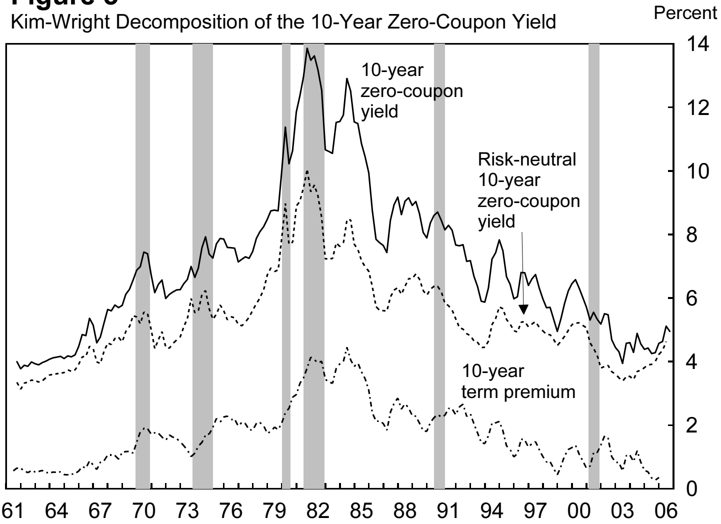
Figure 4

Five Measures of the 10-Year Term Premium



Kim-Wright Term Premium

Figure 5
Kim-Wright Decomposition of the 10-Year Zero-Coupon Yield



GDP Forecasting Results

Table 2
Prediction Equations for GDP Growth
dependent variable: $y_{t+4} - y_t$

	1962–2005 Sample	
	(1)	(2)
$y_t - y_{t-4}$	0.15 (1.57)	0.12 (1.18)
$i_t^{(n)} - i_t$	0.64 (3.64)	
$exsp_t$		0.68 (4.03)
tp_t		0.30 (0.92)

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Note: we cannot reject hypothesis that coefficients on $exsp_t$, tp_t are equal

Regression Specification

Recall new Keynesian IS curve:

$$y_t = -\frac{1}{\gamma} E_t \sum_{j=0}^{\infty} \beta^j (i_{t+j} - \pi_{t+1+j}) + \varepsilon_t$$

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To account for nonstationarity, forecasting regression specification should then be:

$$\begin{aligned}(y_{t+4} - y_t) \quad = \quad & \beta_0 + \beta_1 (y_t - y_{t-4}) + \beta_2 \left(exsp_t - exsp_{t-4}\right) \\ & + \beta_3 \left(tp_t - tp_{t-4}\right) + \varepsilon_t\end{aligned}$$

GDP Forecasting Results

Table 2 (cont.)
Prediction Equations for GDP Growth
dependent variable: $y_{t+4} - y_t$

	1962–2005 Sample	
	(3)	(4)
$y_t - y_{t-4}$	0.32 (3.04)	0.38 (4.22)
$exsp_t$	1.03 (5.64)	
$exsp_{t-4}$	-0.79 (-3.49)	
tp_t	-0.61 (-1.34)	
tp_{t-4}	0.54 (1.24)	
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Conclusions

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   - correlation is different for different structural shocks
2. Reduced-form evidence strongly suggests that policymakers should take term premium into account when forecasting
   - strongly rejected hypothesis that $\beta_3 = \beta_2$ in forecasting regression
3. Declines in the term premium have typically been followed by economic expansion
   - true in both the post-1960 and post-1985 periods

Conclusions

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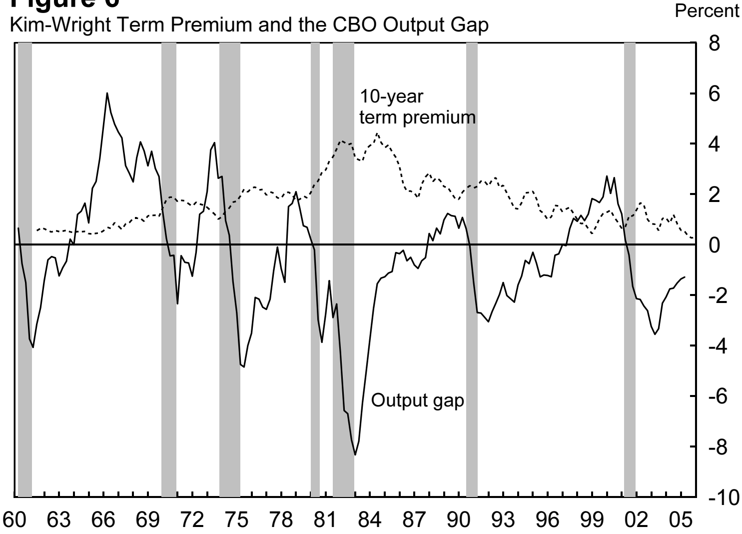
5. Some reduced-form evidence that the Practitioner/Chairman View of macroeconomic implications of declining term premium was correct

Kim-Wright Term Premium and Output Gap

Figure 6
Kim-Wright Term Premium and the CBO Output Gap

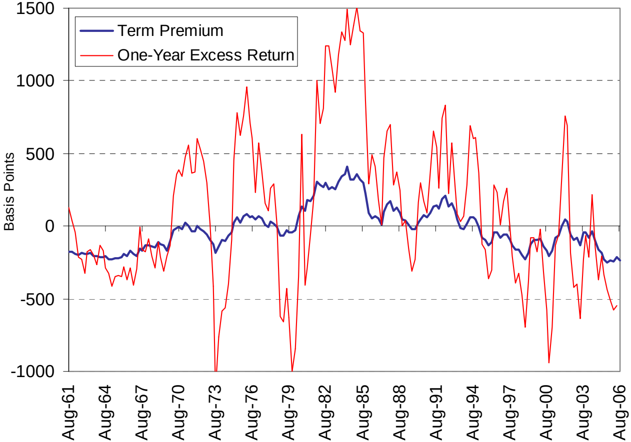


Cochrane-Piazzesi Term Premium Measure

Figure 1
Term Premium for Ten-Year Treasury Security
Implied by Cochrane-Piazzesi Results

Cochrane-Piazzesi Term Premium Measure

Figure 2
Comparison of Term Premium and One-Year Expected Excess Returns for Ten-Year Treasury Security



Five Measures of the Term Premium

Table 1
Correlations between Five Measures of the Term Premium

	BRS	RW	KW	CP	VAR
BRS	1.00				
RW	0.76	1.00			
KW	0.98	0.81	1.00		
CP	0.92	0.87	0.96	1.00	
VAR	0.96	0.68	0.94	0.88	1.00