Comments on Rudebusch and Swanson

The Bond Premium in a DSGE Model with Long-Run Risk

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Background

Main question

- What are the economic forces that justify substantial and time-varying risk premium?

Challenge

- Introducing more financial detail into structural macroeconomic models

Key insights from the literature:

- Epstein-Zin recursive preferences with long-run risk can justify the equity premium (Bansal and Yaron (2004))
- EZ preferences and reduced-form model of consumption and inflation dynamics can generate significant time variation in the term premium (Piazzesi and Schneider (2006), Bansal and Shaliastovich (2008))
- Results found in endowment economies don't always generalize to production economies (Rudebusch and Swanson (2008))

Overview of paper

This paper can generate reasonable mean 10-year bond premium with:

- A DSGE model with production and fixed capital (no investment)
- Epstein-Zin preferences with *extreme* risk aversion
- "Long-run" productivity risk and long-run inflation risk

and without

- time-varying volatilities of shocks
- time-varying risk aversion parameter
- asymmetric information (i.e. common knowledge of process describing evolution of the inflation target)

Important Insights

- Evolution of the bond premium is endogenous.
  - In the model, bond premiums react to structural shocks, they are not the source of structural shocks.
  - Correlations between movements in bond premium and economic activity and inflation depend on the structural shocks.
  - (Eric's comment from yesterday): Is it meaningful to run an impulse response to a bond premium shock? Perhaps, but this paper helps illustrate how important it is to think first about structural identification.
- Variation in bond premiums is primarily due to technology shocks.
- Long-run inflation risk only explains a little of the the mean bond premium, but seems to help on the standard deviation.

A few key expressions and parameters

$$
\begin{aligned}
u(c_t, l_t) &\equiv \frac{c_t^{(1-\gamma)}}{1-\gamma} - \chi_0 \frac{l_t^{1+\chi}}{1+\chi} \\
V_t &\equiv u(c_t, l_t) + \beta \left(E_t V_{t+1}^{1-\alpha} \right)^{1/(1-\alpha)} \\
m_{t+1} &\equiv \left(\frac{V_{t+1}}{(E_t V_{t+1}^{1-\alpha})^{1/(1-\alpha)}} \right)^{\alpha} \frac{\beta u_1(c_{t+1}, l_{t+1})}{u_1(c_t, l_t)} \frac{P_t}{P_{t+1}} \\
p_t^{s^\tau} &= E_t[m_{t+1} p_{t+1}^{s^\tau}] \\
y_t(f) &= A_t \bar{k}^{1-\eta} l_t(f)^{\eta}
\end{aligned}
$$

Important parameters

- IES: Baseline parameterization has $\gamma = 0.66$ and IES $= 1.5$
- utility curvature w.r.t. labour: Baseline parameterization has $\chi = 1.5$
- quasi-CRRA: $= 1 - (1-\alpha)(1-\gamma)$
  Baseline parameterization has quasi-CRRA = 15, implying $\alpha = 43$.

Small Comments 1

- Please clarify in the text the intuition of the interactions between χ, quasi-CRRA and the technology parameters. "Best fit" calibrations involve changes in several parameters, and consequent changes in simulation properties that are difficult to untangle.
- Perhaps an additional column (per table) holding technology parameters constant and only allowing quasi-CRRA and χ to change.
- The model has a consol and δ_c is chosen to set the Macaulay duration of the consol to 10 years. Holding constant the other parameter calibrations, how well would the model do at explaining bond premiums for different Macaulay durations? I would guess that the 5-year bond premium would be too large and the 30-year bond premium would be too small....

Comment 2

Long-run risk is bounded and much lower than in Bansal and Yaron (2004)

- Computational techniques use an approximation around the nonstochastic steady state of levels of real activity.
  - Data (excluding interest rates, inflation, and the bond premium) are HP detrended.
  - Trends in the levels of detrended data are treated as fully known (past, present, and future) by all economic agents.
  - This means that there is considerably less long-run risk than in Bansal and Yaron (2004).

Long-run risk

- Productivity risk in RS has a "long-run persistent" component and an idiosyncratic component:

$$\begin{aligned} logA_t^* &= \rho_{A^*} logA_{t-1}^* + \epsilon_t^{A^*} \\ logA_t &= logA_t^* + \epsilon_t^A \end{aligned}$$

- In Bansal and Yaron (2004), consumption *growth* risk has a long-run persistent component and an idiosyncratic component :

$$\begin{aligned} x_t &= \rho x_{t-1} + \zeta_e \sigma e_t \\ logC_t &= logC_{t-1} + \mu + x_t + \sigma \eta_t \end{aligned}$$

Conditional Variances

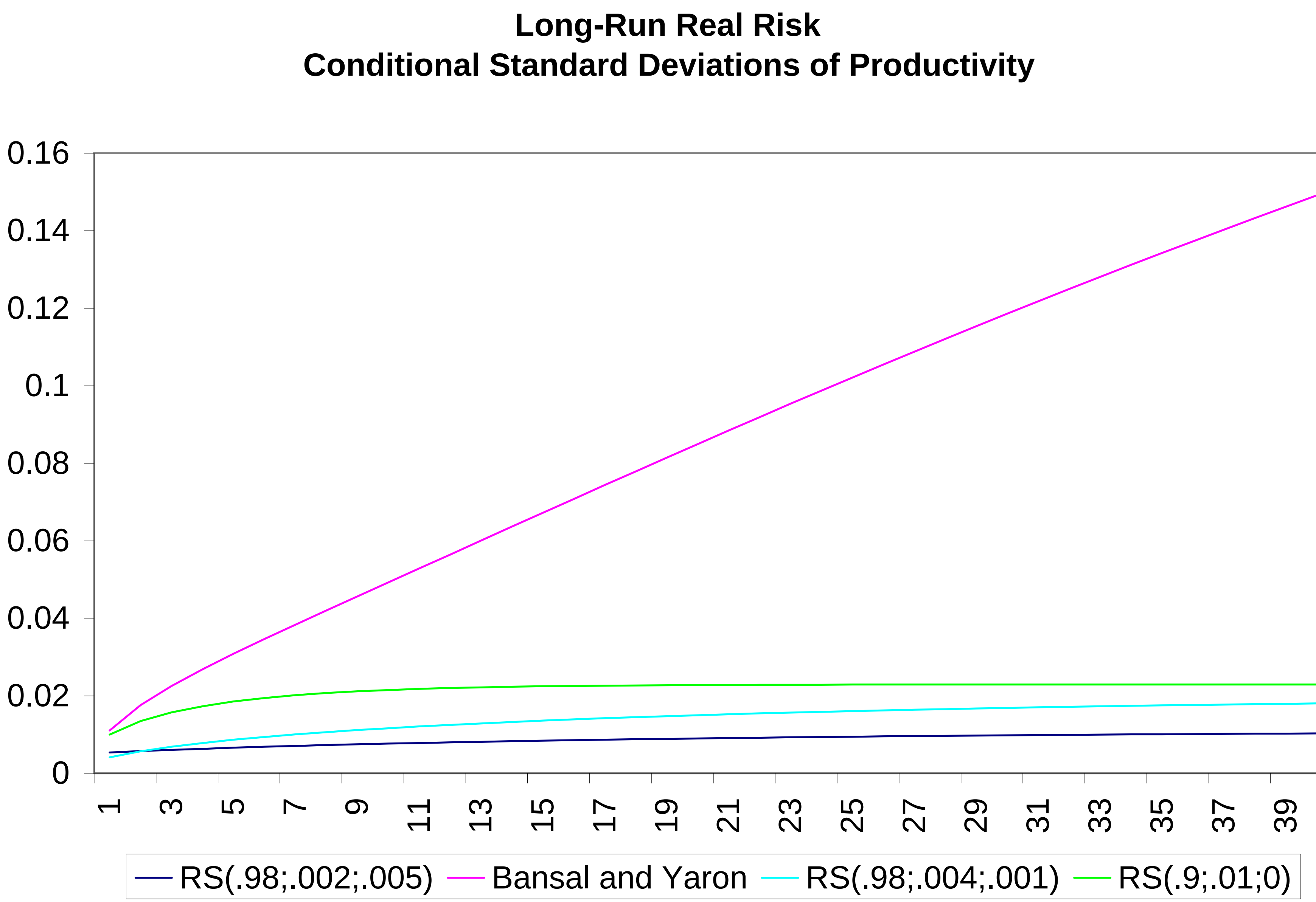
- Rudebusch and Swanson (quarterly calibration: $\rho_{A^*} \in \{0.9, 0.98\}$, $\sigma_{A^*} \in \{0.01, 0.002, 0.004\}$, $\sigma \in \{0, 0.005, 0.001\}$)

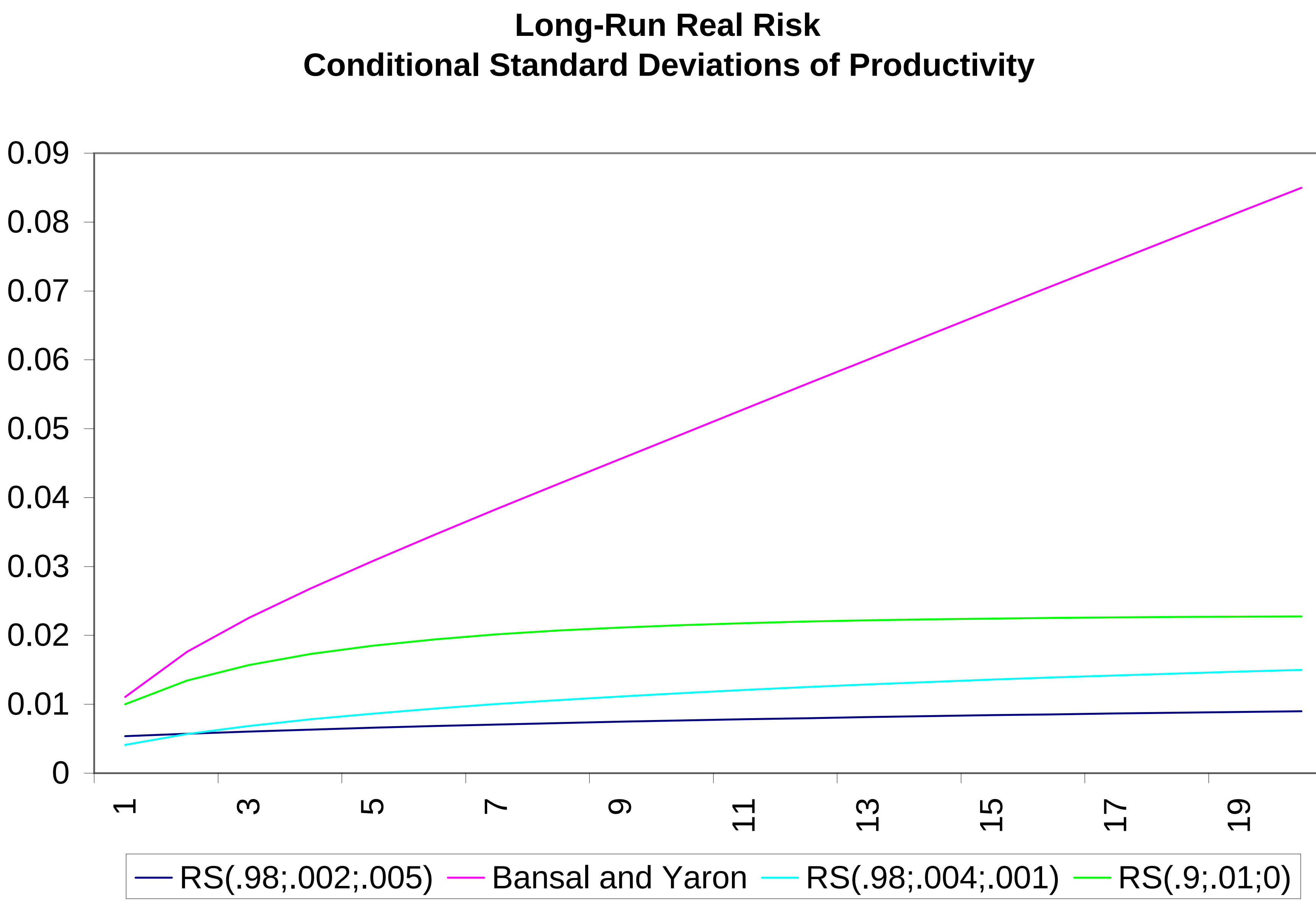
$$
\begin{aligned}
Var_t(\Delta log A_{t+1}) &= \sigma_{A^*}^2 + \sigma_A^2 \\
Var_t(log A_{t+k}) &= \frac{(1-\rho_{A^*}^{2k})\sigma_{A^*}^2}{(1-\rho_{A^*}^2)} + \sigma_{A^*}^2
\end{aligned}
$$

- Bansal and Yaron (monthly calibration: $\rho = 0.979$, $\zeta_e = 0.044$, $\sigma = 0.0078$)

$$
\begin{aligned}
Var_t(\Delta log C_{t+1}) &= \zeta_e^2 \sigma^2 + \sigma^2 \\
Var_t(log C_{t+k}) &= Var_t(\sum_{i=1}^{k} \Delta log C_{t+i}) \\
&= \frac{\zeta_e^2 \sigma^2}{(1-\rho)^2}\left(k - \frac{2\rho(1-\rho^k)}{(1-\rho)} + \frac{\rho^2(1-\rho^{2k})}{(1-\rho^2)}\right) + k\sigma^2
\end{aligned}
$$

- As the horizon of the conditional expectation increases, $Var_t(log A_{t+k})$ is bounded but $Var_t(log C_{t+k})$ is not.


Long-Run Real Risk
Conditional Standard Deviations of Productivity
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
37
39
RS(.98;.002;.005)
Bansal and Yaron
RS(.98;.004;.001)
RS(.9;.01;0)


Long-Run Real Risk
Conditional Standard Deviations of Productivity
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
1
3
5
7
9
11
13
15
17
19
RS(.98;.002;.005)
Bansal and Yaron
RS(.98;.004;.001)
RS(.9;.01;0)

Long-run risk is bounded and much lower than in Bansal and Yaron (2004)

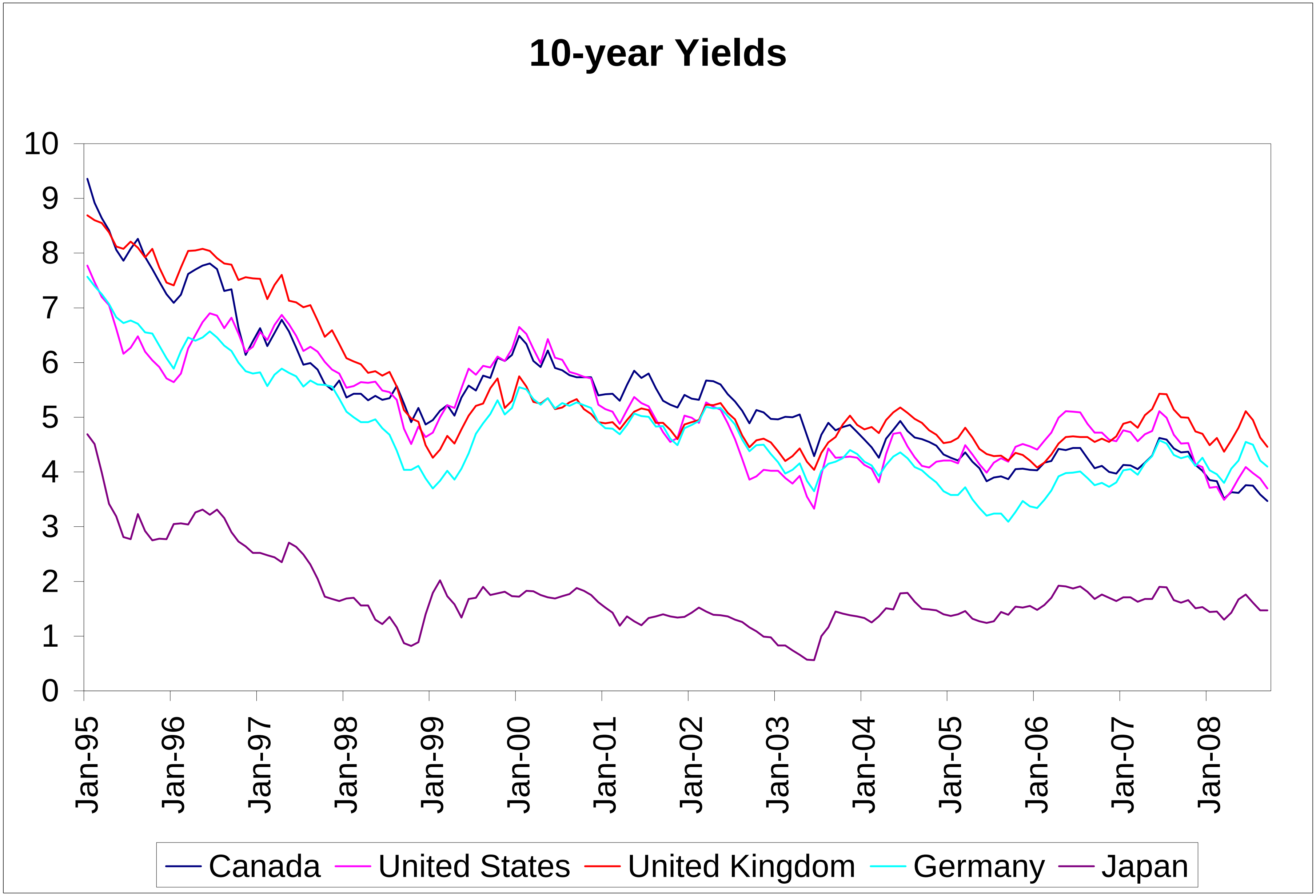
- ... In fact, the specifications with "long-run productivity risk" have less uncertainty around the long-run productivity level than the specification with no long-run productivity risk! In the specifications with "long-run productivity risk", the "best fit" variant chooses parameterizations that result in more uncertainty around the long-run productivity level.
- Perhaps revisit the specification of the productivity process to increase long-run risk, then fix these parameters to estimate the parameters of the utility function that best fit the moments of interest.

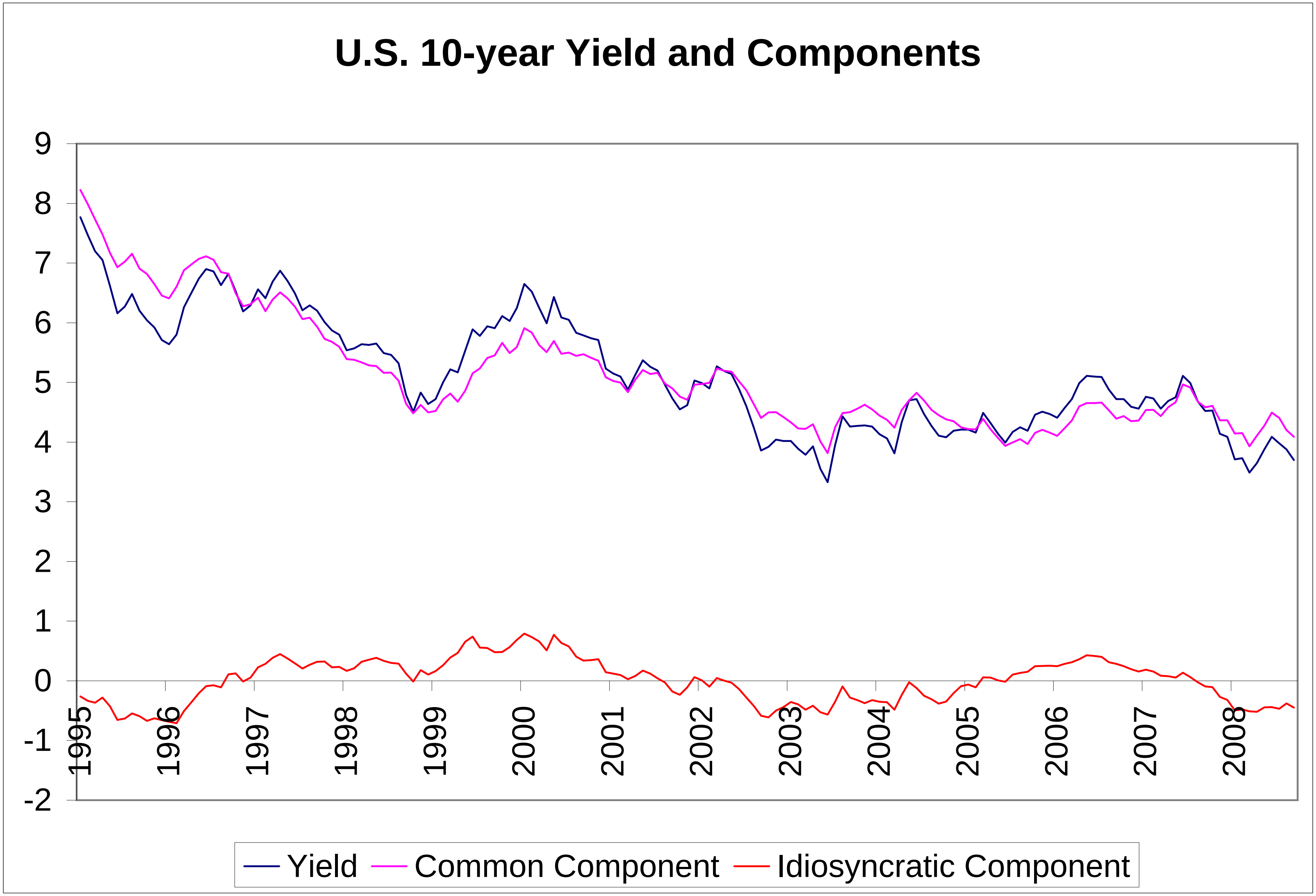
Comment 3 (just food for thought)

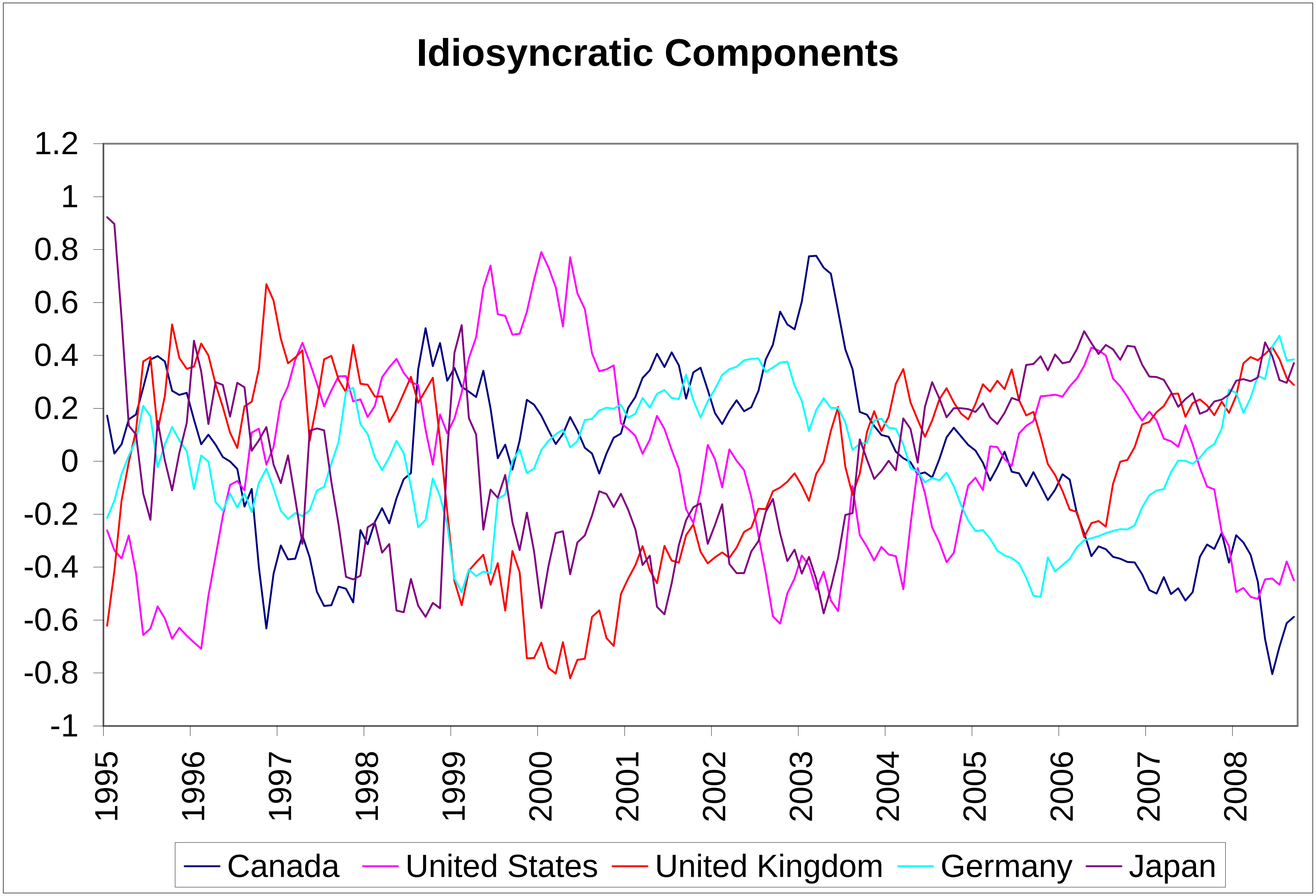
Are we missing something by examining closed-economy models of bond yields?

- Yields are highly correlated across countries. (See figure for data on Canada, US, UK, Germany, Japan.)
- Changes in yields are also highly correlated. Excluding Japan, correlations range between 0.67 and 0.86. Correlations of changes in yields with those for Japan range between 0.2 and 0.4.
- "Rough" calculations suggest that a common international component can explain between about 80% (Japan) and 95% (Germany) of variation in monthly 10-year yields over 1995 to 2008.
- Moreover, the standard deviation of the common component is 3 to 4 times larger than the standard deviation of country-specific components.
- Over the past 10 years, the explanatory power drops somewhat, but remains at about 75-85 % for Canada, the U.S., the U.K., and Germany.
- The standard deviation of the common component also declines over this period, but remains about 1.5 to 2 times larger than the standard deviation of country-specific components.

- Should we be calibrating to the U.S. or to global measures?


10-year Yields
10
9
8
7
6
5
4
3
2
1
0
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Canada
United States
United Kingdom
Germany
Japan


U.S. 10-year Yield and Components
9
8
7
6
5
4
3
2
1
0
-1
-2
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Yield
Common Component
Idiosyncratic Component



Idiosyncratic Components
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Canada
United States
United Kingdom
Germany
Japan