Back to the 1980s or Not? The Drivers of Inflation and Real Risks in Treasury Bonds
Discussion

Martin Lettau
Haas School of Business, UC Berkeley
Goal: understand time-varying correlation of stock and bond returns

Campbell, Pflueger, and Viceira (2020): habit, inflation, stocks, and bonds
  - Correlation of inflation and output gap switched from + to − in 2001
  - Before 2001: Treasuries are risky
  - After 2001: Treasuries are hedges
  - Structural break in output gap/inflation correlation in 2001: − to +
  - Key: Time-varying risk premia

Exogenous inflation process

This paper: endogenous inflation
  - Same Euler equation and asset pricing model
  - Philips curve, monetary policy → endogenous inflation
  - “Structural” shocks
Summary

- **New-Keynesian model**: Euler equation, Philips curve, MP rule
- Asset pricing: habit with time-varying risk aversion
- Exogenous shocks: “supply”, MP, “demand”

- Some parameters held constant: $g, \gamma, \bar{R}_f$, habit, persistence
- Different across subsamples:
  - **MP rule**
  - **Volatilities of shocks**
    - Adaptive inflation expectations (why?)
    - Leverage (why?)
- Goal: match asset pricing moments, in particular stock-bond correlation
New element: Bond preference shock

- Yield of 1-period nominal bond $i_t$ is set by the Fed + Fisher eqn:
  \[ r_{1,t} = \exp(E_t \pi_{t+1} - i_t) \]

- Yields of real/nominal bonds, stocks: Euler eqn with $M_{t+1} = M(\Delta c_{t+1}, S_t)$
  \[ 1 = \exp(-\xi_t) E_t[M_{t+1} R_{1,t+1}] \]
  \[ P_{n,t} = \exp(-\xi_t) E_t[M_{t+1} P_{n-1,t+1}] \]

- $\xi_t$ does not (directly) affect stock prices: $E_t[M_{t+1} R_{s,t+1}] = 1$

- Paper: $\xi_t$ is a preference shocks of stocks vs. bonds

- Alternative interpretation: slope shock (given $C_t$)
  - short rate is set by Fed and given $E_t \pi_{t+i}$
  - $\xi_t > 0$ raises longer yields more than short yields
  - yield curve steepens

- Euler equation: $\xi_t$ affects $\Delta c_{t+1}$
Model: Bond preference shock

- GE effect of $\xi_t > 0$:
  - Direct effect: $Y_{n,t} \uparrow$
  - EIS<1 $\rightarrow$ consumption and output gap $\uparrow$
    $\rightarrow$ Risk aversion $\downarrow$ $\rightarrow$ risk premia $\downarrow$
    $\rightarrow$ Asset prices $\uparrow$ $\rightarrow$ $P_t/D_t \uparrow$, $Y_{n,t} \downarrow$
    $\rightarrow$ positive correlation of stocks and bonds
  - (Net effect of $\xi_t$ on $Y_{n,t}$: $\leq 0$)

- Implication: $\xi_t$ plays many roles simultaneously
  1. Moves yield curve
  2. Affects consumption (via Euler equation) $\rightarrow$ “demand” shock (?)
  3. Shock to output gap
  4. Shock to risk aversion/risk premia of all assets (habit preferences)
Correlation of stocks and bonds

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Stock Return</th>
<th>Bond Return</th>
<th>Return Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970-1982</td>
<td>$P_t \downarrow$, $R^s_t &lt; 0$</td>
<td>$Y_t \uparrow$, $R^b_t &lt; 0$</td>
<td>$\rho(R^s, R^b) &gt; 0$</td>
</tr>
<tr>
<td>1982-2001</td>
<td>$P_t \uparrow$, $R^s_t &gt; 0$</td>
<td>$Y_t \downarrow$, $R^b_t &gt; 0$</td>
<td>$\rho(R^s, R^b) &gt; 0$</td>
</tr>
<tr>
<td>2001-2019</td>
<td>$P_t, R^s_t \approx 0$</td>
<td>$Y_t \downarrow$, $R^b_t &gt; 0$</td>
<td>$\rho(R^s, R^b) \approx 0$</td>
</tr>
</tbody>
</table>
Three exogenous shocks

1. Demand/bond yield shock
2. Supply shock: productivity + sticky wages + adaptive inflation expectations → Philips curve
3. Monetary policy (MP) shock

Key result: importance of shocks differs in subsamples:

- 1979-2001: \( \sigma(\text{supply}), \sigma(\text{mp}) > 0, \sigma(\text{demand}) \approx 0 \)
- 2001-2019: \( \sigma(\text{demand}) > 0, \sigma(\text{supply}), \sigma(\text{mp}) \approx 0 \)

MP rule:

- 1979-2001: \( \gamma^\pi = 1.35, \gamma^X = 0.5, \rho^i = 0.54 \)
- 2001-2019: \( \gamma^\pi = 1.10, \gamma^X = 1.0, \rho^i = 0.80 \)

Other parameters: stickiness of expectations, leverage

- 1979-2001: \( \zeta = 0.60, \delta = 0.5 \)
- 2001-2019: \( \zeta = 0.0, \delta = 0.66 \)
The correlation of stocks and bond depends on 2 effects:

1. **Risk aversion:**
   - \( C_t \), output gap ↑ → RRA, risk premia ↓ → all asset prices ↑ → **positive** correlation of stocks and bonds

2. **“Dividends”:**
   - Stocks: \( D_t = C_t = Y_t \)
   - Bonds: \( 1/\Pi_t \)
   - \( \text{Corr}(R^s_t, R^b_t) \) depends on \( \text{Corr}(\Delta c_t, \pi_t) \leq 0 \)

- **Model:**
  - **MP rule** affects inflation dynamics and dividend/inflation correlation
  - Different shock have different effects on risk aversion, dividends, and inflation mix of shocks important
### Shocks and asset prices

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shocks</td>
<td>Inflation</td>
<td>Output gap</td>
</tr>
<tr>
<td>Policy rate $i_t$</td>
<td>↑↑</td>
<td>↑↑</td>
</tr>
<tr>
<td>Inflation</td>
<td>↑↑</td>
<td>= 0</td>
</tr>
<tr>
<td>Output gap</td>
<td>↓↓</td>
<td>≈ 0</td>
</tr>
<tr>
<td>Consumption</td>
<td>↓↓</td>
<td>≈ 0</td>
</tr>
<tr>
<td>Risk aversion</td>
<td>↑↑</td>
<td>↑</td>
</tr>
<tr>
<td>$P/D$ stocks</td>
<td>↓↓</td>
<td>↓</td>
</tr>
<tr>
<td>Nominal 10-year yield</td>
<td>↑↑</td>
<td>↑</td>
</tr>
<tr>
<td>$R^s_t$ stocks</td>
<td>↓↓</td>
<td>↓</td>
</tr>
<tr>
<td>$R^b_t$ stocks</td>
<td>↓↓</td>
<td>↓</td>
</tr>
</tbody>
</table>

\[
\text{Corr}(\Delta c_t, \pi_t) < 0 \quad \approx 0 \quad \approx 0
\]

\[
\text{Corr}(R^s_t, R^b_t) > 0 \quad > 0 \quad \leq 0
\]
Change in MP rule: reasonable

How about shocks?

\[ \sigma(\text{supply}) = 0.58 \rightarrow 0.07 \]
\[ \sigma(\text{MP}) = 0.55 \rightarrow 0.07 \]
\[ \sigma(\text{demand}) = 0.01 \rightarrow 0.59 \]

Shapiro (2022): estimate contributions of supply and demand shocks to inflation using price, quantity, and expenditure data

Important episodes for stock markets:

- Late 1990s: dot.com boom and correction
- Early 2000s: housing boom
- Late 2000s: financial crisis and recovery
- Early 2020s: COVID

How do these “shocks” fit into the shocks in the model?

Greenwald, Lettau and Ludvigson (2022): high stock returns between 1970 and 2000’s partially due to declining labor share
Notes: Plotted is the expenditure-weighted share of PCE that is labeled as supply or demand driven in a given month, centered five-month moving average. Panel A shows the share of PCE labeled demand driven, and then further decomposed into negative and positive shocks. Panel B shows the analogous series for supply driven labels. All four series above sum to one for any given month. Unweighted shares are shown in online appendix figure A1.
Calibration: Output gap and habit process

- CPV: habit depends on **stochastically detrended consumption**:
  \[ x_t = c_t - (1 - \phi) \sum_{j=0}^{\infty} \phi^j c_{t-1-j} \]

- Equilibrium: \( x_t = \log \text{output gap} \)
- Calibration: \( \phi = 0.99 \)
- Compare \( x_t \) constructed from consumption to BEA output gap

![Graph showing the comparison between BEA output gap and \( x_t \) constructed from consumption]


- gap (BEA)
- \( x \) (0.99)
Persistence of $x_t$ and output gap

- BEA output gap is significantly less persistent than $x_t$ with $\phi = 0.99$
- $\phi = 0.85$ matches persistence better
Persistence: $\phi = 0.85$ instead of $\phi = 0.99$

Better fit for $\phi = 0.8$ than for $\phi = 0.99$

How does lower $\phi$ effect model results?

Next: asset prices
Questions

- Yield spread 2001-2019
  - Model: −0.58% yields curve is on average inverted
  - Data: 2.06%, postwar high in early 2000s and early 2010s (> 3%)
- Can the model capture the secular decline of (long) yields starting in 1982?
- Are consumption/dividend growth forecastable by P/D (or consumption surplus ratio)?
- Campbell-Cochrane habit: increasing term structure of equity → growth premium
- Interpretation of demand/supply shocks:
  - Model assumes no investment → $C_t = Y_t$
  - “Demand” shock, or real interest rate shock?
Suggestions

- Matching moments is useful but how about time series fit?
  - Plot fitted $P/D$ and $Y_{n,t}$
- Plot realized supply/MP/demand shocks (mean zero?)
- Show IRF of consumption surplus ratio $s_t$ ($\approx$ RRA)
- Expected returns depend on $s_t$: use $s_t$ as a forecasting variable for realized returns
- Plot $s_t$ and $P/D, Y_{n,t}$
- How about pre-1979 period?