Can Housing Collateral Explain Long-Run Swings in Asset Returns?

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Two Leading Asset Pricing Paradigms

- Campbell-Cochrane (99) external habit model
  - Preferences: \( m_t = \log \beta - \gamma \Delta c_t - \gamma \Delta s_t \) where log surplus consumption ratio \( s_t \) is persistent and heteroscedastic.
  - Technology: consumption growth is i.i.d.: \( \Delta c_t = g + \varepsilon^c_t \)
  - Introduces time-variation in risk aversion
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- Bansal and Yaron (04) long-run risk model
  - Preferences: Epstein-Zin (89, 91)
    \[
    m_t = \frac{1 - \gamma}{1 - \rho} \log \beta - \rho \frac{1 - \gamma}{1 - \rho} \Delta c_t + \frac{\rho - \gamma}{1 - \rho} r_t^w
    \]
    where \( r_t^w \) is log return on the total wealth portfolio
  - Technology: consumption and dividend growth have small, but very persistent component, as well as heteroscedastic innovations
  - Introduces time-variation in **expected growth rates** and **economic uncertainty**
Alternative: Heterogenous agents

- New mechanism to generate persistence and heteroscedasticity, based on an observable and important friction.
Alternative: Heterogenous agents

- New mechanism to generate persistence and heteroscedasticity, based on an *observable and important friction*.
- Idea: explore impact of housing collateral constraints on equity prices
  - High participation in housing markets : 2/3.
  - Housing wealth = 2 * Equity wealth for households
Alternative: Heterogeneous agents

- New mechanism to generate persistence and heteroscedasticity, based on an *observable and important friction*.
- Idea: explore impact of housing collateral constraints on equity prices.
- Households with heterogenous income realizations trade state-contingent claims to insure against income shocks:
  - Friction: limited contract enforceability
  - Households cannot commit to repay state-contingent promises; they can default
  - Borrowing only sustained by housing collateral
Alternative: Heterogenous agents

- New mechanism to generate persistence and heteroscedasticity, based on an observable and important friction.
- Idea: explore impact of housing collateral constraints on equity prices
- Households with heterogeneous income realizations trade state-contingent claims to insure against income shocks
- New asset pricing factor $\Delta \xi_t^a$ captures extent to which constraints bind

$$m_t = \log \beta - \gamma \Delta c_t + \gamma \Delta \xi_t^a$$

- Standard CRRA preferences
- i.i.d. consumption growth
- Heteroscedasticity and persistence: Times with scarce housing collateral $\Rightarrow$ little risk sharing sustainable $\Rightarrow$ high and volatile equity premia
Empirical Targets

1. **Time Series**  Conditional equity premium and Sharpe ratio, and risk-free rate

2. **Cross-Section**  Value-Growth premium

(3. Standard unconditional AP moments)
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1. **Time Series**  Conditional equity premium and Sharpe ratio, and risk-free rate

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(3. **Standard unconditional AP moments**)

**Method: Quantitative General Equilibrium**

- Calibrate and numerically solve model.
- Are the frictions large enough to generate plausible magnitudes?
A Helicopter Tour of the Model

- State $s_t = (z_t, y_t)$, history $s^t$, probability $\pi(s^t)$
- CRRA utility, CES over non-housing $c$ and housing consumption $h$
- Aggregate consumption: $c^a(z^{t+1}) = \lambda(z_{t+1})c^a(z^t)$
- Labor income: $\eta(y_t, z^t) = \hat{\eta}(y_t, z_t)c^a(z^t)$
- Aggregate housing endowment $\{h(z^t)\}$, $r(z^t) = \frac{c^a(z^t)}{\rho(z^t)h^a(z^t)}$
- Complete menu of state-contingent claims $a(s^t, s')$, prices $q(s^t, s')$
- Households cannot commit to repay claims $\Rightarrow$ solvency constraints
- Frictionless housing markets, rental price $\rho_t(z^t)$
Budget and Collateral Constraints

Budget constraint (sequential):
\[
c_t(\ell, s^t) + \rho_t(z^t) h_t^r(\ell, s^t) + \sum_{s^{t+1}} q_t(s^{t+1}) a_t(\ell, s^{t+1}) + p_t^h(z^t) h_{t+1}^o(\ell, s^t) \leq W_t
\]
where next period’s wealth is
\[
W_{t+1} = \eta_{t+1}(s^{t+1}) + a_t(\ell, s^{t+1}) + h_{t+1}^o(\ell, s^t) \left[ p_{t+1}^h(z^{t+1}) + \rho_{t+1}(z^{t+1}) \right].
\]

State-by-state collateral constraints:
\[
-a_t(\ell, s^t, s') \leq h_{t+1}^o(\ell, s^t) \left[ p_{t+1}^h(z^{t+1}) + \rho_{t+1}(z^{t+1}) \right], \text{ for all } s^t, s'.
\]
Equilibrium Allocations and Prices

- Cumulative multiplier (summarizes all past binding collateral constraints)

\[
\zeta_t(\ell, y^t, z^t) = \begin{cases} 
\zeta_{t-1}(\ell, s^{t-1}) & \text{if } \zeta_{t-1}(\ell, s^{t-1}) > \zeta_t(y^t, z^t) \\
\zeta_t(y^t, z^t) & \text{if } \zeta_{t-1}(\ell, s^{t-1}) \leq \zeta_t(y^t, z^t)
\end{cases}
\]

- Aggregate multiplier across households

\[
\zeta^a_t(z^t) = \sum_{y^t} \int \frac{1}{\xi_t^\gamma(\ell, y^t, z^t)} d\mathcal{L}_0 \frac{\pi(y^t, z^{t}|y_0, z_0)}{\pi(z^{t}|z_0)}.
\]

- Equilibrium consumption allocation

\[
c_t(\ell, s^t) = \frac{\zeta_t(\ell, s^t)^{\frac{1}{\gamma}}}{\zeta^a_t(z^t)} c^a_t(z^t) \quad \text{and} \quad h_t(\ell, s^t) = \frac{\zeta_t(\ell, s^t)^{\frac{1}{\gamma}}}{\zeta^a_t(z^t)} h^a_t(z^t)
\]

- Stochastic discount factor

\[
m_{t+1} = \delta \left( \frac{c^a_{t+1}}{c^a_t} \right)^{-\gamma} \left( \frac{1 + r_{t+1}^{-1}}{1 + r_t^{-1}} \right)^{\frac{1-\varepsilon\gamma}{\varepsilon-1}} \left( \frac{\zeta^a_{t+1}}{\zeta^a_t} \right)^{\gamma}.
\]
## A. Declining Volatility of Equity Premium and Risk-free Rate

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<th>Decade</th>
<th>Equity Premium Volatility</th>
<th>Risk-free Rate Volatility</th>
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B. Risk-free Rate Level

Model Meets Twentieth Century Data

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C. Equity Premium Level

Model Meets Twentieth Century Data

- Model – Equity Premium
- Data – Equity Premium
- Model – Conditional Volatility
- Data – Conditional Volatility
- Model – Conditional Sharpe Ratio
- Data – Conditional Sharpe Ratio

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Other Conditional AP Moments

- Model quantitatively replicates long-horizon predictability facts
  - By the housing collateral ratio
  - By the dividend-price ratio and the risk-free rate

- Volatility of the conditional Sharpe ratio
  - is high and standard models (CCAPM, C&C) cannot generate enough (Lettau-Ludvigson, 2003)
  - Our model generates volatile Sharpe ratios
  - and Sharpe ratios that are higher when housing collateral is scarce.
2. Cross-sectional AP moments: Value premium

- Fact 1: Value stocks have returns that are 6% per year higher than growth stocks.
- Fact 2: Value stocks have higher Sharpe ratios than growth stocks.
- Goal: Endogenously generate value premium in GE model
- Method: Price portfolios with different cash-flow duration.
- Growth stocks are assets with longer maturities than value stocks (Lettau & Wachter, 2006).
Value premium in the Collateral Model

- We model growth stocks (value stocks) as a basket of consumption strips weighted towards longer (shorter) maturities.
- Positive value premium because shorter duration strips are riskier and carry higher risk premia.
- Short duration assets subject to both (temporary) consumption growth shocks and (persistent) collateral shocks.
- Habit model: consumption growth shocks are persistent through effect on habit $\Rightarrow$ negative value premium.

![Graphs showing consumption strip risk premia, consumption strip Sharpe ratios, portfolio risk premium, and portfolio Sharpe ratio over maturity and duration.](image-url)
Conclusions

- Endogenous, state-contingent borrowing constraints interact with shocks in housing market to deliver plausible asset pricing predictions:
  - time-series variation in conditional asset pricing moments
  - cross-sectional variation in returns
  - unconditional asset pricing moments

- Mechanism: Equilibrium changes in the value of the housing stock
  - modify households’ ability to commit to allocations and prices
  - change the degree to which risk sharing takes place
  - endogenously generates time-varying volatility in the Sharpe ratio on equity

- Direct evidence on risk-sharing among regions lends credibility to the mechanism
  (Lustig and Van Nieuwerburgh, 2006)