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ASSET PRICING WITH HETEROGENEOUS AGENTS AND LONG-RUN RISK

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Asset pricing

- Departure from the ‘representative agent’ paradigm

Dynamics of wealth distribution

- Consumption-saving decisions
- Portfolio choices

Interaction

- Wealth-distribution becomes a new state variable
Rational expectations framework

- Agents, nature, and econometrician share a common probability measure (model)
- Source of cross-equation restrictions / testable implications
- Source of discipline
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Applications in asset pricing

- Hansen, Singleton (1982)
  - simple risk and preference specifications fail to match even elementary asset price moments

- Long-run risk literature (Bansal, Yaron (2004), ...)
  - combination of persistent risk and nonseparable preferences helps
  - large martingale component in the stochastic discount factor
WHERE ARE THE PERSISTENT RISK COMPONENTS?

**Approach 1: ‘Dark matter’ approach (Chen, Dou, Kogan (2015))**

- Persistent risk must exist because asset prices tell us so.
- Use Euler equations as pricing restrictions for identification
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**Approach 2: Better measurement**

- Nakamura, Sergeyev, Steinsson (2016) — international data
- Schorfheide, Song, Yaron (2016) — careful modeling of measurement errors
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Approach 3: Hansen, Sargent (2001)

- Reinterpret a martingale in the SDF as a ‘worst-case model’ distortion
- Blur the distinction between beliefs and preferences
An econometrician measuring the persistent component is not enough.

- Euler equations involves investors’ expectations

\[ 1 = E_t \left[ \frac{S_{t+1}}{S_t} R_{t+1} \right] \]

- Investors must have a full understanding of its presence
WHY SUBJECTIVE BELIEFS?

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Persistent components are hard to measure: opens room for

- Learning / subjective beliefs

- Disagreement / heterogeneous beliefs
  - Morris (1995): agree to disagree
  - Andrei, Hasler, Jeanneret (2016): heterogeneous signals
  - Collin-Dufresne, Johannes, Lochstoer (2016b): heterogeneous experiences
Endowment economy, two types of agents, complete markets

- Epstein–Zin preferences
- Consumption dynamics as in the long-run risk literature

\[
\begin{align*}
\Delta c_{t+1} &= \mu_c + x_t + \sigma \eta_{c,t+1} \\
 x_{t+1} &= \rho_x x_t + \phi_x \sigma \eta_{x,t+1} \\
 \Delta d_{t+1} &= \mu_d + \Phi x_t + \phi_d \sigma \eta_{d,t+1} + \phi_{d,c} \sigma \eta_{c,t+1}
\end{align*}
\]

- Agents disagree about the persistence of the long-run risk component $\rho_x$
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Solution approach

- Planner’s problem with time-varying Pareto weights
- Incorporates nonseparable preferences ([Dumas, Uppal, Wang (2000)]) interacted with subjective beliefs ([Borovička (2016)])
Presence of agents who believe in lower persistence $\rho_x$ (long-run risk ‘deniers’) significantly reduces risk premia

- These agents offer cheap insurance against shocks to $x_t$
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Moreover, ‘deniers’ gain wealth over time $\Rightarrow$ risk premia fall further

- This is in contrast to separable preferences
- Under separable preferences, agents with incorrect beliefs lose wealth on average
‘Deniers’ of long run risk can be, on average, interpreted as optimists

- Belief in lower $\rho_x$ implies lower required compensation for holding risky asset
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Optimists in the economy gain wealth

- **Risk premium channel**: ‘Deniers’ invest in risky, high-return assets
  - ‘Deniers’ are optimistic about long run risk. Strong effect when risk aversion is high.

- **Savings channel**: ‘Deniers’ save more
  - When $IES > 1$, agents with high subjective expected return save more.
Risk premia

· attenuation due to presence of long-run risk ‘skeptics’

Price-dividend ratio

· more volatile due to fluctuations in the wealth distribution
  · but is it at the right frequency?
  · much of the fluctuation in the data is at the business-cycle frequency
  · long-run risk is about lower frequencies

Return predictability?

· standard tests use P/D as a predictor for returns and consumption growth
· measures of wealth distribution as a predictor?
Sources of wealth heterogeneity / inequality

- income heterogeneity alone not strong enough
- heterogeneity in consumption/saving behavior & portfolio returns

The heterogeneous beliefs model yields predictions for

- heterogeneity in saving rates
- heterogeneity in portfolio composition and expected and realized returns
- vis-à-vis equilibrium-determined asset prices

Compare to

- data on return heterogeneity: Calvet, Campbell, Sodini (2009), Fagereng, Guiso, Malacrino, Pistaferri (2016)
Equilibrium model where belief heterogeneity jointly determines

- asset price dynamics
- heterogeneity in saving and portfolio decisions
- wealth dynamics

All can (and should!) be tested in the data

- departure from rational expectations increases the number of free parameters
- new data provide empirical discipline