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ASSET PRICING WITH HETEROGENEOUS AGENTS AND LONG-RUN RISK

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January 2017

WHY MODELS WITH HETEROGENEOUS AGENTS?

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))

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- Use Euler equations as pricing restrictions for identification

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- 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

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Persistent components are **hard to measure**: opens room for

- **Learning / subjective beliefs**
  - Collard, Mukerji, Sheppard, Tallon (2012), Andrei, Carlin, Hasler (2016), Collin-Dufresne, Johannes, Lochstoer (2016a)
- **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

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

- Agents **disagree about the persistence** of the long-run risk component ρ_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))

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- These agents offer cheap insurance against shocks to x_t

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Moreover, 'deniers' gain wealth over time $\implies$ risk premia fall further

- This is **in contrast to separable preferences**
- Under separable preferences, agents with incorrect beliefs lose wealth on average

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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)
- **related theories**: Benhabib, Bisin (2016), Kacperczyk, Nosal and Stevens (2015), Bhandari (2015)

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