Disagreement, Speculation, and Aggregate Investment

Steven D. Baker    Burton Hollifield    Emilio Osambela

Discussed by Jaroslav Borovička (NYU)

July 16, 2013
Plan for the discussion

- nice clean paper

- clearly separates two channels

\[
Y_t = AK_t = C_t + I_t \quad \text{consumption-investment decision}
\]
\[
C_t = C_{a,t} + C_{b,t} \quad \text{consumption distribution}
\]

- mitigates some undesirable effects generated in heterogeneous agent economies with iid consumption growth
Plan for the discussion

1. Comment on the way how optimists and pessimists are modeled
   - speculation vs. preference for consumption/saving

2. Discuss the mechanism and results
   - asset pricing implications (qualitative / quantitative)
   - role of the wealth distribution as the state variable
   - ‘anomalies’
Modeling of belief distortions

- Agent $j$ with **subjective probability measure** $Q_j$

$$V_{j,0} = E_0^{Q_j} \left[ \int_0^\infty e^{-\rho t} u(C_{j,t}) \, dt \right]$$
Modeling of belief distortions

• Agent $j$ with subjective probability measure $Q_j$

$$V_{j,0} = E_0^{Q_j} \left[ \int_0^\infty e^{-\rho t} u(C_{j,t}) \, dt \right] = E_0 \left[ \int_0^\infty M_{j,t} e^{-\rho t} u(C_{j,t}) \, dt \right]$$

with

$$M_{j,t} = \exp \left( \int_0^t u_{j,s} \, dW_s - \frac{1}{2} \int_0^t |u_{j,s}|^2 \, ds \right)$$

(here, the disagreement process $u_{j,s} = (\delta_z - \delta_j) / \sigma$)
Modeling of belief distortions

Agent $j$ with subjective probability measure $Q_j$

$$V_{j,0} = E_0^Q\left[ \int_0^\infty e^{-\rho t} u(C_{j,t}) \, dt \right] = E_0\left[ \int_0^\infty M_{j,t} e^{-\rho t} u(C_{j,t}) \, dt \right]$$

with

$$M_{j,t} = \exp\left( \int_0^t u_{j,s} \, dW_s - \frac{1}{2} \int_0^t |u_{j,s}|^2 \, ds \right)$$

(here, the disagreement process $u_{j,s} = (\delta_z - \delta_j) / \sigma$)

- agent overweighs/underweighs probabilities = speculation
Modeling of belief distortions

- Agent \( j \) with \textbf{subjective probability measure} \( Q_j \)

\[
V_{j,0} = E_0^{Q_j} \left[ \int_0^\infty e^{-\rho t} u(C_{j,t}) \, dt \right] = E_0 \left[ \int_0^\infty M_{j,t} e^{-\rho t} u(C_{j,t}) \, dt \right]
\]

with

\[
M_{j,t} = \exp \left( \int_0^t u_{j,s} dW_s - \frac{1}{2} \int_0^t |u_{j,s}|^2 \, ds \right)
\]

(here, the disagreement process \( u_{j,s} = (\delta_z - \delta_j) / \sigma \))

- \textit{agent overweighs/underweighs probabilities = speculation}

- The agent then \textbf{perceives a different trend} in quantities that are driven by the Brownian motion:

\[
\frac{dK_t}{K_t} = (\phi (i_t) - \delta_j) \, dt + \sigma dW_{j,t}
\]
Two consequences

1. Agents’ **disagreement** modeled through different $M_j$ processes leads to volatile relative consumption allocations (static problem $C_t = C_{a,t} + C_{b,t}$)

\[
\frac{M_{a,t}}{M_{b,t}} = \frac{1}{\lambda} \frac{u'(C_{b,t})}{u'(C_{a,t})}
\]
Two consequences

1. Agents’ **disagreement** modeled through different $M_j$ processes leads to volatile relative consumption allocations (static problem $C_t = C_{a,t} + C_{b,t}$)

\[
\frac{M_{a,t}}{M_{b,t}} = \frac{1}{\lambda} \frac{u'(C_{b,t})}{u'(C_{a,t})}
\]

This is the **speculative motive**. Risk premia move around with wealth shares.

- Good shock: optimists gain a larger wealth share $\implies$ lower risk premium.
Two consequences

1. Agents’ **disagreement** modeled through different $M_j$ processes leads to volatile relative consumption allocations (static problem $C_t = C_{a,t} + C_{b,t}$)

$$\frac{M_{a,t}}{M_{b,t}} = \frac{1}{\lambda} \frac{u'(C_{b,t})}{u'(C_{a,t})}$$

This is the **speculative motive**. Risk premia move around with wealth shares.

- Good shock: optimists gain a larger wealth share $\implies$ lower risk premium.

2. **Different perceived trends** lead to different aggregate **consumption-saving decisions** $(Y_t = C_t + I_t)$

- Optimists perceive a higher trend $\implies$ with $IES < 1$, wealth effect dominates $\implies$ lower desire to save.
Two consequences

1. Agents’ **disagreement** modeled through different $M_j$ processes leads to volatile relative consumption allocations (static problem $C_t = C_{a,t} + C_{b,t}$)

$$\frac{M_{a,t}}{M_{b,t}} = \frac{1}{\lambda} \frac{u'(C_{b,t})}{u'(C_{a,t})}$$

This is the **speculative motive**. Risk premia move around with wealth shares.

- Good shock: optimists gain a larger wealth share $\implies$ lower risk premium.

2. Different perceived trends lead to different aggregate consumption-saving decisions ($Y_t = C_t + I_t$)

- Optimists perceive a higher trend $\implies$ with $IES < 1$, wealth effect dominates $\implies$ lower desire to save.
- Good shock: higher risk-free interest rate and (in a production economy) a lower saving rate.
- Authors call this **speculative aggregate consumption risk**. Is it about speculation?
Risk-free rate vs risk premium effects

In **good times**, optimists gain a larger wealth share

- risk premia decrease $\implies$ P/D ratios pushed up, expected returns down
- risk-free rate increases $\implies$ P/D ratios pushed down, expected returns up
Risk-free rate vs risk premium effects

In **good times**, optimists gain a larger wealth share

- risk premia decrease $\implies$ P/D ratios pushed up, expected returns down
- risk-free rate increases $\implies$ P/D ratios pushed down, expected returns up

Empirically, the first effect should dominate.

- It is the **opposite in this paper** because IES is very low . . .
Risk-free rate vs risk premium effects

In **good times**, optimists gain a larger wealth share

- risk premia decrease $\implies$ P/D ratios pushed up, expected returns down
- risk-free rate increases $\implies$ P/D ratios pushed down, expected returns up

Empirically, the first effect should dominate.

- It is the **opposite in this paper** because IES is very low . . .
- . . . at least weaker than in an endowment economy with iid growth.
  - production side (investment choice) absorbs some of the fluctuations in the risk-free rate
Risk-free rate vs risk premium effects

In **good times**, optimists gain a larger wealth share

- risk premia decrease $\implies$ P/D ratios pushed up, expected returns down
- risk-free rate increases $\implies$ P/D ratios pushed down, expected returns up

Empirically, the first effect should dominate.

- It is the **opposite in this paper** because IES is very low . . .
- . . . at least weaker than in an endowment economy with iid growth.
  - production side (investment choice) absorbs some of the fluctuations in the risk-free rate

**Solution**

- Compensate willingness to save of the optimistic agent
  - Make the optimist more patient
Risk-free rate vs risk premium effects

In **good times**, optimists gain a larger wealth share

- risk premia decrease $\implies$ P/D ratios pushed up, expected returns down
- risk-free rate increases $\implies$ P/D ratios pushed down, expected returns up

Empirically, the first effect should dominate.

- It is the **opposite in this paper** because IES is very low . . .
- . . . at least weaker than in an endowment economy with iid growth.
  - production side (investment choice) absorbs some of the fluctuations in the risk-free rate

**Solution**

- Compensate willingness to save of the optimistic agent
  - Make the optimist more patient
- Recursive (Duffie-Epstein-Zin) preferences with $IES > 1$.
  - $IES > 1$ will flip the result.
Qualitative and quantitative success of the results

- Authors claim superior performance relative to an endowment economy
  - heterogeneous beliefs but iid aggregate consumption growth.

- But do we gain also relative to a similar economy with homogeneous beliefs?

- Or are we just (at least partially) correcting unappealing features of the endowment economy?
Interest rates

- IR less sloped than in the endowment economy $\Rightarrow$ lower volatility
- but in the representative agent economy, IR is constant
Consumption and investment

- aggregate consumption: $C_t = \frac{C_t}{K_t} K_t$ (and $\frac{C_t}{K_t}$ and $K_t$ move in the same direction)
- consumption more volatile than investment (equal volatility in representative agent economy)
Consumption volatility

- aggregate consumption volatility increases, but only very modestly
- price of risk will also increase only very modestly
Price of risk

- price of risk a weighted average of the prices in homogeneous agent economies
- small endogenous effect generated by the heterogeneity
Stock return volatility

- stock return volatility in the endowment economy lower than in the homogenous agent economy
  - strongly procyclical risk-free interest rate
- production economy: risk-free rate less procyclical
  - stock returns still less volatile than in the homogeneous agent economy
- risk-free rate strongly procyclical, risk premia modestly countercyclical
- \( \Rightarrow \) price-dividend ratio countercyclical, although less than in the endowment economy
Fluctuations in the wealth distribution

The only relevant state variable is the wealth distribution.

- How much fluctuations in wealth distribution does the model generate?
  - way to discipline the belief distortions
  - simulate and show statistics
Fluctuations in the wealth distribution

The only relevant state variable is the wealth distribution.

- How much fluctuations in wealth distribution does the model generate?
  - way to discipline the belief distortions
  - simulate and show statistics
- How much fluctuations in wealth distribution do we really observe in data?
Fluctuations in the wealth distribution

The only relevant state variable is the wealth distribution.

- How much fluctuations in wealth distribution does the model generate?
  - way to discipline the belief distortions
  - simulate and show statistics

- How much fluctuations in wealth distribution do we really observe in data?

- tension: high risk aversion moderates fluctuations in wealth distribution
  - trying to correct for this with a higher belief dispersion makes the risk-free rate more volatile
Fluctuations in the wealth distribution

The only relevant state variable is the wealth distribution.

- How much fluctuations in wealth distribution does the model generate?
  - way to discipline the belief distortions
  - simulate and show statistics
- How much fluctuations in wealth distribution do we really observe in data?
- tension: high risk aversion moderates fluctuations in wealth distribution
  - trying to correct for this with a higher belief dispersion makes the risk-free rate more volatile

Alternatives

- Fluctuations in beliefs
- This seems to be more promising (although more difficult to discipline).
Fluctuations in the wealth distribution

The only relevant state variable is the wealth distribution.

- How much fluctuations in wealth distribution does the model generate?
  - way to discipline the belief distortions
  - simulate and show statistics

- How much fluctuations in wealth distribution do we really observe in data?

  **tension**: high risk aversion moderates fluctuations in wealth distribution
  - trying to correct for this with a higher belief dispersion makes the risk-free rate more volatile

Alternatives

- Fluctuations in beliefs
  - This seems to be more promising (although more difficult to discipline).

Long horizon implications

- No steady state distribution for wealth share.
- Recursive preferences would address this (*Borovička (2013)*).
value / size premium etc. are cross-sectional predictions \(\Rightarrow\) this is a representative firm model
Anomalies

- value / size premium etc. are cross-sectional predictions ⇒ this is a representative firm model
- try to gain time-series insight from good and bad times
  - the logic then must be (?) that different firms are permanently in good or bad times and thus have different associated risk premia
Anomalies

- value / size premium etc. are **cross-sectional predictions** → this is a representative firm model
- try to gain time-series **insight from good and bad times**
  - the logic then must be (?) that different firms are permanently in good or bad times and thus have different associated risk premia
- but the above shape is driven by the **risk-free rate effect**, not risk premium
  - value / size premia are about risk premia
Belief heterogeneity in a simple endowment economy generates many undesirable features
  - speculation (betting) vs. preferences for consumption / saving

Adding production side alleviates these problems to some extent
  - model still performs worse in many aspects than a homogeneous economy

Separating IES and risk aversion would help much more (Duffie-Epstein-Zin)

Is the wealth distribution mechanism the right story?

Anomalies . . .

Still a nice paper: uncovers all these features in a very transparent way.