A Risk-centric Model of Demand Recessions and Macroprudential Policy

Ricardo Caballero Alp Simsek

MIT and NBER

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Output and risks are absorbed simultaneously

- A productive capacity (and its expansion) generates output and risks, **both** of which need to be absorbed by economic agents
- "Traditional" Keynesian macro focused on the output gap.
- "Traditional" finance focused on risk pricing.
- First attempts to bridge the gap:
  - Brunnermeier-Sannikov and balance sheet recessions (supply side).
  - Safe asset shortages and safety traps.

This paper: A risk-centric macro model.

- Output gaps & risks are jointly determined and feed into each other.
- **Amplification** mechanisms, powerful with **pessimism**.
- Disagreement/**Speculation** worsens recessions, motivates **macropru.**

Key features:

- **Aggregate risk** and **interest rate frictions.**
- **No financial frictions.**

Two period model to illustrate the demand mechanism

- Periods, $t \in \{0, 1\}$. Capital is fixed. Productivity, $z_0 = 1$
- z_1 is uncertain with expected growth, g, and volatility, σ.
- Actual output, $y_t \leq z_t$. Assume $y_1 = z_1$. Focus on y_0.
- Market portfolio with payoff z_1 and endogenous price Q.
- **Demand side:** Log utility, choose $c_0, a_0, \omega^k, \omega^f$ (in eq, $\omega^k = 1$).
- **Supply side:** NK firms with fixed prices,

$$y_0 = c_0 \leq z_0.$$

- **Monetary policy:** Replicates $y_0 = z_0 = 1$ subject to **lower bound:**

$$r^f = \max\left(0, r^{f*}\right).$$

- Log utility implies **output-price relationship:**

$$y_0 = e^{\rho} Q.$$

- Optimal portfolio choice implies **risk-balance condition:**

$$\sigma = \underbrace{\frac{g - \log Q - r^f}{\sigma}}_{\text{Sharpe ratio}}$$

First-best, $y_0 = z_0 = 1$, requires $Q^* = e^{-\rho}$ and interest rate:

$$r^{f*} = g + \rho - \sigma^2 \ .$$

Sufficiently large σ-shock implies $r^f = 0$ and **recession:**

$$\log Q = g - \sigma^2 < \log Q^*.$$

Dynamic model to analyze amplification mechanisms

- **Potential** output growth is a state contingent Bru-San process:

$$\frac{dAk_{t,s}}{Ak_{t,s}} = \underbrace{\left(\varphi\left(\frac{i_{t,s}}{k_{t,s}}\right) - \delta\right)}_{g_{t,s}} dt + \sigma_s dZ_t \text{ for each } s \in S = \{1, 2\}.$$

- States differ only in terms of **the risk premium**, $\sigma_1^2 < \sigma_2^2$.
- Transition out of each state according to Poisson processes.
- λ_s denotes the transition probability out of state s into state $s' \neq s$.
- Remaining assumptions are the same as before.

Output-price relation(s) in the dynamic model

- Prices affect consumption (wealth effect) and investment (Q):

$$\frac{c_{t,s}}{k_{t,s}} = \rho Q_{t,s} \text{ and } \frac{i_{t,s}}{k_{t,s}} = \psi \left(Q_{t,s} - 1 \right).$$

- There is still **output-price relationship:**

$$A\eta_{t,s} = \rho Q_{t,s} + \psi \left(Q_{t,s} - 1 \right).$$

- There is full factor utilization, $\eta_{t,s} = 1$, only if, $Q_{t,s} = Q^*$.
- There is also **growth-price relationship:**

$$g_{t,s} = \psi q_{t,s} - \delta, \text{ where } q_{t,s} = \log Q_{t,s}.$$

Risk balance conditions in the dynamic model

$$\sigma_s = \frac{\overbrace{\rho + \psi q_s - \delta + \lambda_s \left(1 - \frac{Q_s}{Q_{s'}}\right)}^{\text{return to capital including transition gains/losses}} - r_s^f}{\sigma_s} \text{ for } s \in \{1, 2\}.$$

High-risk-premium state 2 features,

$$r_2^f = 0, q_2 < q^*.$$

Low-risk-premium state 1 features,

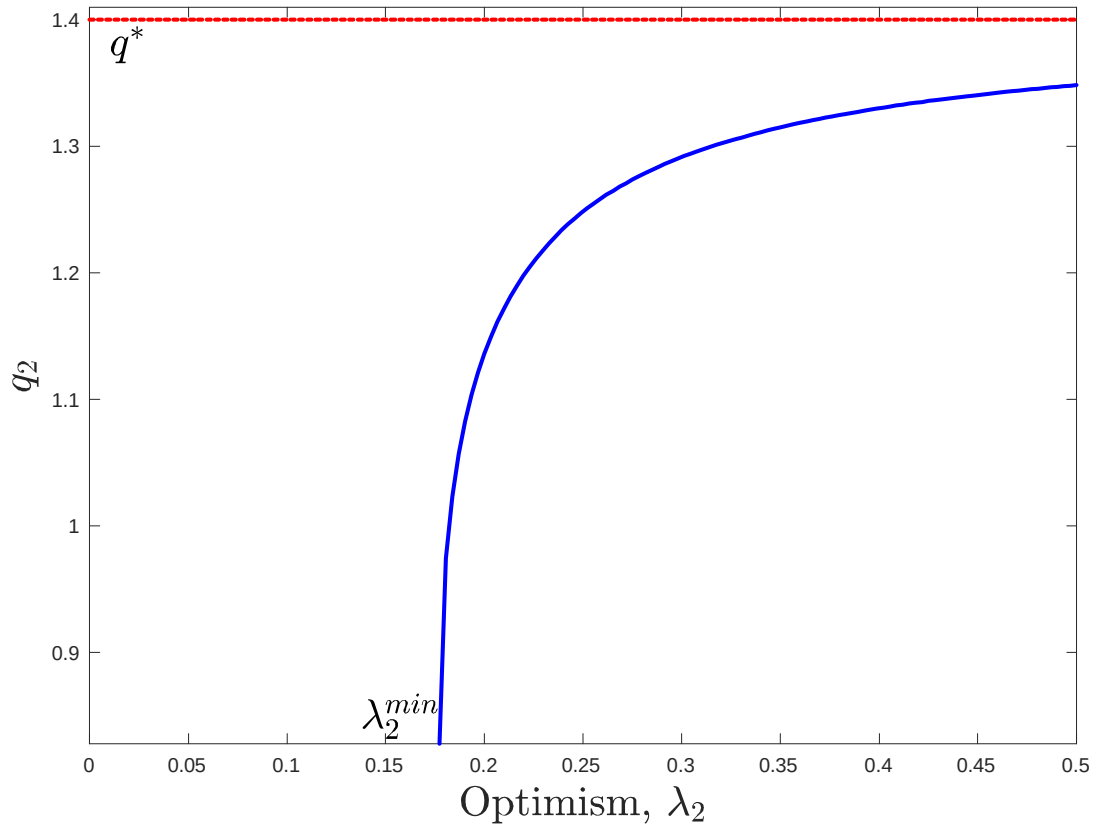
$$r_1^f > 0, q_1 = q^*.$$

High risk-premium state: Low prices and feedbacks

$$\sigma_2 = \frac{\overbrace{\frac{\rho Q_2}{Q_2} + \psi q_2 - \delta}^{\text{feedbacks}} + \overbrace{\lambda_2 \left(1 - \frac{Q_2}{Q^*}\right)}^{\text{hope}} - 0}{\sigma_2}$$

Adjustment through Q_2 leads to an (inefficient) recession.

Destabilizing feedbacks: Low dividends, ρQ_2, low growth, $\psi q_2 - \delta$.



- Feedbacks becomes more severe as λ_2 drops (pessimism).
- This also reduces the interest rates during the low-risk state, r_1^f.

Disagreements to analyze speculation

- **Belief disagreements** are important in this context:

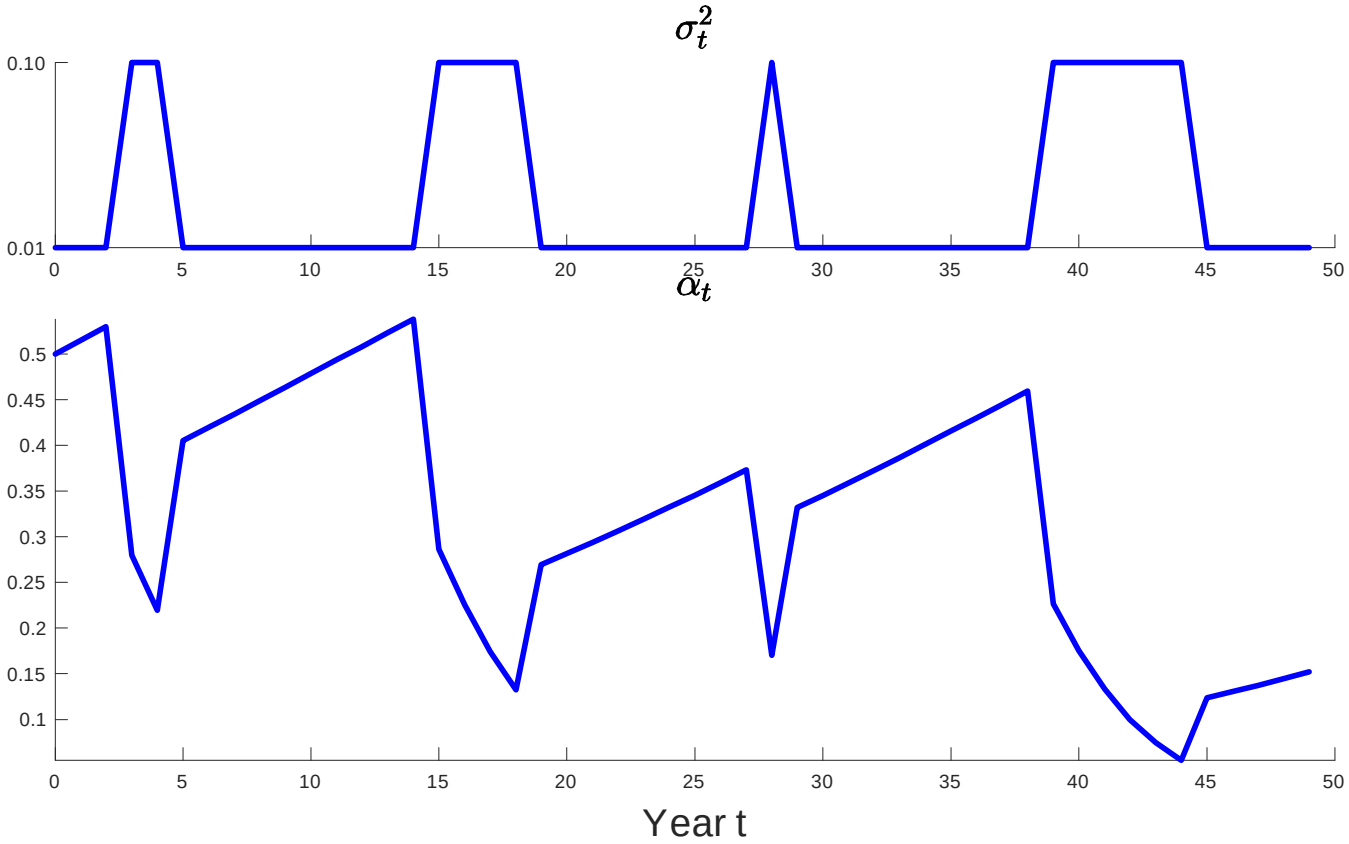
$$\overbrace{\lambda_2^o > \lambda_2^p}^{\text{optimists think recovery is likely and the recession is unlikely}} \quad , \quad \overbrace{\lambda_1^o < \lambda_1^p}$$

- **Effective optimism** depends on optimists' wealth share:

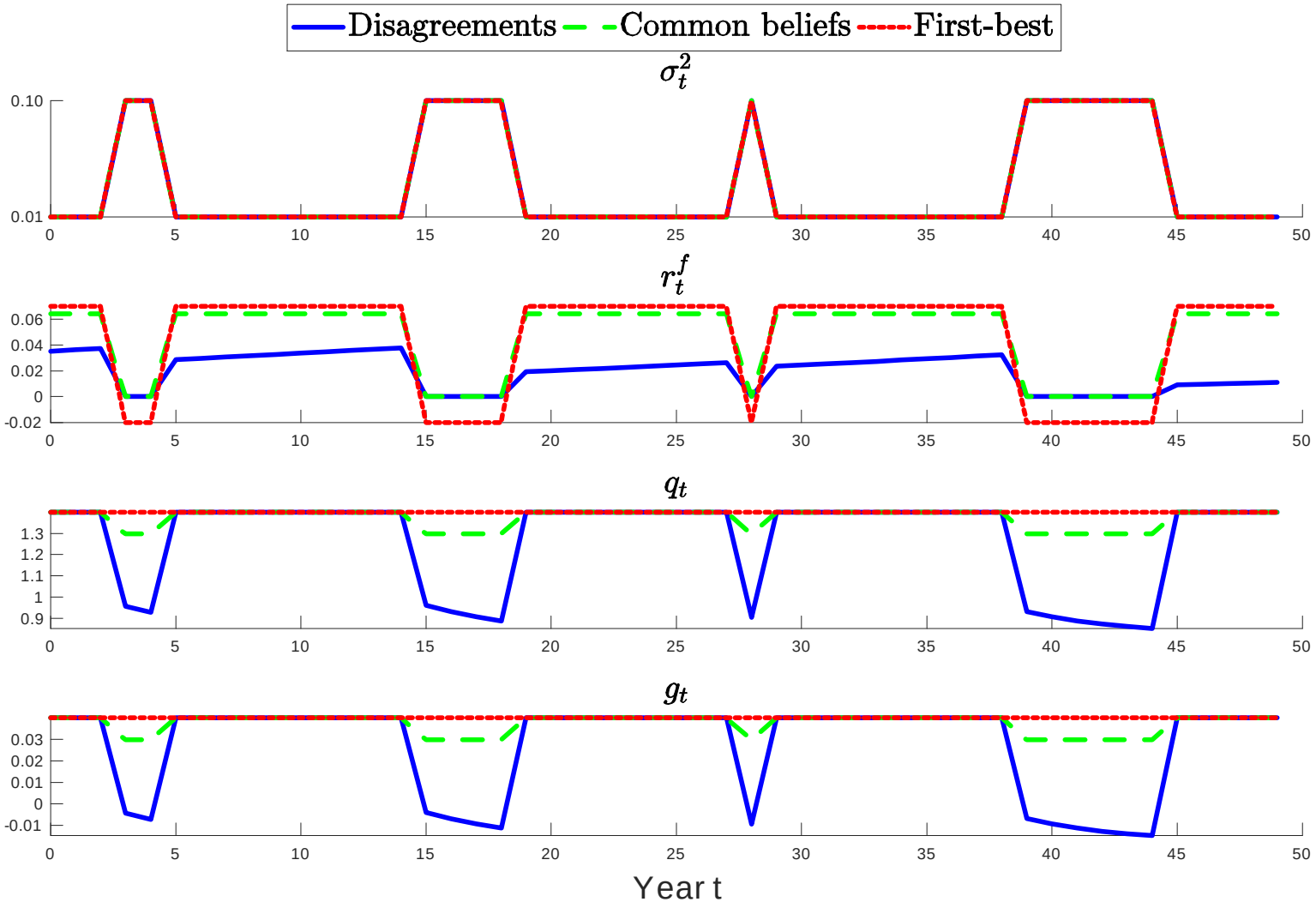
$$\overline{\lambda}_{t,s} = \alpha_{t,s}\lambda_s^o + (1 - \alpha_{t,s})\,\lambda_s^p.$$

- **Complete markets:** Arrow-Debreu securities for jump events.
- Optimists **speculate** via these securities...

Speculation induces extrapolation in effective belief



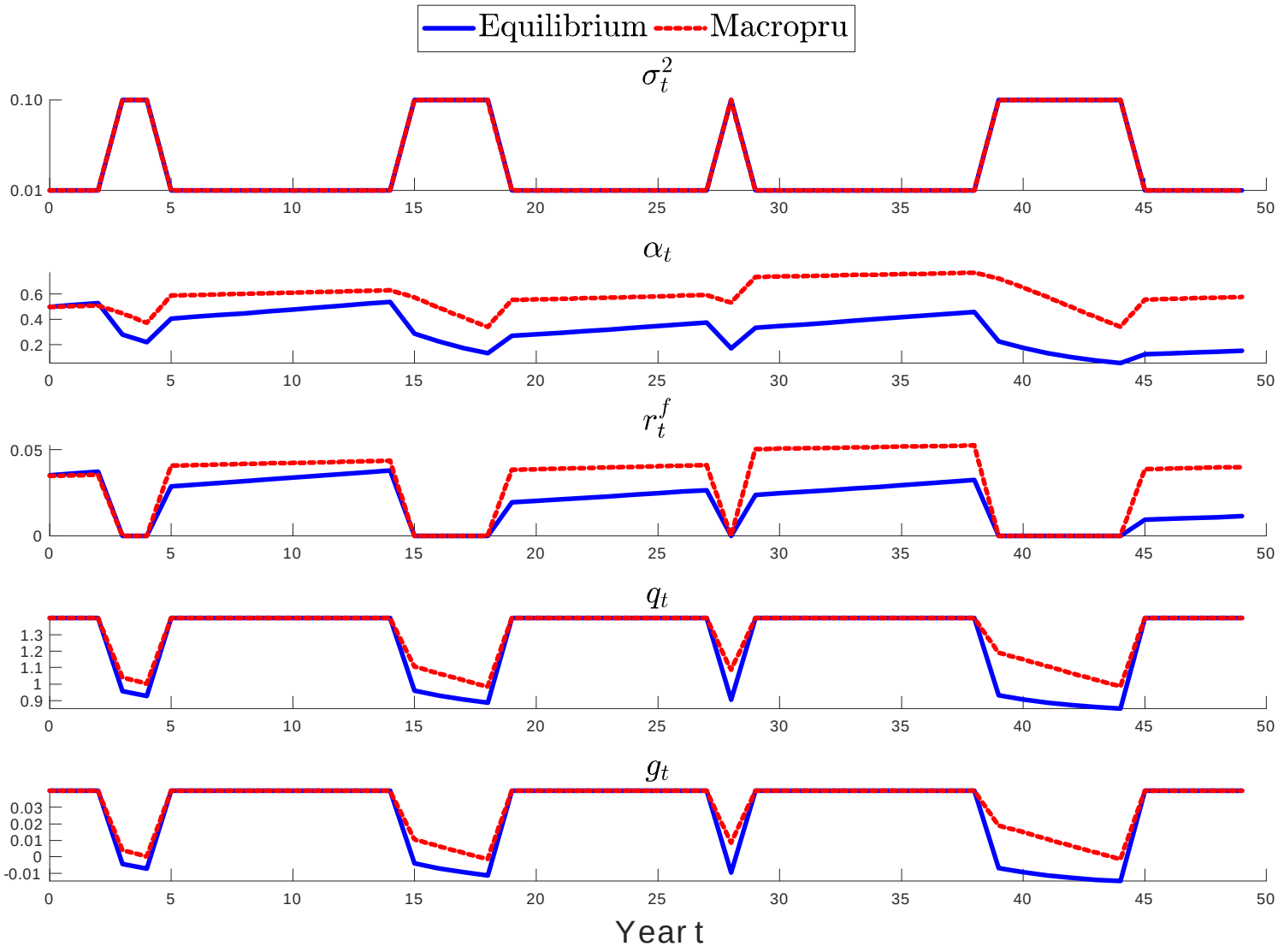
S-driven extrapolation drags down aggregate demand/worsens recession...

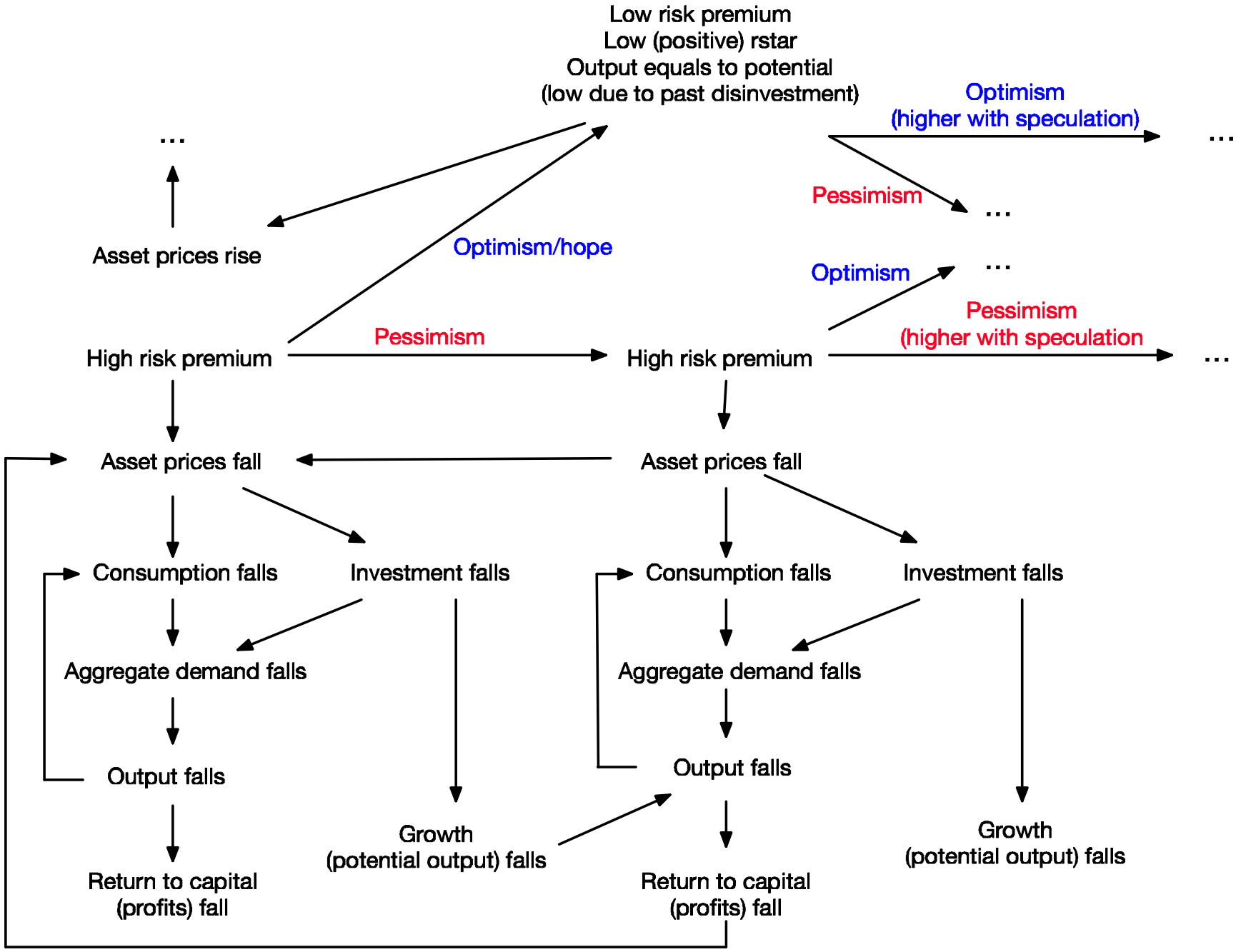

Disagreements
Common beliefs
First-best
σ_t^2
0.10
0.01
r_t^f
0.06
0.04
0.02
0
-0.02
q_t
1.3
1.2
1.1
1
0.9
g_t
0.03
0.02
0.01
0
-0.01
0
5
10
15
20
25
30
35
40
45
50
Year t

Procyclical macroprudential policy improves welfare

- Macroprudential policy: Make optimists invest as-if more pessimistic.
- Generates a **Pareto improvement** (we respect people's beliefs)...
- ...because it internalizes **aggregate demand externalities**.

It is less valuable in the high-vol state (and can even lower welfare) due to its adverse effect on current asset prices/aggregate demand.


Equilibrium
Macropru
σ_t^2
α_t
r_t^f
q_t
g_t
Year t


Low risk premium
Low (positive) rstar
Output equals to potential
(low due to past disinvestment)
Optimism
(higher with speculation)
...
...
Pessimism
...
Asset prices rise
Optimism/hope
Optimism
...
Pessimism
(higher with speculation
Pessimism
High risk premium
High risk premium
...
Asset prices fall
Asset prices fall
Consumption falls
Investment falls
Consumption falls
Investment falls
Aggregate demand falls
Aggregate demand falls
Output falls
Output falls
Growth
(potential output) falls
Growth
(potential output) falls
Return to capital
(profits) fall
Return to capital
(profits) fall