Dynamic Information Regimes in Financial Markets

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Motivating question

- How do small shocks get amplified into crises and crashes?
- Can information dynamics contribute to these effects?
- Three vignettes: Greek debt crisis; subprime MBS crisis; brokerage firm closures
- Key features: costly information acquisition, stochastic information precision; feedback from investors to information environment; rational investors choices

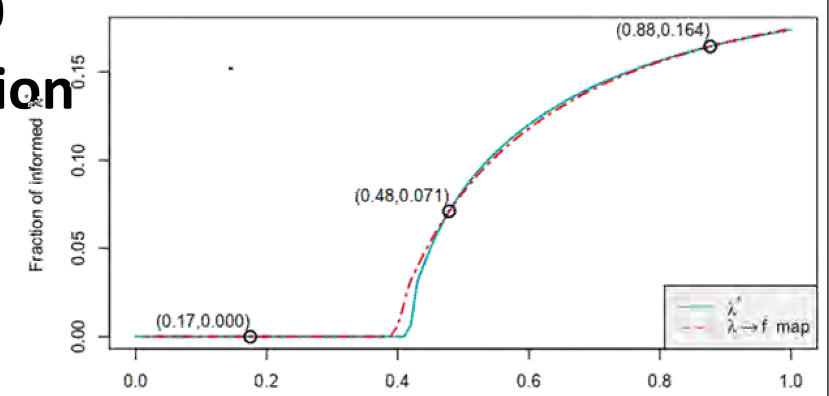
With more information:

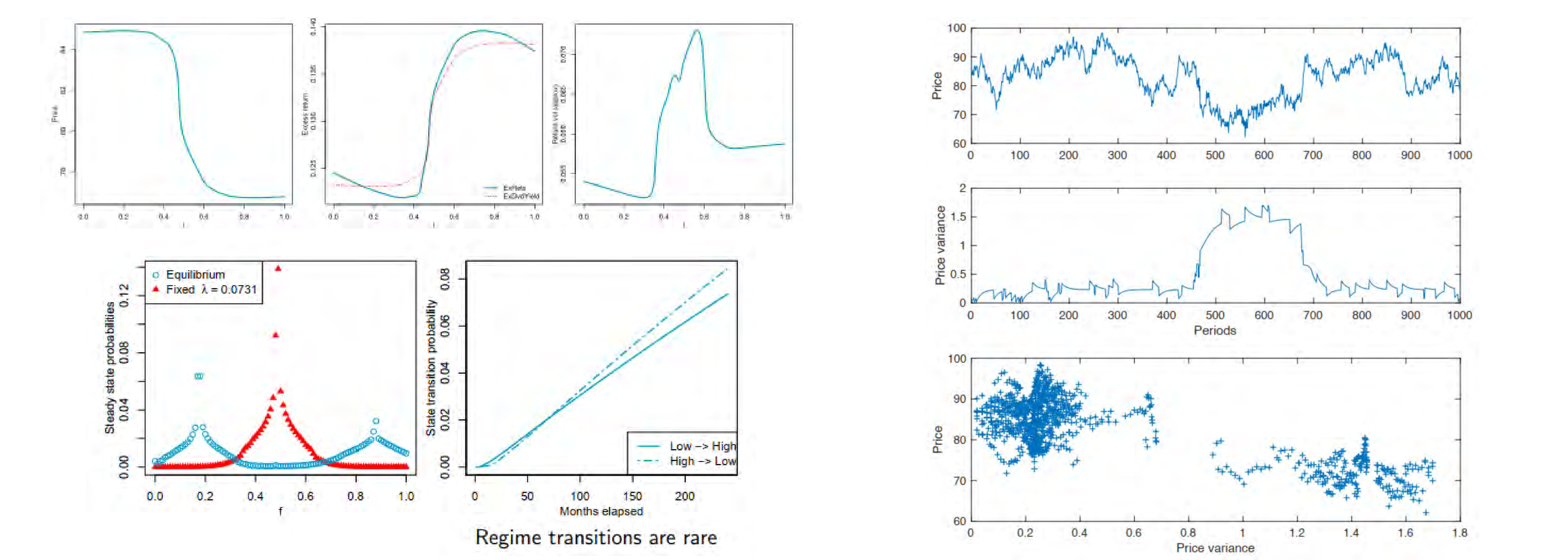
- Price volatility increases and price typically falls
- Market moves between "good" (low volatility, high price) and "bad" (high volatility, low price) regimes
- Regime switches driven by information acquisition and asymmetry, feedback from investors
- Effects can be potentially dramatic even without negative information of fundamentals

1. Level of knowable information model

$f_t = \Pi_{[0,1]}(a_f + k_f(f_{t-1} - a_f) + b_f\lambda(f_{t-1}) + \epsilon_{f,t}), b_f>0$

- Informed fraction generally increases with precision
- Simulated process (with shocks) spends most of its time near high and low intersections
- Middle intersection is an unstable equilibrium
- Two regimes emerge from information choices





More information is available/more investors seek information
This drives up the price variance (in a dynamic model):

- information reduces uncertainty about the current dividend…
- … but it increases uncertainty about end-of-period price (when more information becomes available about the next dividend)

With higher variance, more asymmetry, risk-averse investors require a higher return, lowering the price
This could be one factor (not the only one) in crashes and crises

Model introduction

- Dividend process follows: $D_t = \bar{D} + \rho(D_{t-1} - \bar{D}) + M_t, \rho \in [0,1)$
- Riskless asset has return R; supply of risky asset is: $X_t \sim N(\mu_X, \sigma_X^2)$
- Dividend innovations decomposed as: $M_t = m_{t-1} + \theta_{t-1} + \varepsilon_t$, corresponding to private knowledge, public knowledge, and random perturbation
- Precisions are given by: $f_t = Var[m_t + \theta_t]/Var[M]$, $\phi_t = Var[m_t]/Var[m_t + \theta_t]$
- Overlapping generating investors choose to become informed or not at a cost c_I
- Based on their information, they solve

$$J_t^{U/I} = \max_q E[E[W_{t+1}|\mathbf{I}_t^{U/I}, f_{t+1}] - \frac{\gamma}{2} Var[W_{t+1}|\mathbf{I}_t^{U/I}, f_{t+1}]|\mathbf{I}_t^{U/I}]$$

Model solved by: market clearing and information equilibrium

- Demand of risky asset equals its supply
- Investor is indifferent between getting informed (at the cost) or not

There exists a market equilibrium with a linear price process as

$$P_t = a(f_t) + b(f_t)m_t - c(f_t)(X_t - \mu_X) + g\theta_t + d(f_t)D_t$$

- There exists $(\mathbf{b}, \mathbf{c}, \lambda)$ such that $(\mathbf{b}, \mathbf{c})$ defines a market equilibrium given λ, and λ defines a possibly mixed information equilibrium given $(\mathbf{b}, \mathbf{c})$

2. Public-private mix model

$\phi_t = \Pi_{[0,1]}(\phi_{t-1} + b_\phi\lambda(\phi_{t-1}) + \epsilon_{\phi,t}), b_\phi<0$

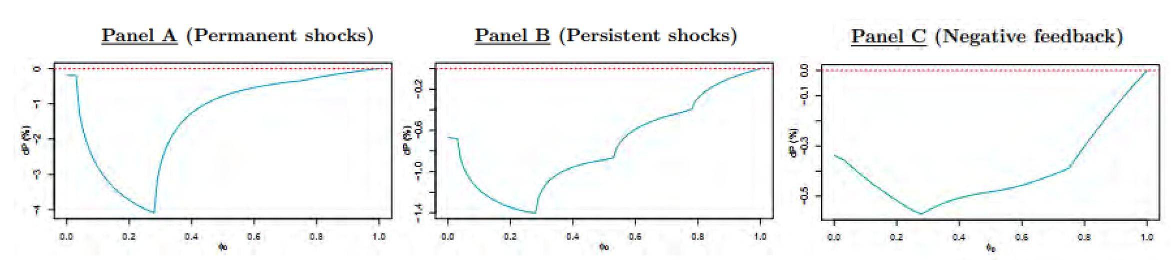


Figure 12: Equilibrium price responses to exogenous information shocks to ϕ

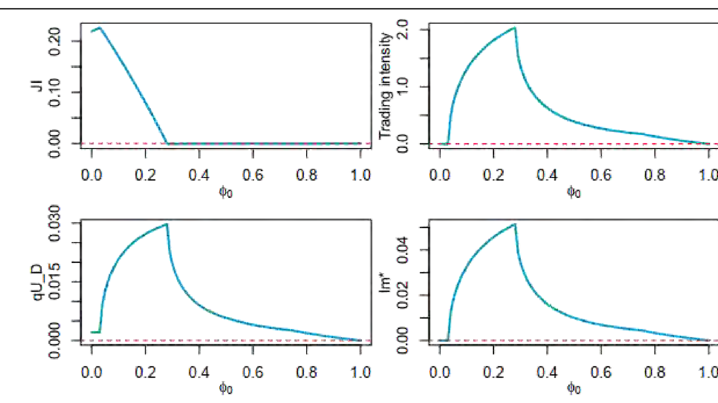


Figure 11: Equilibrium responses to a shock $\phi_{t+1} = \phi_t + 0.25$.

With brokerage disclosure (a negative shock $\epsilon_{\phi,t}$ in our model)

- Prices of affected stocks become less informative
  $c(\phi_t)$ increases, implying greater price impact, less liquidity
- Hedge funds trade more aggressively on affected stocks
  Goldstein-Yang (2015) measure of trading intensity increases,

$$I_t = \lambda_t \frac{\partial q_t^I}{\partial m_t} = \frac{b(\phi_t)}{c(\phi_t)}$$

- Hedge funds experience better investment performance
  Moving out of the region $\lambda(\phi_t) = 0$, the first investor to become informed has an increase in expected utility
- Sophisticated investors increase their information acquisition
- Conditional on large hedge fund presence , closure has smaller effect on price informativeness (marginal quantities decrease)
- Negative feedback stabilizes the price impact after brokerage closure

Selected references

1. Grossman and Stiglitz (1980), Spiegel (1998), Watanabe (2008)
2. Gorton and Ordonez (2014), Chen et al. (2018)