China's Model of Managing the Financial System

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Motivation

- Growing concerns about financial instability of China
  - Chinese stock market: Turmoil in 2015
  - Chinese exchange market: Concerns about FX management
  - Housing markets: Overheating
  - Rising leverage across the nation
- China's financial system: new conceptual framework needed
- China has a distinct economic model: two-track system
  - state sector vs. private sector (planning mixed with market economy)
  - financial system serves mainly to fund the state sector
- Distinct institutional setting in the financial markets
  - Large population of inexperienced retail investors
  - Heavy interventions by the government

Government's Paternalistic Philosophy

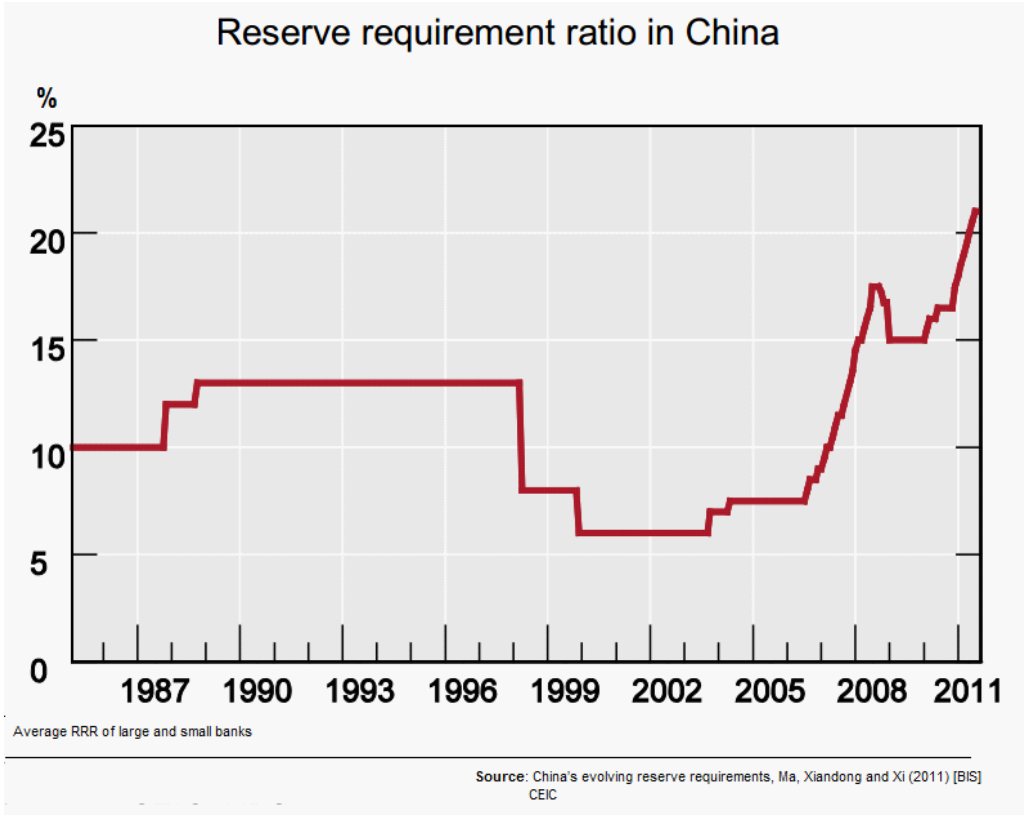
- Large price **volatility** in China's stock markets and heavy turnover
  - highest turnover rate among major stock markets
- Asset prices often **deviate from fundamentals**
  - large price differentials between A-B and A-H stock pairs, e.g., Mei, Scheinkman and Xiong (2009)
  - dramatic warrant bubble in 2005-2008, e.g., Xiong and Yu (2011)
- Large population of **inexperienced retail investors**
  - retail investors hold 50% of tradable shares and contribute to 90% of trading volume
- **CSRC's mission**: protect retail investors and stabilize markets

Government Interventions in China's Financial System

- Counter-cyclical **policies and regulations**
  - interest rate policy and bank reserve ratio policy
    - since Nov 2014, interest rate was reduced 6 times and reserve ratio 5 times
  - suspension and quota control of IPO issuance
  - stamp tax on stock trading
  - mortgage rate and first payment requirement
  - ...
- Public guidance by official **media**, such as People's Daily and Xinhua Press
- **Direct trading** in stock markets
  - A "national team" was directed to bail out the stock market in summer 2015

Reserve Requirement Ratio in China

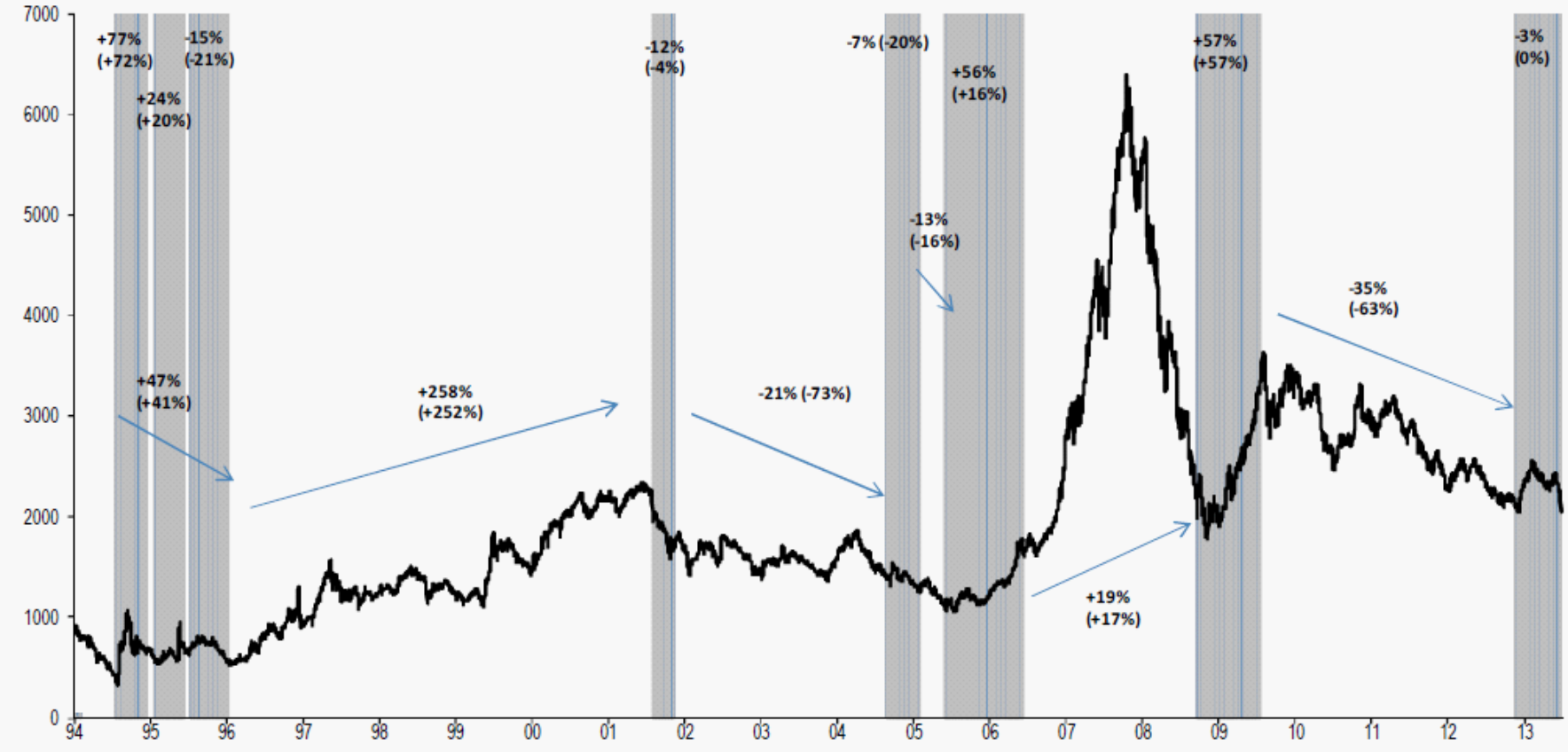
- Active monetary policy instrument: up 32 times, down 4 times from 2003-2011
- Powerful and direct impact on credit supply, money multiplier



IPO Issuance in A-Share Markets

- The government (CSRC) directly **controls IPO issuance**
  - had suspended IPO issuance 8 times
  - quantity and allocation of quota

Figure 1: Shanghai A share index performance over eight IPO suspension periods

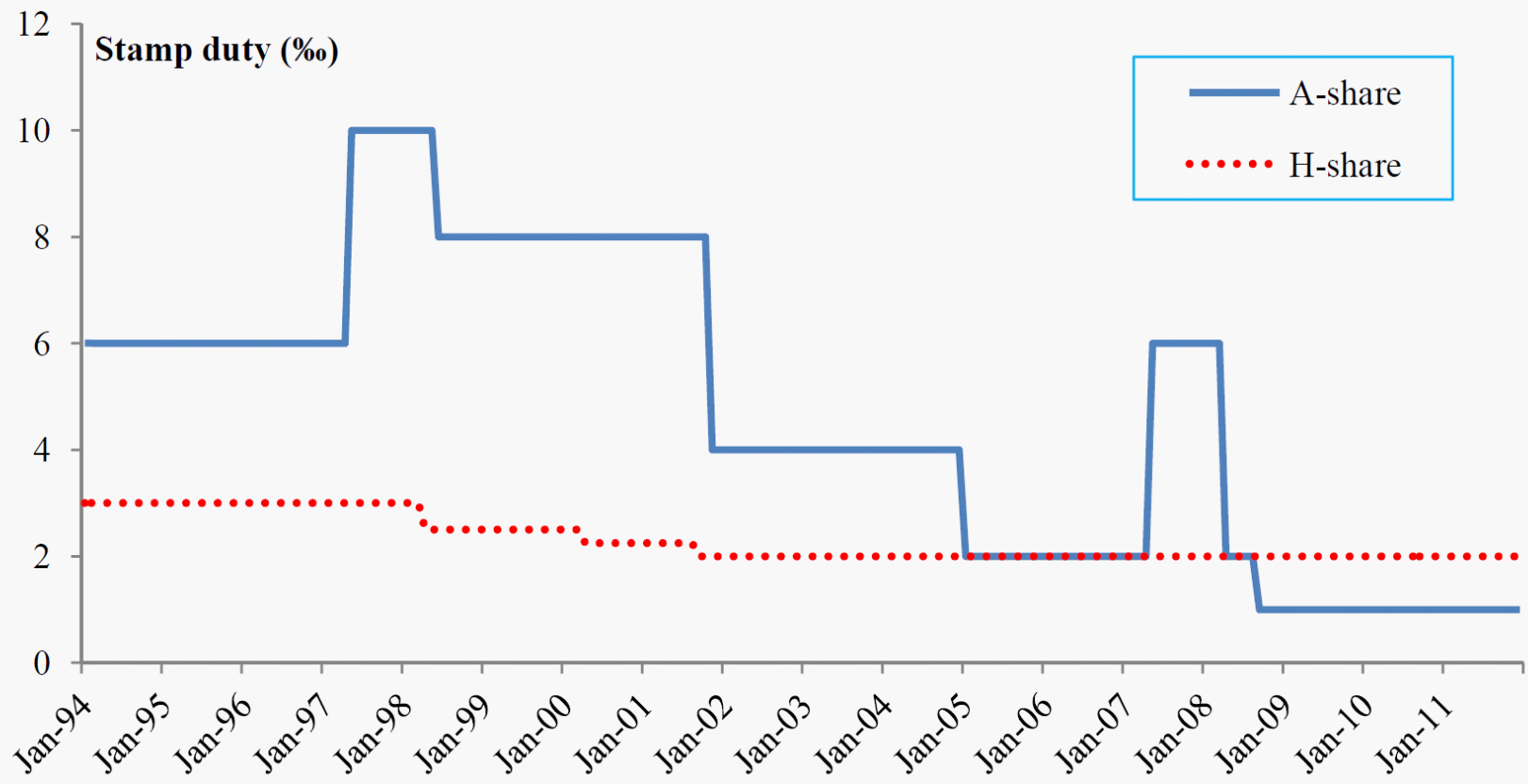


Source: Bloomberg, Datastream. Remark: Grey areas are the IPO suspension periods. Figures in blanket are performance relative to MXEM.

Stamp Tax in Stock Trading

Figure 1 Evolution of Stamp Duties in China and Hong Kong

The figure shows the evolution of trading stamp duty (sum over buyers and sellers) in A-share and H-share markets. Y-axis shows the absolute level of stamp duty in ‰.



Conceptual Questions

Need a framework to analyze the effects of government intervention in asset markets

- How would government intervention affect market dynamics?
- How would market participants react to government intervention?
  - trade along with or against the government?
- What is the right objective of government intervention?
  - reduce price volatility or improve information efficiency?

We develope a framework

- Intensive intervention makes **government noise a pricing factor** in asset prices and this factor gets further **magnified by market speculation**
- Potential inconsistency: **reducing price volatility** and **improving information efficiency**

A Model with Perfect Information

Infinitely many periods: $t = 0, 1, 2...$
A risky asset, which pays a stream of **dividends** over time:

$$D_t = \theta_t + \varepsilon_t^D$$

- θ_t is an exogenous **fundamental variable**:

$$\theta_t = \rho_\theta \theta_{t-1} + \varepsilon_t^\theta$$

  - **Publicly observable**
  - will be made unobservable later to introduce information frictions and policy errors
- Government intervention does not directly affect asset cash flow
  - different from Pastor & Veronesi (2012) and Bond & Goldstein (2015), which focus on policy interventions that affect cash flow

A Model with Perfect Information

Noise traders submit random market orders:

$$N_t = \rho_N N_{t-1} + \sigma_N \varepsilon_t^N$$

- Price insensitive orders, capturing unstable market forces

Rational short-term investors each maximize myopic trading profit:

$$U_t^i = \max_{X_t^i} E\left[-\exp\left(-\gamma W_{t+1}^i\right) \mid \theta_t, N_t \right]$$

with $W_{t+1}^i = R^f \bar{W} + X_t^i R_{t+1}$ and $R_{t+1} = D_{t+1} + P_{t+1} - R^f P_t$.

- Equilibrium without any government intervention:

$$\int_0^1 X_t^i \, dt = N_t$$

Market Breakdown

Conjecture a linear equilibrium: $P_t = \frac{\rho_\theta}{R^f - \rho_\theta}\theta_t + p_N N_t$

- Optimal position of each myopic investor:

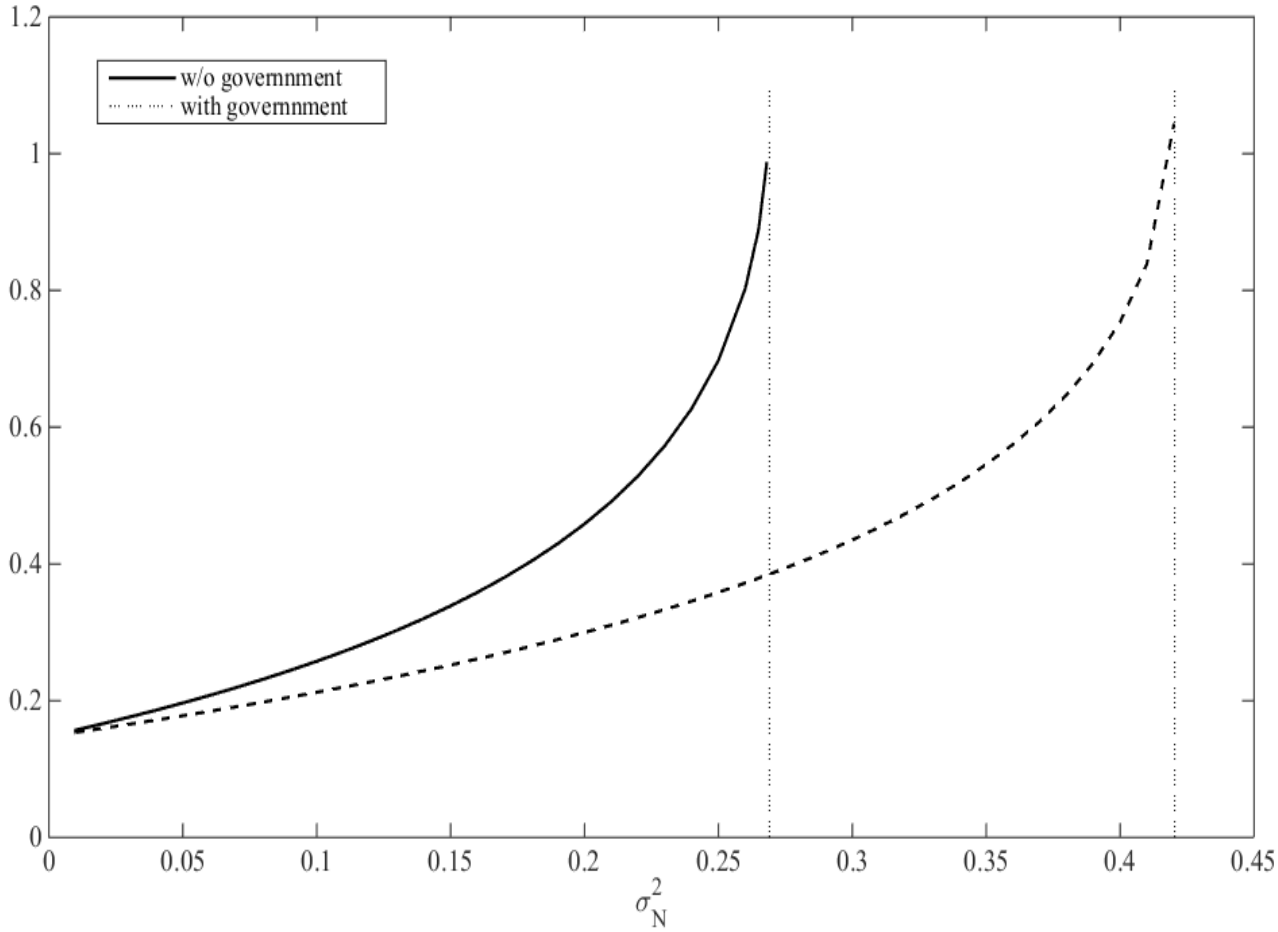
$$X_t^i = \frac{1}{\gamma}\frac{E_t\left[D_{t+1} + P_{t+1} - R^f P_t\right]}{Var_t\left[D_{t+1} + P_{t+1}\right]} = \frac{1}{\gamma}\frac{p_N\left(\rho_N - R^f\right)}{\sigma_D^2 + \left(\frac{R^f}{R^f - \rho_\theta}\right)^2 \sigma_\theta^2 + p_N^2\sigma_N^2} N_t$$

- The **market breaks down** when

$$\sigma_N > \sigma_N^* = \frac{R^f - \rho_N}{2\gamma\sqrt{\sigma_D^2 + \left(\frac{R^f}{R^f - \rho_\theta}\right)^2 \sigma_\theta^2}}.$$

  - Short-term investors ineffectively in trading against noise trader risk, a la DSSW (1990)

Volatility Explosion



Government Intervention

Introduce a government which trades the asset

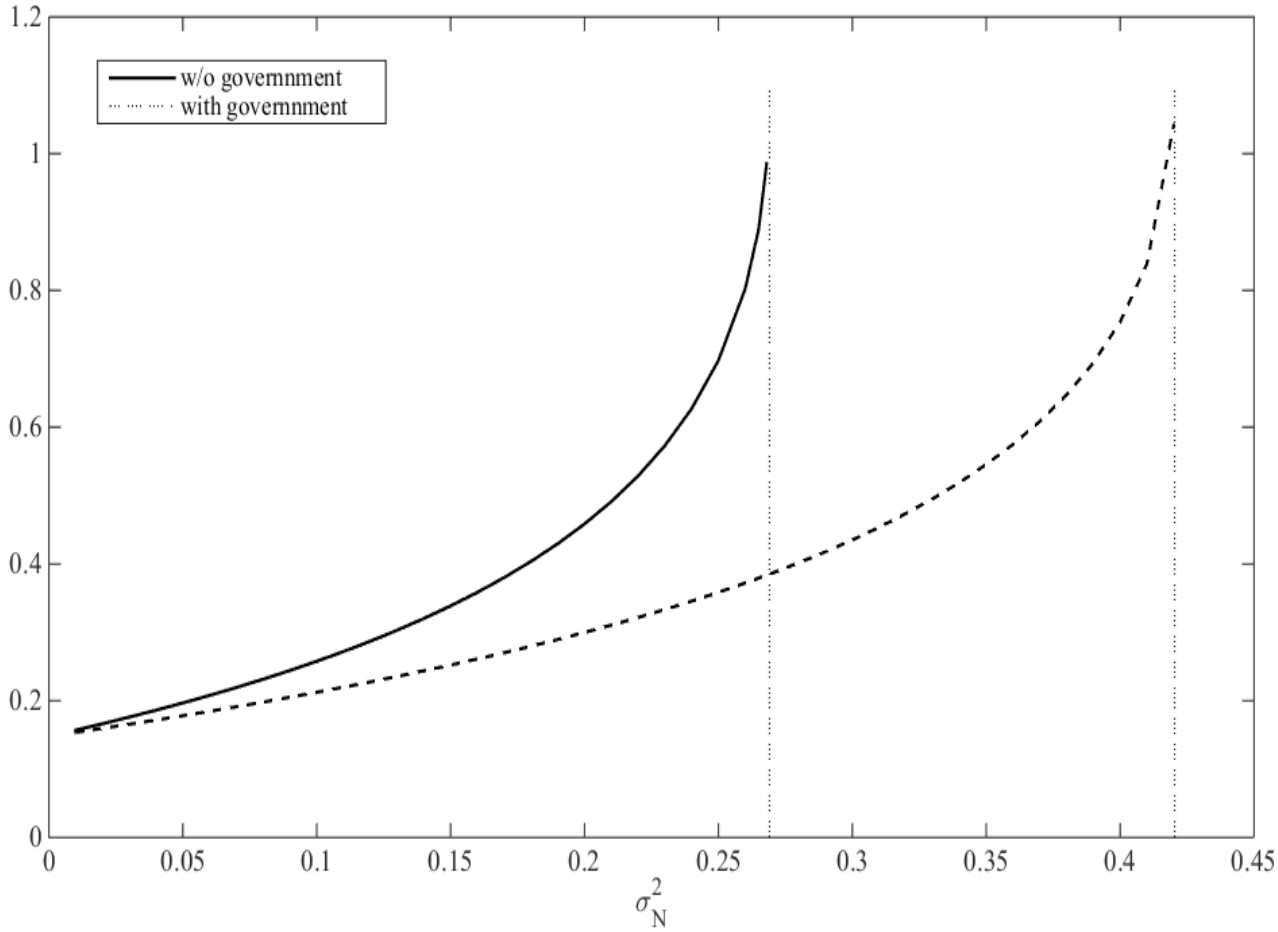
$$X_t^G = \vartheta^N N_t$$

- Again conjecture a linear equilibrium: $P_t = \frac{\rho_\theta}{R^f - \rho_\theta}\theta_t + p_N N_t$
- The market clearing $\int_0^1 x_t^i dt + X_t^G = N_t$ implies the market breaks down only when

$$\sigma_N > \frac{1}{1-\vartheta^N} \frac{R^f - \rho_N}{2\gamma_i \sqrt{\sigma_D^2 + \left(\frac{R^f}{R^f - \rho_\theta}\right)^2 \sigma_\theta^2}}$$

  - $\vartheta^N > 0$ **mitigates** the region of market failure and may prevent failure if sufficiently large

Volatility Explosion



Government Intervention

- Define the government objective: choose ϑ_N to maximize

$$-\gamma_\sigma Var\left[\Delta P_t\left(\vartheta_N\right)\right] - \gamma_\theta Var\left[P_t\left(\vartheta_N\right) - \frac{1}{R^f - \rho_\theta}\theta_{t+1}\right] - \psi Var\left[\vartheta_N N_t\right]$$

- Penalty for price volatility, penalty for price deviation from fundamental, and cost of trading
- Two possible objectives: reducing volatility and improving information efficiency
  - often treated as equivalent
  - reducing price volatility is more convenient and widely adopted in practice, e.g., in US monetary policy - Stein and Sundarem (2016)
- The government internalizes the market failure by taking a sufficiently large ϑ_N to prevent market breakdown

An Extended Model with Information Frictions

Suppose that θ_t is **unobservable**

The public market information set $\mathcal{F}_t^M = \sigma\left(\{D_s, P_s\}_{s \leq t}\right)$

- $\hat{\theta}_{t+1}^M = E\left[\theta_{t+1} \mid \mathcal{F}_t^M\right]$ serves as the anchor of asset valuation

Investor i chooses $a_t^i \in \{0, 1\}$ to acquire private information:

$$s_t^i = \theta_{t+1} + \left[a_t^i \tau_s\right]^{-1/2} \varepsilon_t^{s,i} \quad \text{or} \quad g_t^i = G_{t+1} + \left[\left(1 - a_t^i\right) \tau_g\right]^{-1/2} \varepsilon_t^{g,i}$$

- $\mathcal{F}_t^i = \mathcal{F}_t^M \vee \left\{a_t^i s_t^i + \left(1 - a_t^i\right) g_t^i\right\}$
- His belief $\hat{\theta}_{t+1}^i = E\left[\theta_{t+1} \mid \mathcal{F}_t^i\right]$ and myopic objecctive:

$$U_t^i = \max_{a_t^i \in \{0,1\}} E\left[\max_{X_t^i} E\left[-\exp\left(-\gamma W_{t+1}^i\right) \mid \mathcal{F}_t^i\right] \mid \mathcal{F}_{t-1}^M\right]$$

An Extended Model with Information Frictions

The government has no private information and intervenes

$$X_t^G = \vartheta_{\hat{N}} \hat{N}_t^M + \sqrt{Var\left[\vartheta_{\hat{N}} \hat{N}_t^M \mid \mathcal{F}_{t-1}^M\right]} G_t$$

- $\hat{N}_t^M = E\left[N_t \mid \mathcal{F}_t^M\right]$ is the market perceived noise trading
- $G_t \sim \mathcal{N}\left(0, \sigma_G^2\right)$ is iid noise, caused by frictions or moral hazard
  - more noise gets in when the government trades more intensively
  - G_t is a pricing factor in asset prices, revealed at t but unobservable before t

A myopic preference for trading:

$$\max_{\vartheta_N} -\gamma_\theta Var\left[P_t\left(\vartheta_{\hat{N}}\right) - \frac{1}{R^f - \rho_\theta}\theta_{t+1} \mid \mathcal{F}_{t-1}^M\right]$$
$$-\gamma_\sigma Var\left[\Delta P_t\left(\vartheta_{\hat{N}}\right) \mid \mathcal{F}_{t-1}^M\right] - \psi Var\left[X_t^G \mid \mathcal{F}_{t-1}^M\right]$$

Noisy Rational Expectations Equilibrium

- State vectore $\Psi_t = \left[\begin{array}{cccc} \hat{\theta}_{t+1}^M & \hat{N}_t^M & G_t & \hat{G}_{t+1}^M \end{array} \right]$
- Investor optimization: at t, investor i chooses $a_t^i = a^i\left(\Psi_{t-1}\right)$ and trades $X^i\left(\Psi_t, a_t^i s_t^i + \left(1 - a_t^i\right) g_t^i, P_t\right)$
- Government optimization: at t, the government chooses $\vartheta_{\hat{N}}$.
- Market clearing:

$$\int_0^1 X^i\left(\Psi_t, a_t^i s_t^i + \left(1 - a_t^i\right) g_t^i, P_t\right) di + X^G\left(\Psi_t\right) = N_t,$$

A Benchmark without Government Intervention

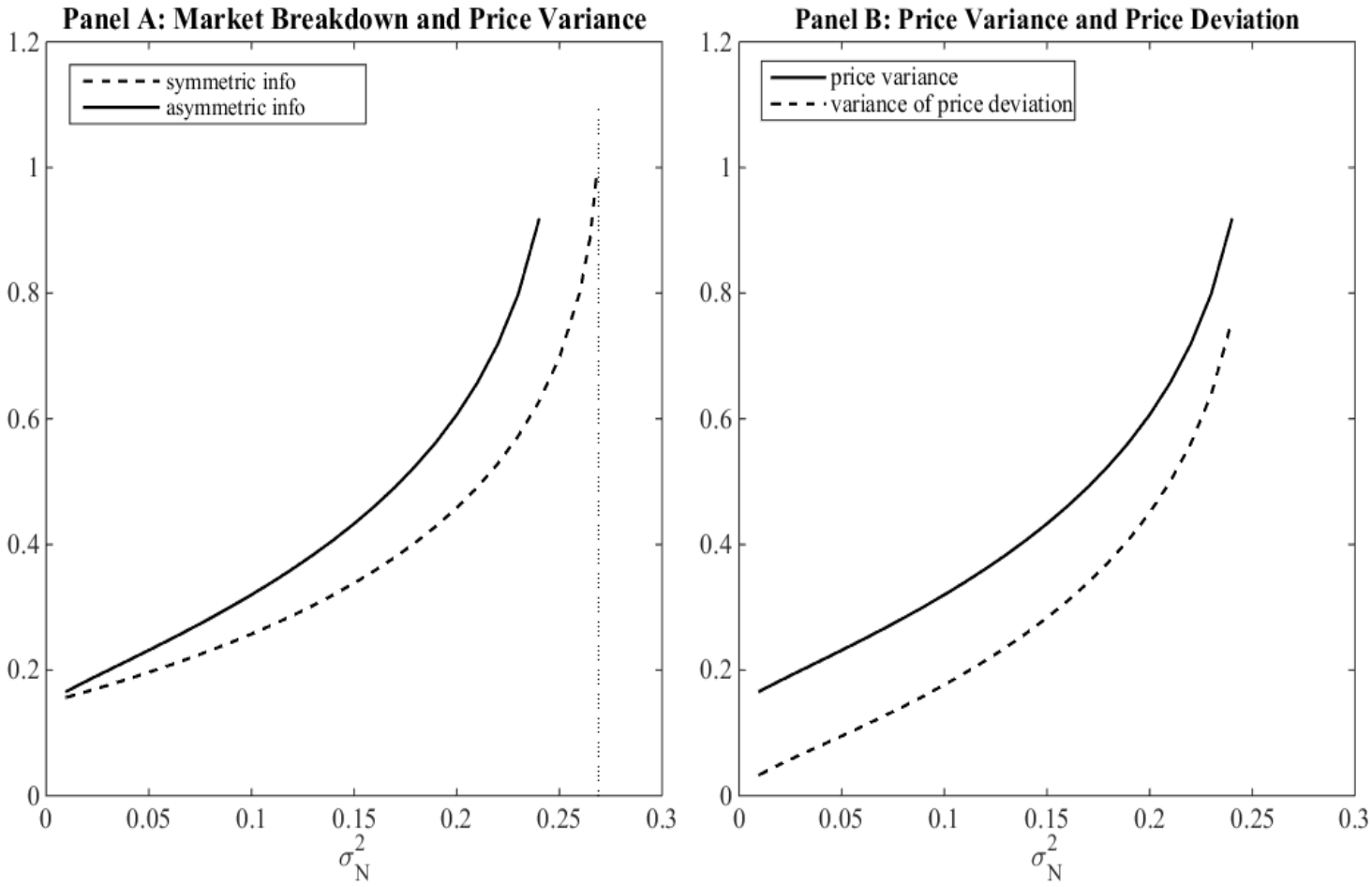
The setting in each period is similar to Hellwig (1980)

- $\hat{\theta}_t^M = E\left[\theta_{t+1} \mid \mathcal{F}_t^M\right]$ acts as the anchor of the market valuation
- X_t^i linearly increases with $s_t^i - \hat{\theta}_{t+1}^M$ and decreases with P_t
- Market clearing implies

$$P_t = \frac{1}{R^f - \rho_\theta}\hat{\theta}_{t+1}^M + p_\theta\left(\theta_{t+1} - \hat{\theta}_{t+1}^M\right) + p_N N_t$$

  - asymmetric information makes the market easier to break down
  - reducing volatility is consistent with improving information efficiency

Market Breakdown with Information Frictions & No Government Intervention



Equilibria with Government Intervention

G_t and $\hat{G}^M_{t+1} = E\left[G_{t+1} \mid \mathcal{F}^M_t\right]$ enter the price

- A **fundamental-centric** equilibrium - all investors acquire information about θ_{t+1}

$$P_t = \frac{1}{R^f - \rho_\theta}\hat{\theta}^M_{t+1} + p_\theta\left(\theta_{t+1} - \hat{\theta}^M_{t+1}\right) + p_g G_t + p_N N_t$$

- A **government-centric** equilibrium - all investors acquire information about G_{t+1}

$$P_t = \frac{1}{R^f - \rho_\theta}\hat{\theta}^M_{t+1} + p_{\hat{G}}\hat{G}^M_{t+1} + p_G\left(G_{t+1} - \hat{G}^M_{t+1}\right) + p_g G_t + p_N N_t$$

- A mixed equilibrium - some investors on θ_{t+1} some on G_{t+1}

$$\begin{aligned} P_t &= \frac{1}{R^f - \rho_\theta}\hat{\theta}^M_{t+1} + p_{\hat{G}}\hat{G}^M_{t+1} + p_\theta\left(\theta_{t+1} - \hat{\theta}^M_{t+1}\right) \\ &\quad + p_G\left(G_{t+1} - \hat{G}^M_{t+1}\right) + p_g G_t + p_N N_t \end{aligned}$$

Investor Information Acquisition Policy

Investor i chooses $a_t^i \in \{0,1\}$ to improve prediction of $E\left[R_{t+1} \mid \mathcal{F}_t^i\right]$

Exponential utility $\Longrightarrow$ **minimize** $Var\left[R_{t+1} | \mathcal{F}_t^M, a_t^i s_t^i + \left(1 - a_t^i\right) g_t^i\right]$

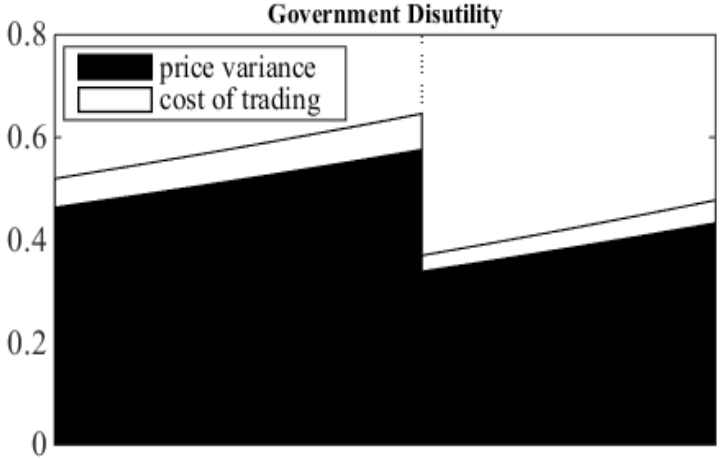
- $a_t^i = 1$ if $\dfrac{Cov\left[R_{t+1}, g_t^i \mid \mathcal{F}_t^M\right]^2}{Var\left[g_t^i \mid \mathcal{F}_t^M\right]} > \dfrac{Cov\left[R_{t+1}, s_t^i \mid \mathcal{F}_t^M\right]^2}{Var\left[s_t^i \mid \mathcal{F}_t^M\right]}$
- $a_t^i = 0$ if $\dfrac{Cov\left[R_{t+1}, g_t^i \mid \mathcal{F}_t^M\right]^2}{Var\left[g_t^i \mid \mathcal{F}_t^M\right]} < \dfrac{Cov\left[R_{t+1}, s_t^i \mid \mathcal{F}_t^M\right]^2}{Var\left[s_t^i \mid \mathcal{F}_t^M\right]}$
- $a_t^i = 0$ or 1 otherwise

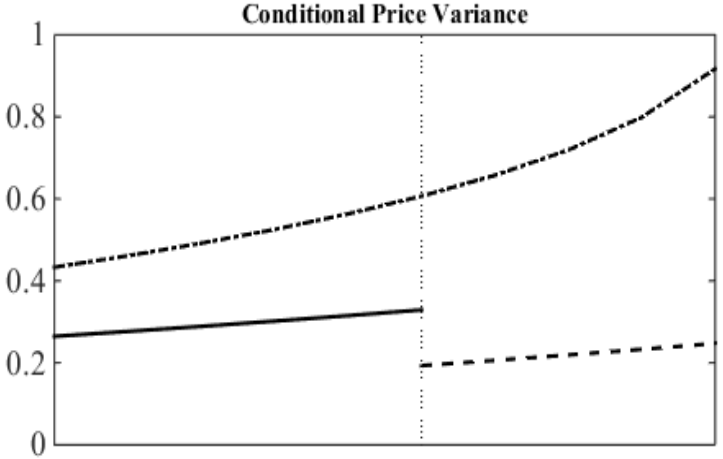
Numerical Illustration

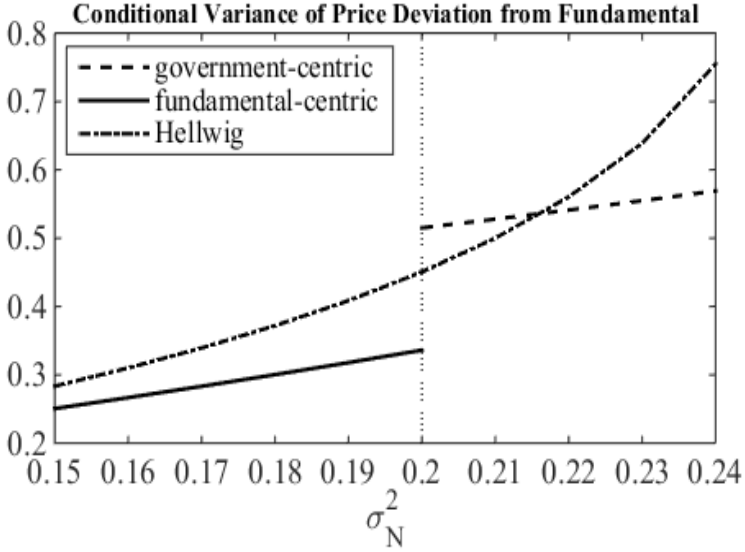
Table I: Baseline Model Parameters

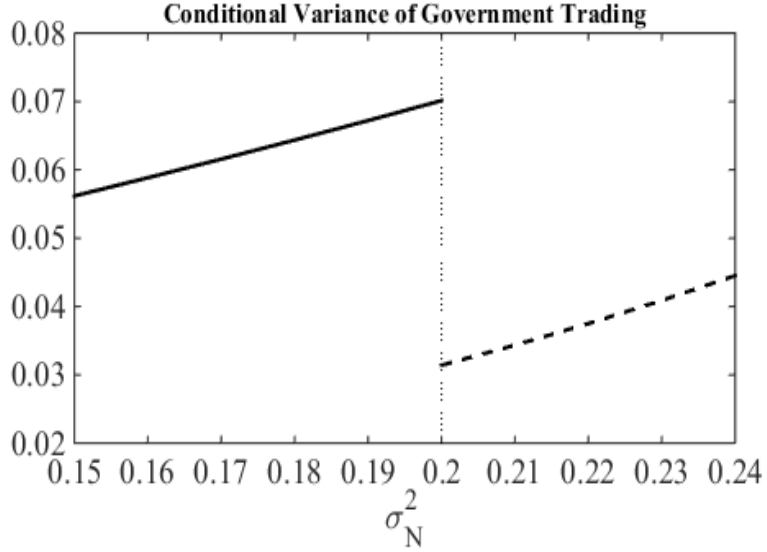
Government:	$\gamma_\sigma = 1,\ \gamma_\theta = 0,\ \psi = 1,\ \sigma_G^2 = 2$
Asset Fundamental:	$\rho_\theta = 0.75,\ \sigma_\theta^2 = 0.01,\ \sigma_D^2 = .8$
Noise Trading:	$\rho_N = 0,\ \sigma_N^2 = 0.2$
Investors:	$\gamma = 1,\ \tau_s = 500,\ \tau_g = 500,\ R^f = 1.01$

Market Equilibrium vs Noise Trading Volatility



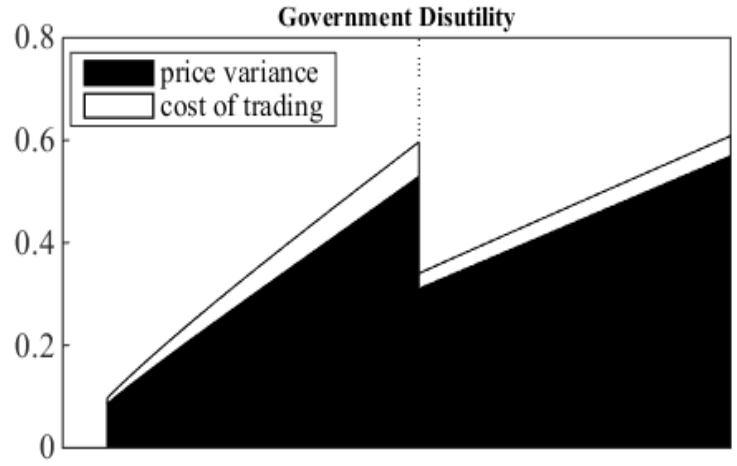


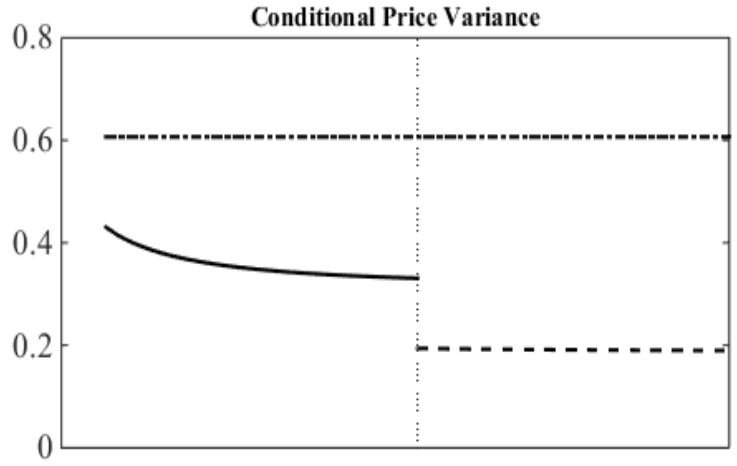


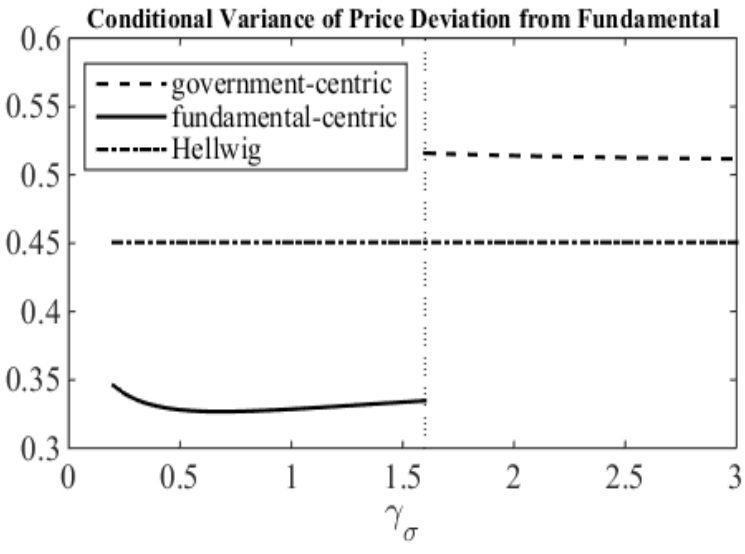


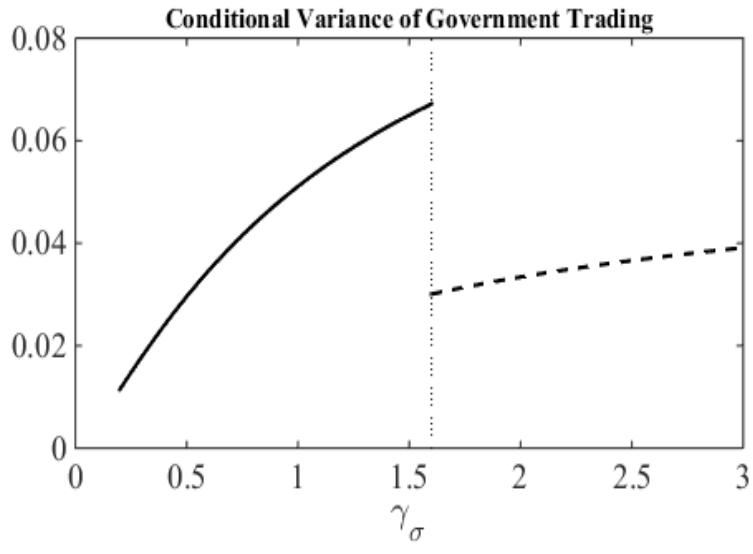
- The market shifts to the government-centric equilibrium as intervention intensifies
  - volatility jumps down but price inefficiency jumps up
  - **inconsistency** between reducing volatility and improving price efficiency
- The government trades less in the government-centric equilibrium
  - investors' private information about fundamental may cause them to trade against the government

Market Equilibrium vs Incentive to Reduce Volatility

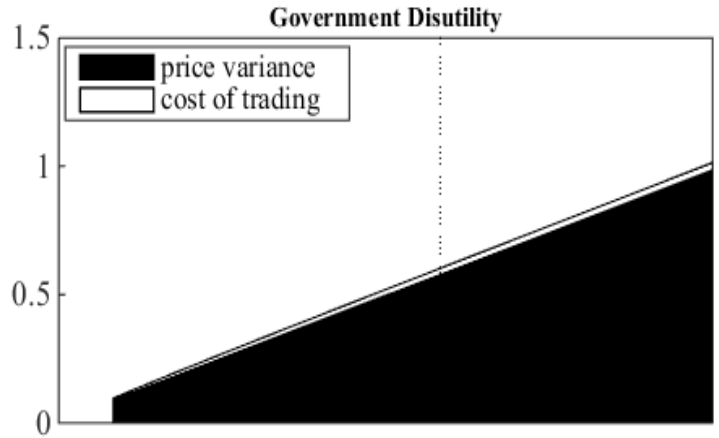


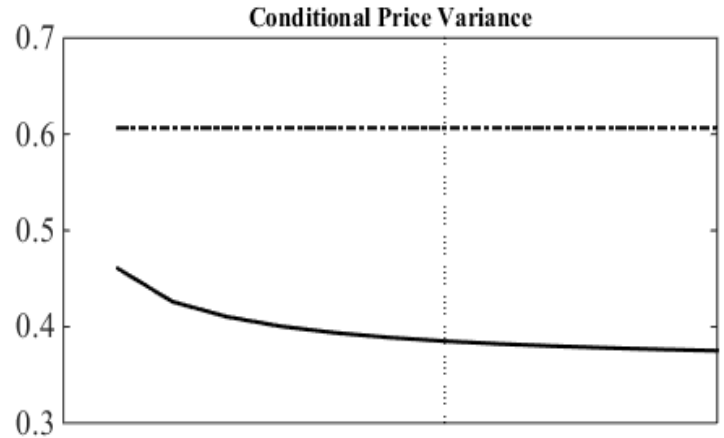


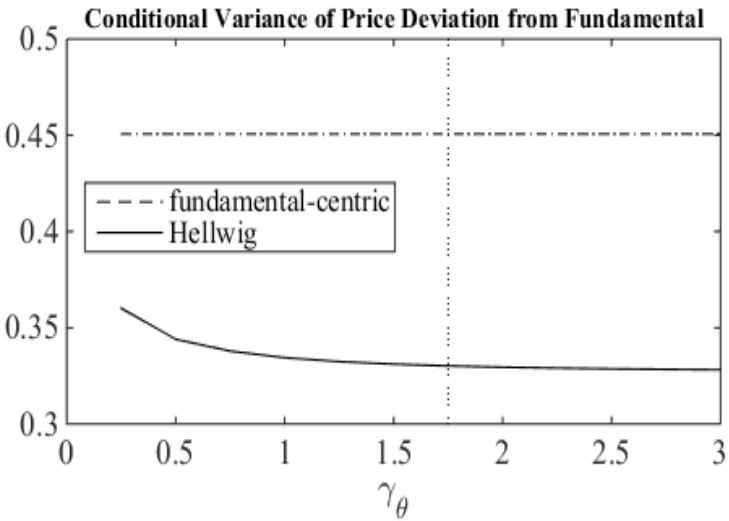


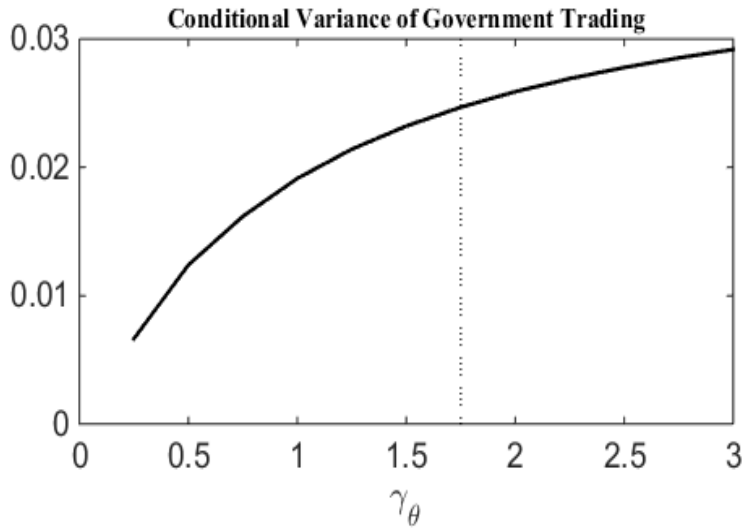


Market Equilibrium vs Incentive to Improve Price Efficiency









Conclusion

- Unregulated market can be highly volatile and might break down, especially when
  - noise trading risk is large
  - Intuition: short-term investors ineffective in trading against noise traders
- Government intervention helps to stabilize the market
- Adverse effects:
  - Active government intervention renders noise in government trading a pricing factor
  - intervention induces investors to **speculate on government noise** rather than fundamentals, which amplifies effects of policy errors
- Inconsistency between objectives of reducing **price volatility** and improving **information efficiency**

Risks in China's Financial System

- Commonly concerned risks
  - Noise trader risk created by inexperienced retail investors
  - Rising leverage across the nation
  - Overheating housing markets
- Another risk: policy errors **magnified** by financial market speculation

- China's model of transforming the real economy
  - "crossing the river by touching the stone"
- This approach may not work for reforming the financial system
  - highly demanding on regulator expertise
  - a financial policy error may be immediately amplified by market speculation, leading to violent market fluctuations
    - the stock market turmoil in summer 2015
    - the breakdown of the circuit breaker in January 2016
    - the exchange rate crash in August 2015