

Impacts of Monetary Stimulus on Credit Allocation and Macroeconomy: Evidence from China¹

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¹The views expressed herein are those of the authors and do not necessarily reflect the views of the Federal Reserve Banks of Atlanta, the Federal Reserve System, or the National Bureau of Economic Research.

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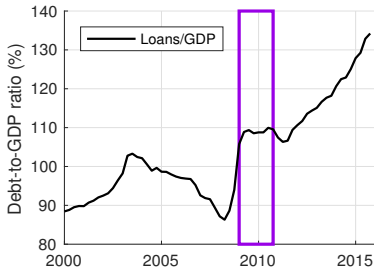
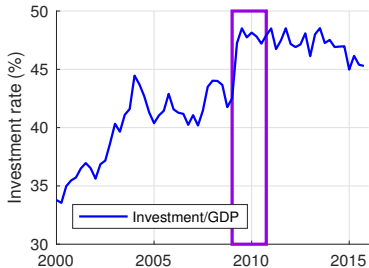
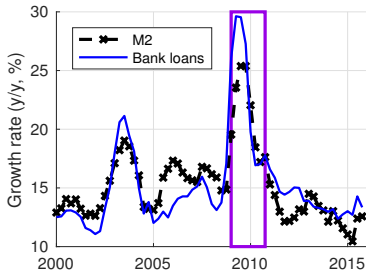
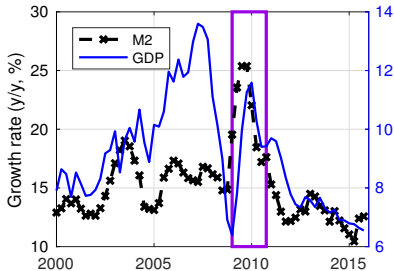
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Background

- In the aftermath of the 2008 global financial crisis, central banks around the world (Federal Reserve System, European Central Bank, Bank of Japan, and People's Bank of China) have initiated massive monetary stimulus in an attempt to combat the crisis and rescue the sagging economy.
- What are the consequences of such an unusual change of monetary policy on the financial system and the real economy?
- To answer this important question, one needs an empirical framework to
 - ① first identify the change of monetary policy,
 - ② and then assess the monetary transmission channel through which the policy change affects the real economy.
- In this paper we propose such a framework and apply it to the Chinese economy.

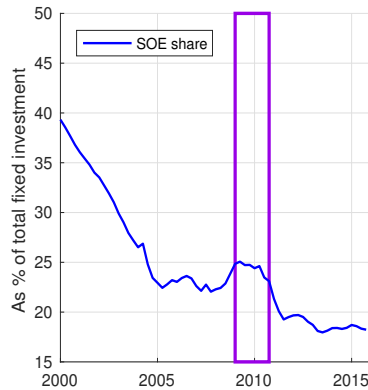
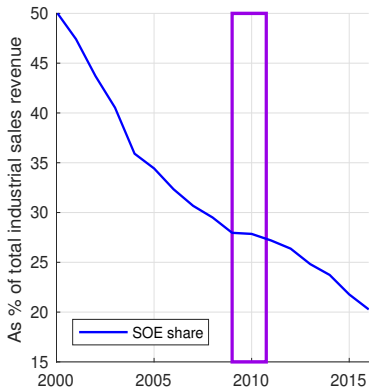
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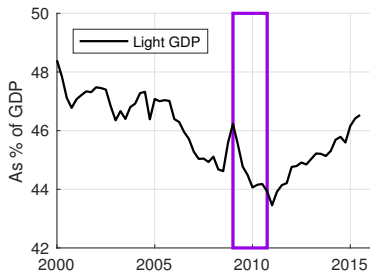
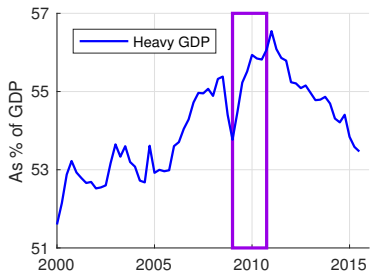
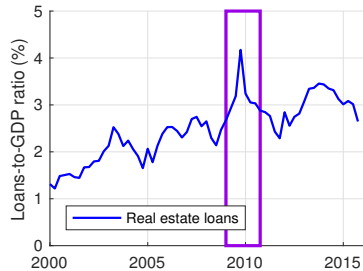
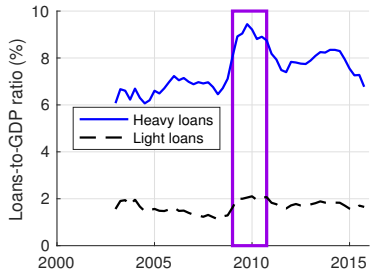
Conventional view

- State owned enterprises (SOEs) play a crucial role in the stimulus because China has long been a planned economy.
- The data, however, provides little support for this view.



Heavy vs. light sectors

- Rather than relying on SOEs, the Chinese government placed more emphasis on certain industries for their stimulus plan.
 - ▶ These industries include **real estate**, **infrastructure**, and manufacturing industries often labeled by the Chinese government as “heavy industries.”
- The light sector includes education, scientific research, health care, entertainment, and environment.



Methodology

- Develop an empirical framework
 - ▶ to answer the question of how much of these observed macroeconomic movements is caused by monetary stimulus—the stimulus initiated by massive monetary injection;
 - ▶ by disentangling how much of monetary stimulus is attributable to a policy change from the effect of such a change.
- We imbed endogenous-switching monetary policy of Chen, Ren, and Zha (2017) in our multivariate system.

Monetary stimulus

- A result of monetary policy switching to a much more aggressive regime to combat the fall of GDP growth below its official target.
 - ▶ As it turned out, the Chinese government's 4-trillion stimulus plan was not even close to its actual action.
 - ▶ Most of the monetary injection occurred in 2009.
 - ▶ M2 increased by 4.2 trillion in 2009Q1 alone and by a total of 11.5 trillion during the 2009Q1-Q3 period.
- Stimulus period: 2009Q1-Q3.
- The rest: consequences of the stimulus in these three quarters.

The PBC's Governor Xiaochuan Zhou:

As China has the features of both a large transition economy and an emerging market economy, the central bank of China and its monetary policy are yet to be well understood by the outside world.

24 June 2016

Findings of monetary transmission in China

- 1 Monetary policy is more important in the shortfall state than in normal times. The monetary policy shock contributes to as high as 45% of the GDP fluctuation in the shortfall state, in contrast to only one fifth in the normal state.
- 2 Monetary policy has asymmetric effects on bank credit allocation. In response to a monetary policy shock, more credit is allocated to financing investment in the heavy sector than in the light sector for both normal and shortfall states. The asymmetry of credit allocation is exacerbated in the shortfall state.
- 3 Asymmetric credit allocation to the heavy sector plays a critical role in promoting growth of investment over that of consumption. And growth of heavy GDP is a driving force of GDP growth in the whole economy.

The effects of the 2009 monetary stimulus

- The unprecedented monetary expansion is a result of endogenous switching from normal monetary policy to aggressive monetary policy.
- This expansion boosted annual GDP growth by as high as 4% by the end of 2009,
 - ▶ which accounted for 85% of the annual growth rate of GDP between 2008Q4 and 2009Q4.
- GDP growth was mainly through bank loans allocated
 - ▶ more to financing investment in the heavy sector (e.g., **real estate**)
 - ▶ than in the light sector (e.g., education, scientific research, and healthcare).
- The effects on investment-to-GDP and debt-to-GDP ratios were much more persistent and lasted for a longer period.
- An intertemporal tradeoff between short-run GDP growth and longer-run indebtedness in overcapacity industries.

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Data

- A challenging task.
- The methodology of collecting and constructing the quarterly time series is based on Higgins and Zha (2015) and Chang et al. (2016).
- The main data sources are China's National Bureau of Statistics, People's Bank of China, and CEIC.
- All the series are seasonal adjustments except interest and exchange rates.
- Sample: 1999Q1-2016Q2 (longer than the Great Moderation period prior to 2008).

Monetary policy

- Denote $g_{m,t} = \Delta M_t$, $\pi_t = \Delta P_t$, $g_{x,t} = \Delta x_t$, and $g_{x,t}^* = x_t^* - x_{t-1}$.
 - ▶ The (log) GDP target is x_t^* and thus $g_{x,t}^*$ measures the targeted GDP growth.
- Chen, Ren, and Zha (2017)'s regime-switching monetary policy equation is specified as

$$g_{m,t} = \gamma_0 + \gamma_m g_{m,t-1} + \gamma_\pi (\pi_{t-1} - \pi^*) + \gamma_{x,t} (g_{x,t-1} - g_{x,t-1}^*) + \sigma_{m,t} \varepsilon_{m,t}, \quad (1)$$

where $\varepsilon_{m,t}$ is a serially independent monetary policy shock with the standard normal distribution,

$$\gamma_{x,t} = \begin{cases} \gamma_{x,a} & \text{if } g_{x,t-1} - g_{x,t-1}^* \geq 0 \\ \gamma_{x,b} & \text{if } g_{x,t-1} - g_{x,t-1}^* < 0 \end{cases}, \quad \sigma_{m,t} = \begin{cases} \sigma_{m,a} & \text{if } g_{x,t-1} - g_{x,t-1}^* \geq 0 \\ \sigma_{m,b} & \text{if } g_{x,t-1} - g_{x,t-1}^* < 0 \end{cases}$$

- The subscript “a” stands for “above the target” and “b” for “below the target”.
- Tightly estimated coefficients: $\gamma_m = 0.391$, $\gamma_\pi = -0.397$, $\gamma_{x,a} = 0.183$, $\gamma_{x,b} = -1.299$, $\sigma_{m,a} = 0.005$, $\sigma_{m,b} = 0.010$.

Econometric methodology

- We postulate the dynamics of y_t in a general system of simultaneous equations

$$A_0 y_t + b_0 M_t = c + \sum_{\ell=1}^4 A_{\ell} y_{t-\ell} + \sum_{\ell=1}^4 b_{\ell} M_{t-\ell} + \xi_t. \quad (2)$$

- Without any restrictions, system (2) is unidentified because the transformed system

$$(QA_0)y_t + (Qb_0)M_t = (Qc) + \sum_{\ell=1}^4 (QA_{\ell})y_{t-\ell} + \sum_{\ell=1}^4 (Qb_{\ell})M_{t-\ell} + Q\xi_t$$

by any orthogonal matrix Q generates the same dynamics of y_t as does the original system.

Proposition 1

Proposition

The impulse responses to a monetary policy shock, $\varepsilon_{m,t}$, can be computed from the following regime-dependent system:

$$\begin{bmatrix} M_t \\ y_t \end{bmatrix} = \tilde{b}_t + \underbrace{\sum_{\ell=1}^4 \begin{bmatrix} \tilde{B}_{\ell,t}^{11} & \tilde{B}_{\ell,t}^{12} \\ \tilde{B}_{\ell,t}^{21} & \tilde{B}_{\ell,t}^{22} \end{bmatrix}}_{\tilde{B}_{\ell,t}} \begin{bmatrix} M_{t-\ell} \\ y_{t-\ell} \end{bmatrix} + \tilde{D}_t \begin{bmatrix} \varepsilon_{m,t} \\ \xi_t \end{bmatrix}, \quad (3)$$

where $\tilde{B}_{1,t}^{12}$ is a function of $\gamma_{x,t}$ and γ_{π} and $\tilde{B}_{1,t}^{22}$ is a function of $\gamma_{x,t}$, γ_{π} , b_0 , and A_0 .

Proposition 2

Proposition

When the system represented by (1) and (2) is jointly estimated, the following two results hold.

- *The monetary policy rule (1) is identified, even though the subsystem (2) is unidentified.*
- *Impulse responses of y_t to $\varepsilon_{m,t}$ are invariant to the rotation matrix Q .*

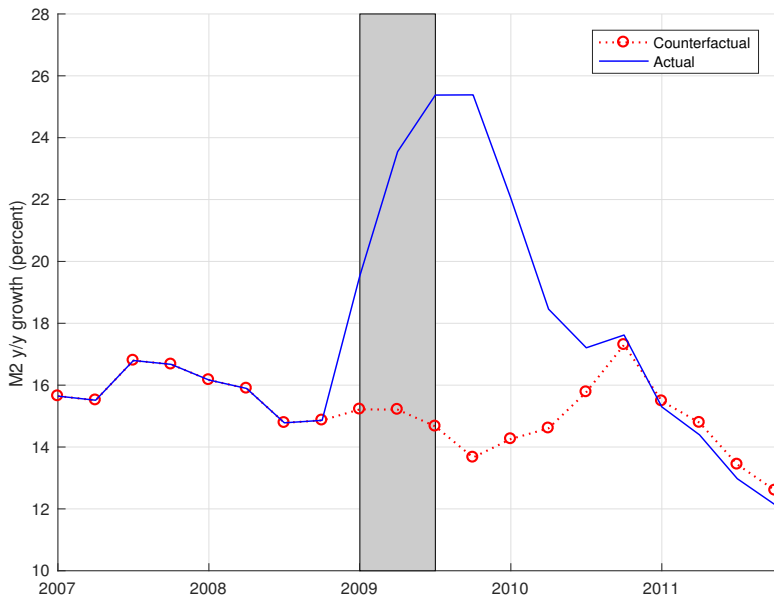
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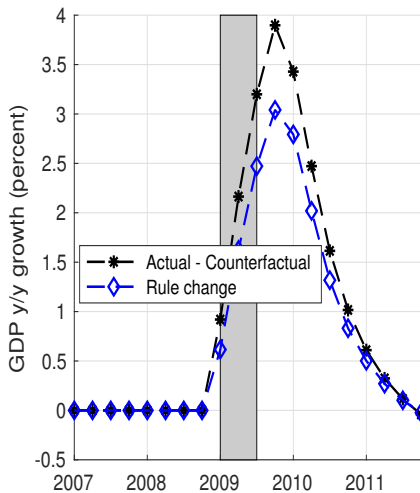
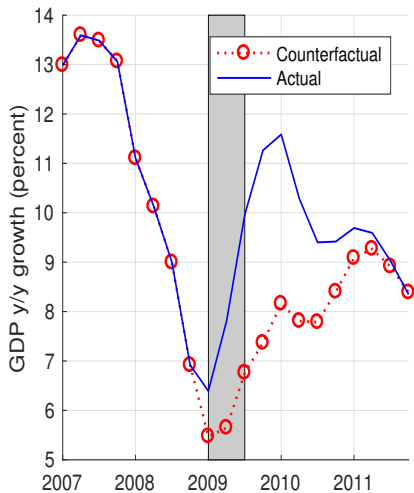
The dynamic impacts of the 2009 monetary stimulus

- Simulate a counterfactual economy in which we assume that monetary policy had not changed (i.e., the normal accommodative monetary policy had remained) and there were no expansionary monetary policy shocks in 2009Q1-Q3.
- Following Sims and Zha (2006), we back out the monetary policy shock sequence $\varepsilon_{m,t}$ and all the other reduced-form shock sequences u_t and keep these shocks intact in our counterfactual simulations, except for monetary policy shocks in 2009Q1-Q3.
- The difference between actual and counterfactual paths measures the effect of extremely stimulative monetary policy (both endogenous and exogenous) during these three quarters.

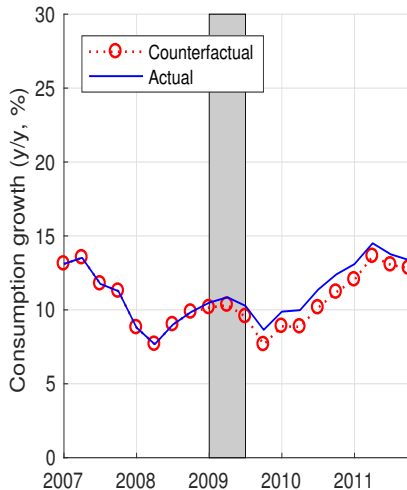
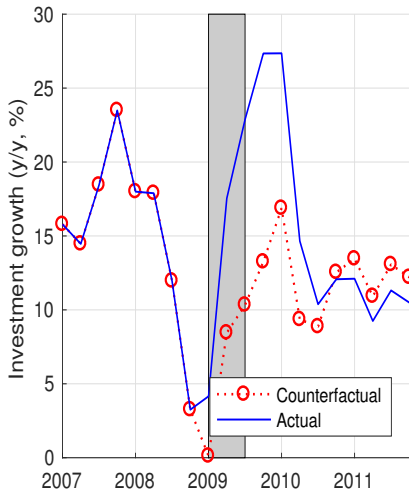
Stimulus period



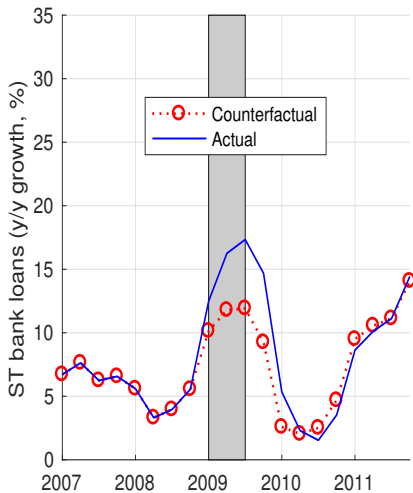
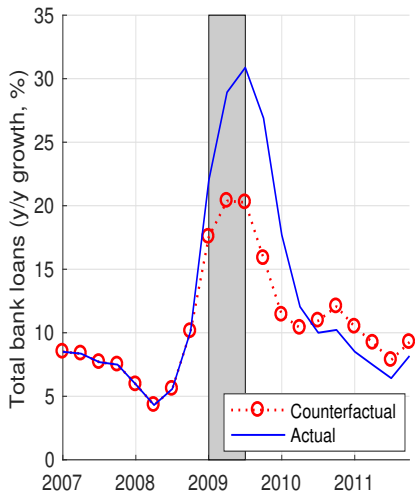
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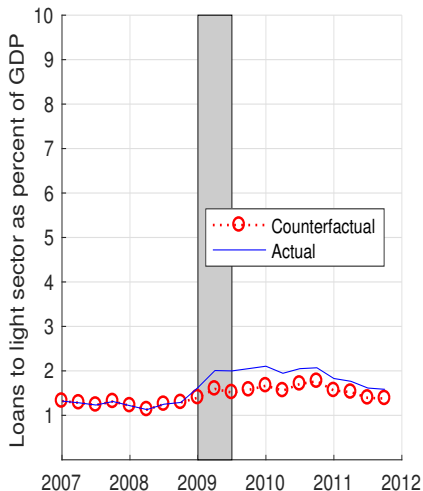
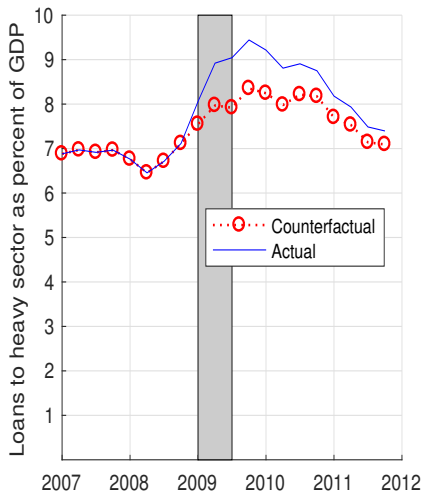
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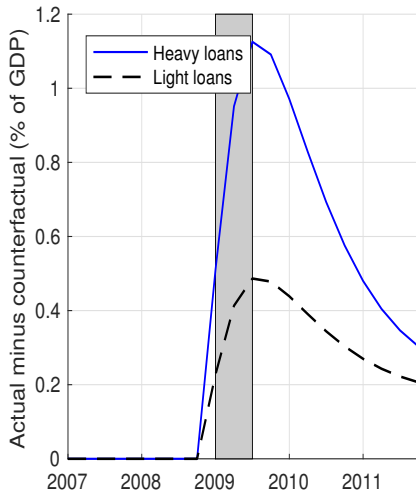
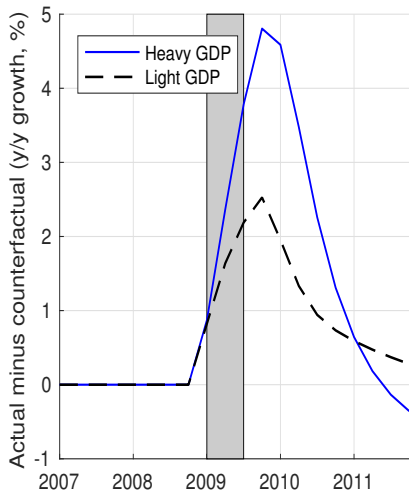
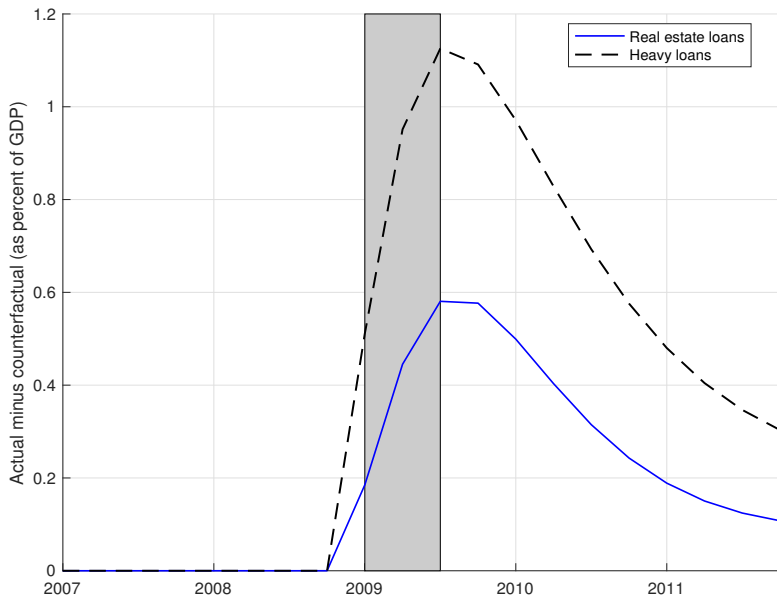


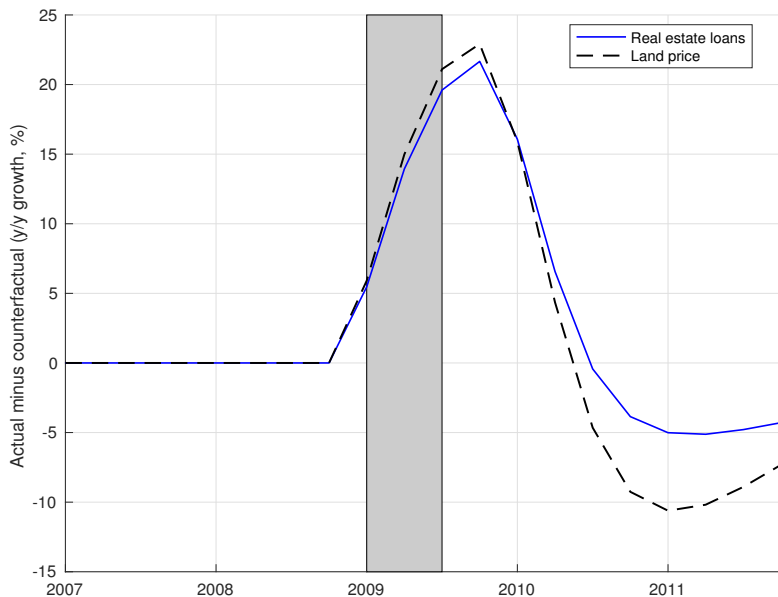
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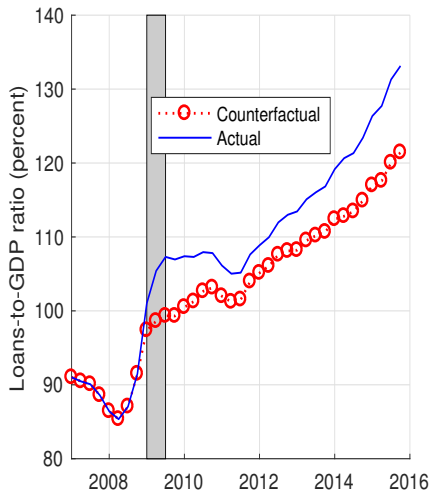
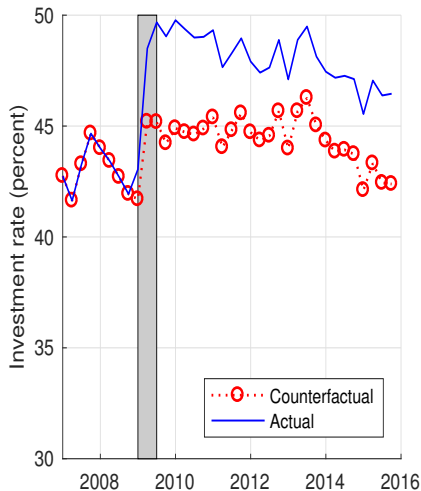
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The dynamic impacts of the 2009 monetary stimulus



Conclusion

- An intertemporal tradeoff between short-run GDP growth and longer-run indebtedness in real estate and other overcapacity industries.
- In 2015, there were six industries that suffered the most severe overcapacity problem measured by the rate of capacity utilization:
 - ▶ steel (67%), coal (64.9%), cement (73.8%), flat glass (68.0%), electrolytic aluminum (75.4%), and shipbuilding (69%).
- A graver situation: the fast accumulation of the vacant real estate stock.
- Measured by the floor space,
 - ▶ real estate vacancy increased from 199.47 million square meters in 2009 to 718.53 million square meters in 2015;
 - ▶ the space of 718.53 million square meters can accommodate 24 million individuals in China;
 - ▶ oversupply of real estate properties.

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