INTERMEDIARY LEVERAGE CYCLES AND FINANCIAL STABILITY
by Tobias Adrian and Nina Boyarchenko

Harjoat S. Bhamra

UBC & Imperial

2013

Outline

- Aim
- Why do we care?
- Model Summary & Results
- Comments

Paper's aim:

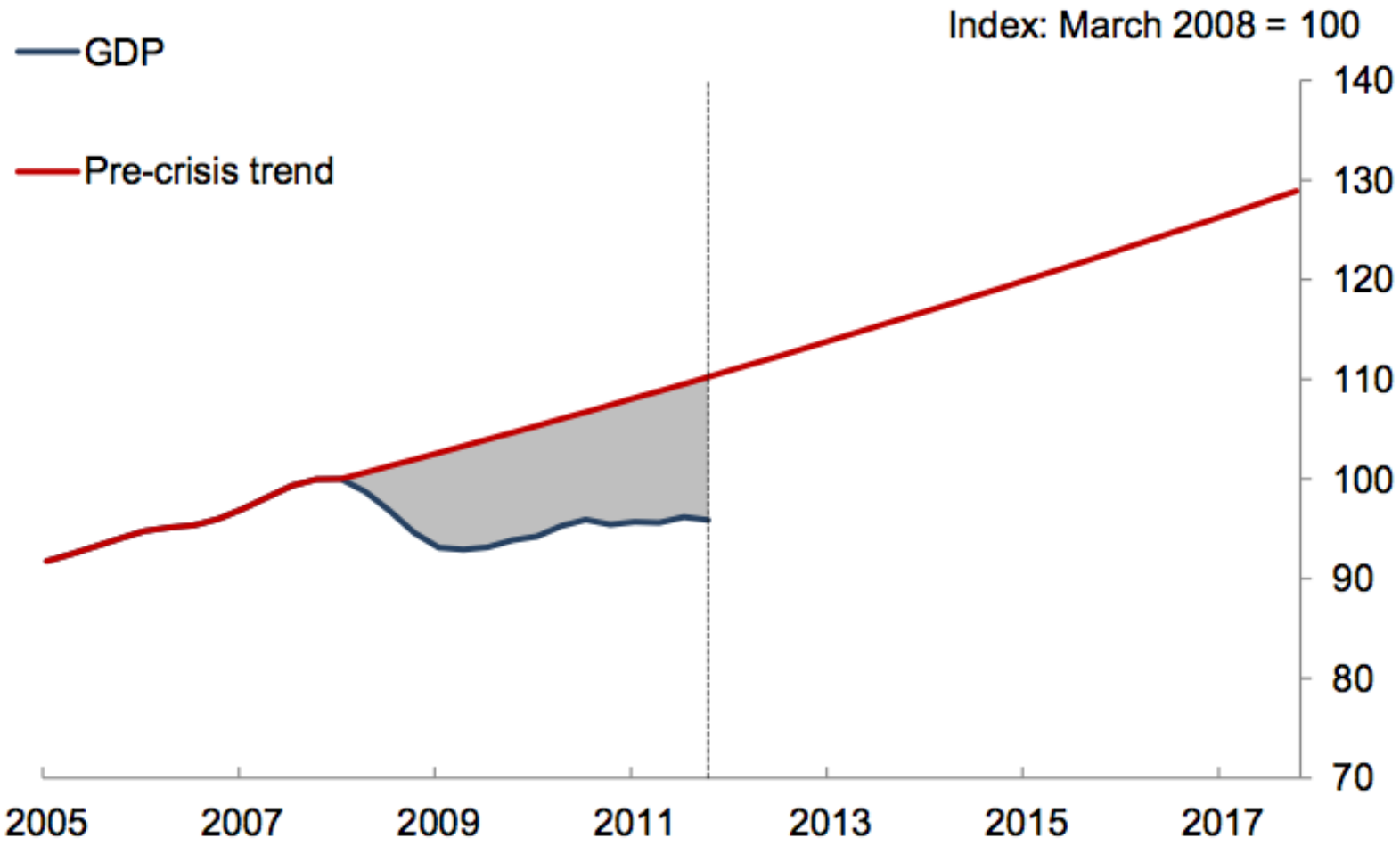
- Study how **macroprudential policies** impact the systemic risk-return trade-off.
  - How does a specific macroprudential policy (leverage constraint on financial intermediaries) affect default rates and systemic risk?
  - How does this work in general equilibrium
  - Impact on social welfare

Macroprudential policies

- Macroprudential policies: focus on regulating and supervising the financial system as a whole.
- Until recently regulation focused on individual institutions – microprudential

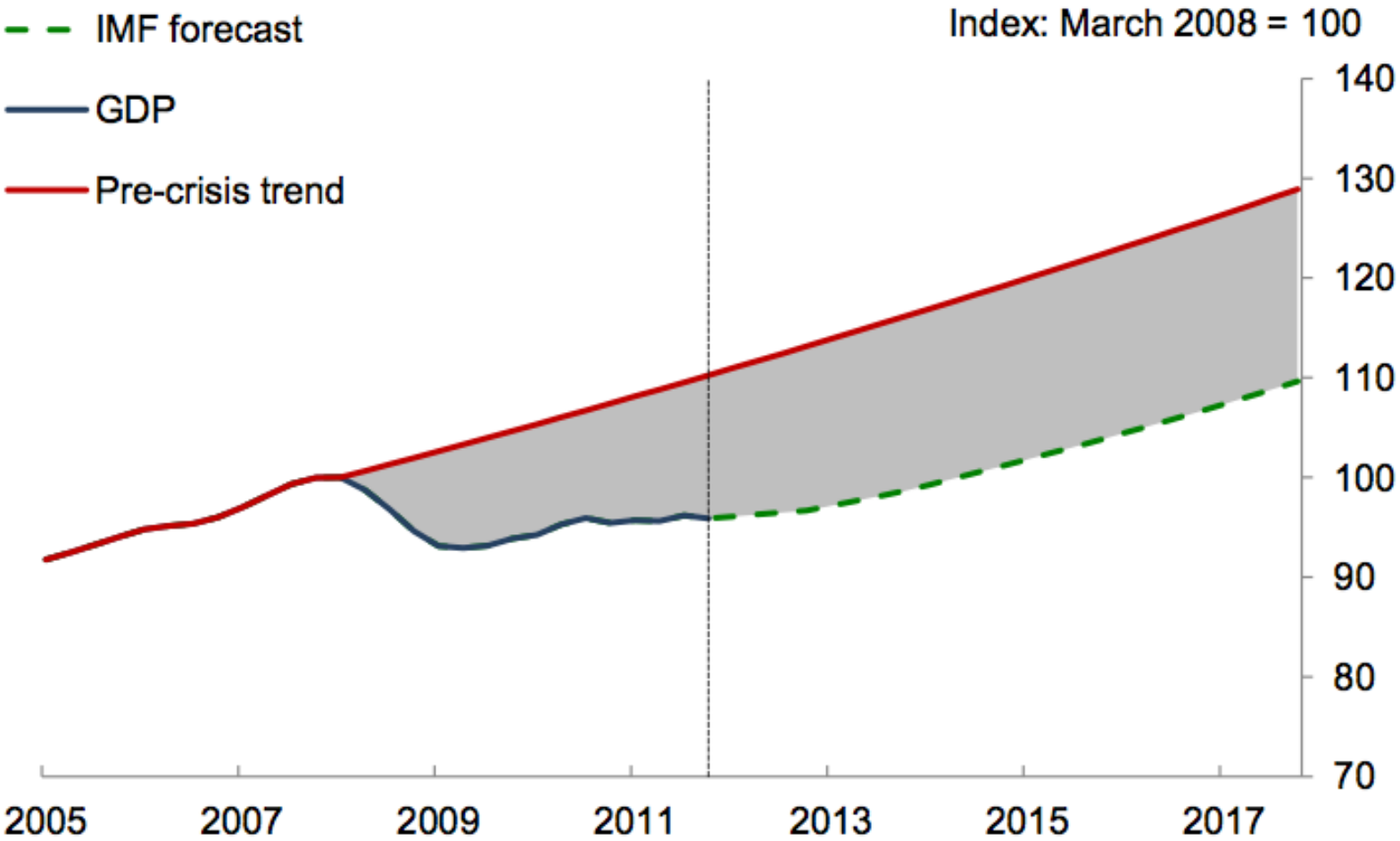
- Why do we care about regulating the financial system?
- Why shift focus from microprudential to macroprudential policies?

- Problems in the financial sector can damage the real economy

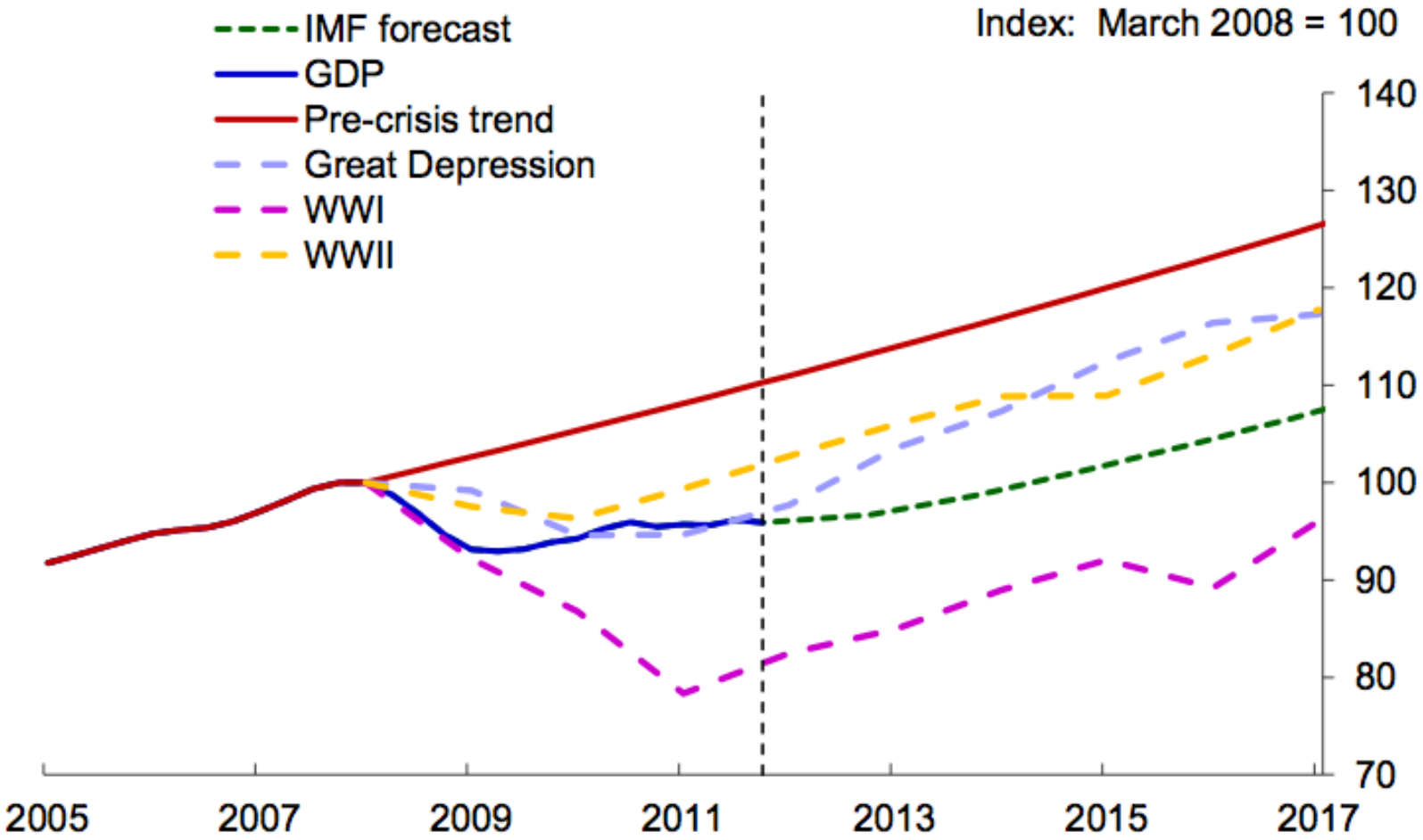


Cumulative output loss=37% of pre-crisis GDP

New trends are not always good



Cumulative output loss=139% of pre-crisis GDP



Only WWI was more costly

Post-crisis thoughts

- Are economies with sophisticated financial markets self –correcting?
  - Maybe/Maybe not. But if the correction involves lower trend in GDP growth, we are unhappy
- Is low and stable inflation a guarantee of financial and macroeconomic stability?
  - Not this time!
- Was the existing prudential framework focused on individual institutions (microprudential) sufficient to ensure financial stability?
  - No. Did not insulate us from systemic shocks!

$\Rightarrow$ need a macroprudential policy framework

Macroprudential policy again

- Purpose of macroprudential policy is to reduce systemic risk.
- Systemic risk: "the risk of developments that threaten the stability of the financial system as a whole and consequently the broader economy (Bernanke, 2009).
  - E.g., types of financial imbalances that led to the 2007-2008 bust.
- Two key aspects of systemic risk.
  - time-series dimension: the procyclicality of the financial system: excess risk-taking in booms and excess deleveraging in busts.
  - cross-sectional dimension: the risk of contagion due to simultaneous weakness or failure of financial institutions.
- Macroprudential policy is a set of tools that help reduce these two forms of systemic risk (Borio 2009; Bank of England 2011).

This paper: studies the effectiveness of bank leverage constraints as a macroprudential policy designed to reduce the time-series dimension of systemic risk.

Production economy

- Linear technology $Y_t = A_t \cdot \underbrace{K_t}_{\text{no. of units of capital}}$

$$a_t = \ln A_t : \; da_t = \bar{a}dt + \sigma_a dZ_{at} \tag{1}$$

  - Holding K_t units of capital gives you an output flow of Y_t

$$\text{price of one capital unit} : p_{kt} = E_t \left[\int_t^\infty \frac{\Lambda_u}{\Lambda_t} \frac{Y_u}{Y_t} du \right] \tag{2}$$

- Capital held by household and financial intermediary: only the financial intermediary can invest
- Capital accumulation equation

$$dK_t = (\Phi(i_t) \cdot \underbrace{k_t}_{\text{no. of units of capital held by FI}} - \lambda_k K_t)dt \tag{3}$$

- Change in log output

$$dy_t = da_t + \left(\Phi(i_t) \frac{k_t}{K_t} - \lambda_k \right) dt \tag{4}$$

  - Investment-based growth stems from financial intermediary

Household

$$\sup_{\{(c_t)_{t\geq 0},(\pi_{kt})_{t\geq 0},(\pi_{bt})_{t\geq 0}\}} E_0 \int_0^\infty e^{-\xi_t} e^{-\rho_h t} \ln c_t \, dt \tag{5}$$

s.t.

$$dw_{ht} = r_{ft} w_{ht} + \pi_{kt} w_{ht}(\underbrace{dR_{kt}}_{\text{return on capital}} - r_{ft} dt) + \pi_{bt} w_{ht}(\underbrace{dR_{bt}}_{\text{return on risky debt}} - r_{ft} dt) \tag{6}$$

$$- c_t dt \tag{7}$$

Financial Intermediary

$$\sup_{\{(k_t)_{t\geq 0},(b_t)_{t\geq 0},(i_t)_{t\geq 0}\}} E\left[\int_0^{\tau_D} e^{-\rho t} w_t dt\right], \tag{8}$$

$$w_t = p_{kt}A_t k_t - p_{bt}A_t b_t \tag{9}$$

$$dw_t = p_{kt}A_t k_t \cdot \underbrace{dr_{kt}}_{=dR_{kt}} + \underbrace{\left(\Phi(i_t) - \frac{i_t}{p_{kt}}\right)dt}_{\text{extra return to compensate for the cost of investment}} - p_{bt}A_t b_t dR_{bt} \tag{10}$$

- extra return is partially passed on to the households as coupon payments on the intermediaries debt
- intermediaries issue floating rate debt, with coupon rate $C_{bt}A_t$ until maturity
- debt is retired at rate λ_b and issued at rate β_t

$$db_t = (\underbrace{\beta_t}_{\text{control}} - \lambda_b) b_t dt \tag{11}$$

- leverage: $\theta_t = \frac{p_{kt}A_t k_t}{w_t}$

Default and Restructuring

Exogenous default policy:

$$\tau_D = \inf_{t \geq 0} \{ w_t \leq \overline{\omega} \quad \underbrace{p_{kt} Y_t}_{\text{aggregate wealth}} \quad \}, \tag{12}$$

$$\text{i.e. } \tau_D = \inf_{t \geq 0} \left\{ \theta_t \geq \frac{1}{\overline{\omega}} \frac{k_t}{K_t} \right\} \tag{13}$$

Default $\Rightarrow$ restructuring: $\theta_{\tau_D +} = \frac{p_{k\tau_D} A_{\tau_D} k_{\tau_D}}{w_{\tau_D +}} = \underline{\theta}$

Leverage constraint

$$\theta_t = \frac{1}{\alpha} \frac{1}{\sqrt{\frac{1}{dt} E_t \left[\left(\frac{d(p_{kt} A_t)}{p_{kt} A_t} \right)^2 \right]}} \tag{14}$$

- $\frac{1}{dt} E_t \left[\left(\frac{d(p_{kt} A_t)}{p_{kt} A_t} \right)^2 \right]$ is the instantaneous variance of percentage changes in the price of one unit of capital
- higher variance $\Rightarrow$ lower leverage
- higher α: stricter macroprudential policy

Equilibrium

$$K_t = k_t + k_{ht} \tag{15}$$

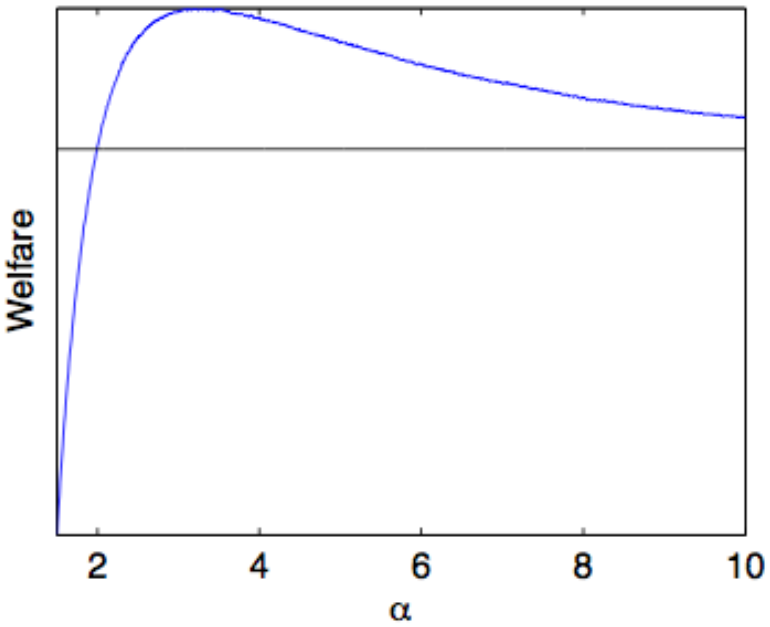
$$b_t = b_{ht} \tag{16}$$

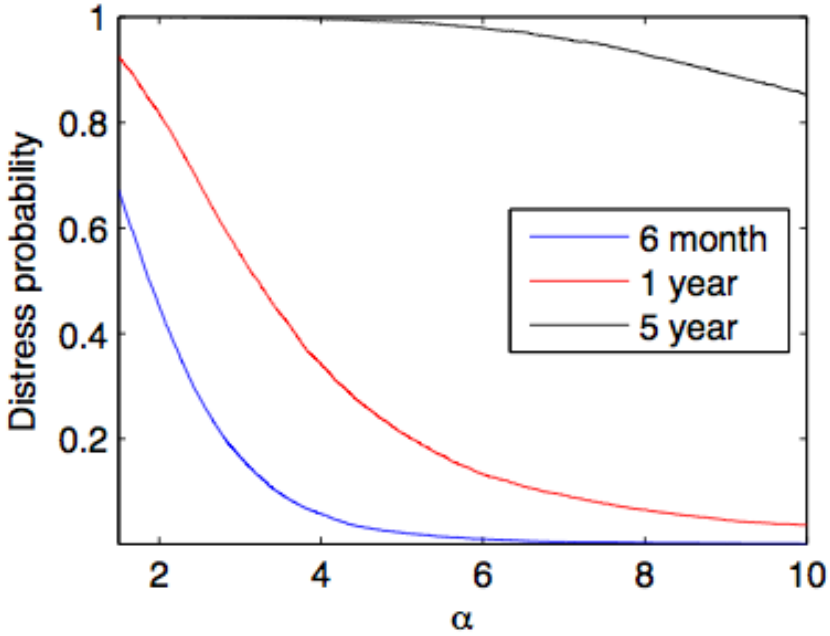
$$\pi_{kt} + \pi_{bt} = 1 \tag{17}$$

$$Y_t = c_t + A_t i_t k_t \tag{18}$$

Key-Tradeoff in Model

- Keeping leverage constant: avoid default
- Allowing for time varying leverage (subject to leverage constraint):
  - Benefit: better investment policy $\Rightarrow$ welfare gains
  - Cost: possibility of financial distress



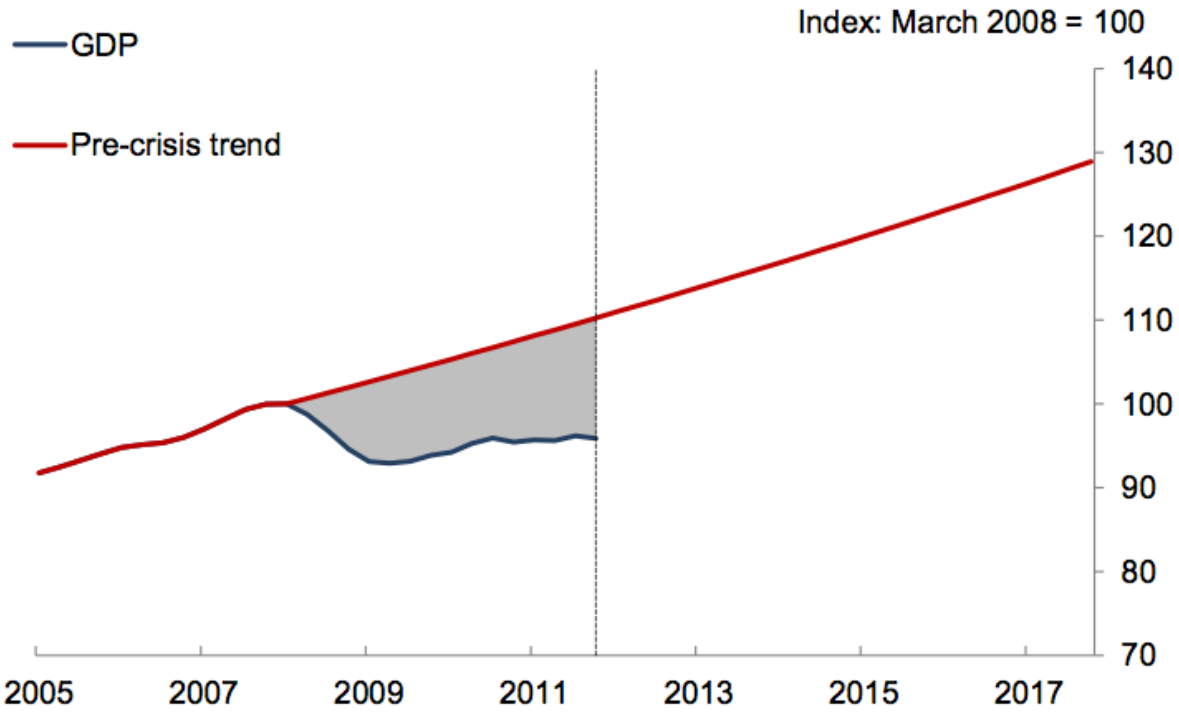


Comments – Big Picture I

- Is the constant leverage case the correct benchmark?
  - It is a stricter constraint than the constraint linking leverage to the variance of percentage changes in the price of one unit of capital
  - Existing results suggest that the looser variance constraint is better
- What about no constraints as a benchmark. Does that reflect the state of pre-crisis macroprudential policy?
- If so, then introducing the variance based leverage constraint may make things worse in terms of welfare.

Comments – Big Picture

- Only one financial intermediary: all risk is system-wide
  - Model can only address the time-series dimension of systematic risk
- More focus on time series implications of model
  - Using a suitable benchmark, simulate output, consumption, asset returns etc for benchmark model and model with VaR based leverage constraint
  - What are the differences, in particular for trend output?
  - More bluntly, what does your model have to say about this?



Comments – Technical

- Objective function for financial intermediary: maximizing expected value of integral over a stock of wealth wrt time. Units don't make sense.
- Appendix contains a model where this not an issue: use this model in main text.

Comments – Other Papers

- This is a growing literature
- How does the this paper compare with: Miles, Yang, &Marcheggiano (2012), DiTella (2012), etc.

Comments – Stylistic

- Make paper accessible to more (discrete-time) people
- Is there a quick way of outlining a recursive method of solving for equilibrium?

Summary

- Interesting research question
- Impressive technically
- Think about how to model pre-crisis macroprudential policy: setting the correct benchmark
- Time series implications for trend output relative to benchmark