Banks as Leverage Machines: Designing Models for Macroprudential Policy Analysis

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Presentation based on…

- Benes, Laxton, Mongardini (2016). Mitigating the Deadly Embrace in Financial Cycles: Countercyclical Buffers and Loan-to-Value Limits. IMF Working Paper 16/[xxx] (forthcoming).
- Benes, Kumhof, Laxton (2014). Financial Crises in DSGE Models: A Prototype Model. IMF Working Paper No 14/56.
- Benes, Kumhof, Laxton (2014). Financial Crises in DSGE Models: Selected Applications of MAPMOD. IMF Working Paper No 14/57.

Outline

1. Motivation: Empirical evidence on financial cycles
2. Brief description of MAPMOD
3. Simulations of good vs. bad credit expansions
4. Macroprudential policies
5. Conclusions

Basic Features of Financial Cycles

- Empirical literature:
  - Seeds of financial crises are sowed well before the crisis breaks out
  - Combination of high growth in credit and in property prices is a good indicator of risk of a financial crisis
- Problem: Difficult to identify credit bubbles in real time; not all credit expansions are bad
- Bottom line: Need a model where there can be both good and bad credit expansions

MAPMOD Mark 1

- Designed to study the risks of excessive credit expansions and asset price bubbles
- Focus on credit risk, not liquidity issues
- Captures nonlinear interactions between borrower balance sheets, bank balance sheets and the real economy
- Replicates basic features of financial cycles
- Provides a useful framework for assessing macroprudential policy tradeoffs:
  - Benefits of reducing risks of financial crises
  - Costs of macroprudential policies in normal times

Active Bankers versus Passive Bankers

Passive bankers wait for new deposits which they then use to fund new loans or to buy securities

Bank Balance Sheet

Assets	Liabilities
Loans	Deposits
Securities	Equity

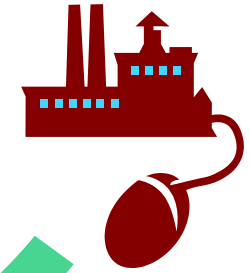
Active bankers see new opportunities to make loans with higher returns or lower risk and then create the deposits that fund the loans

Virtuous Credit Cycle. Or Vicious?

Improved economic prospects, asset prices appreciate

Bankers make more loans

Bankers make loans to firms and consumers



Firms use loans to buy machinery and hire workers

Incomes increase

Aggregate spending increases

Source: World Economic Outlook, January 2016

Brief Description of MAPMOD

- Borrowers use bank loans to finance consumption and investment expenditures
- They borrow against the value of their assets (physical capital, housing, stocks)
- Individual defaults are a function of ex-post asset prices
- Individual defaults driven by: (1) common aggregate factors, and (2) idiosyncratic factors
- Critical that some of the risk cannot be diversified and stays with banks

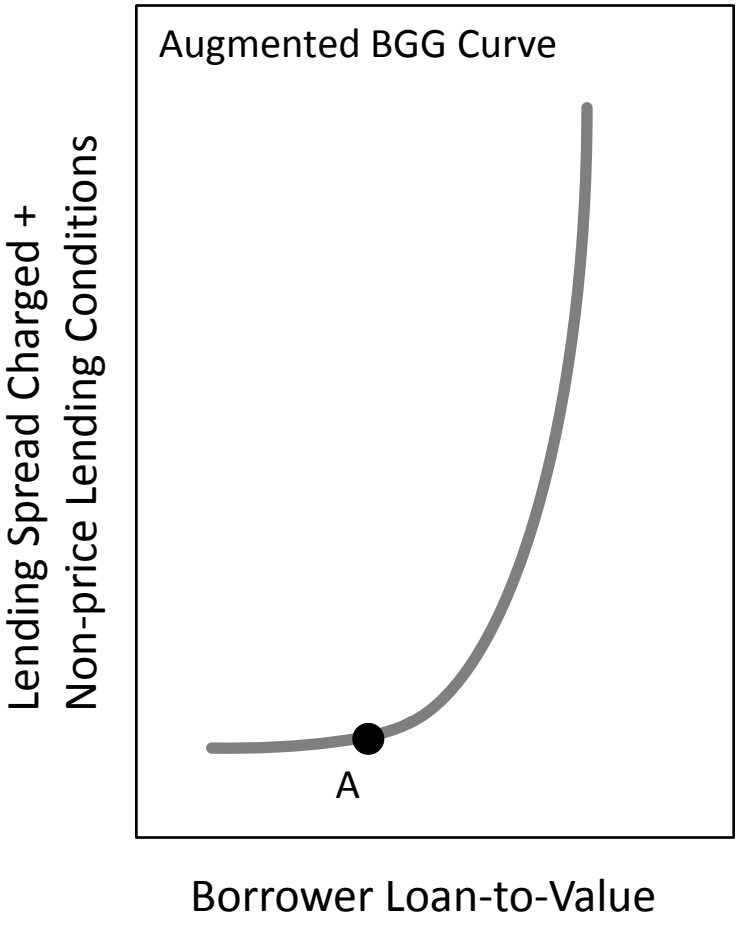
Brief Description of MAPMOD

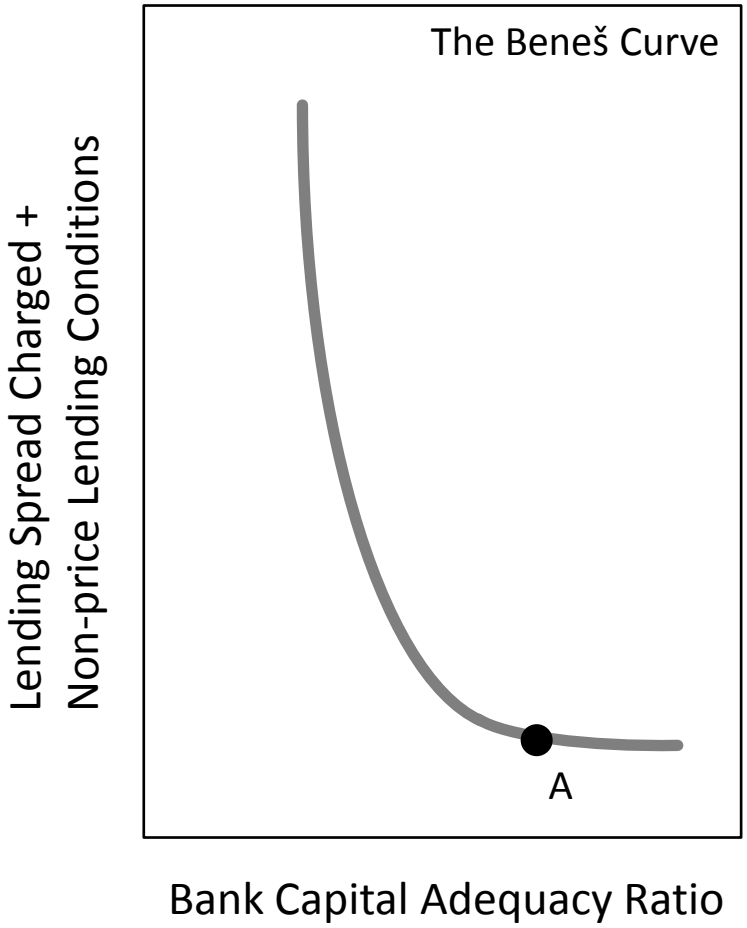
- Banks hold loan books, not trading books.
- Banks ability to expand balance sheets limited by capital regulation
  - Minimum CAR applicable to ex-post realized values of assets, liabilities and equity
- Banks make two types of decisions
  - Assess borrowers (and their assets) and offer individual lending supply curves
  - Choose optimal size of loan portfolio given profitability and risk capacity of bank capital

Two Fundamental Nonlinearities

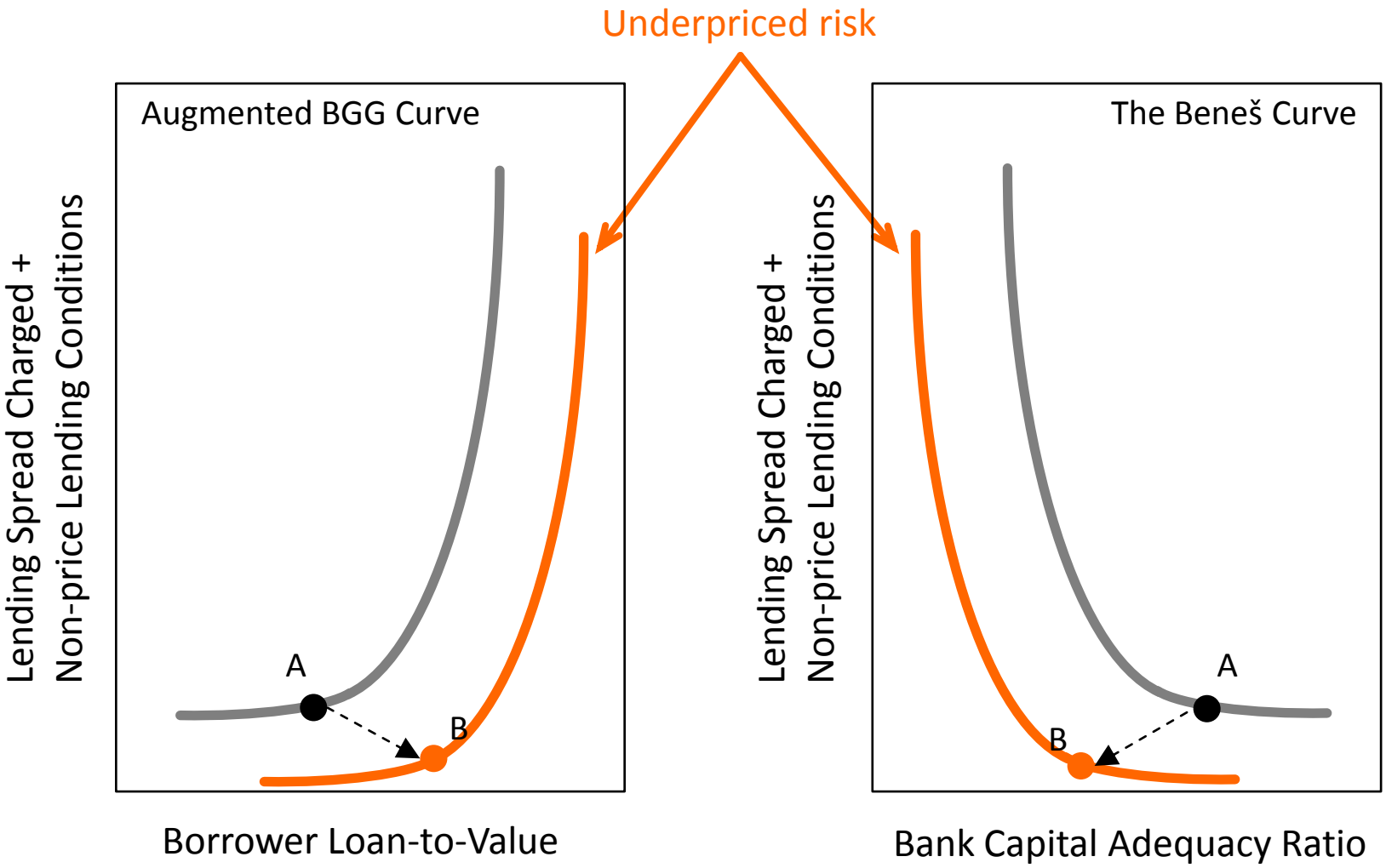
- Individual lending supply curve
  - Lending spreads increasing in loan-to-value ratio
  - Nonlinearity given by distribution of total individual risk (both aggregate and idiosyncratic)
- Optimal loan portfolio curve
  - Lending spreads decreasing in bank capital adequacy ratio
  - Nonlinearity given by distribution of aggregate risk on loan book

Two Fundamental Nonlinearities

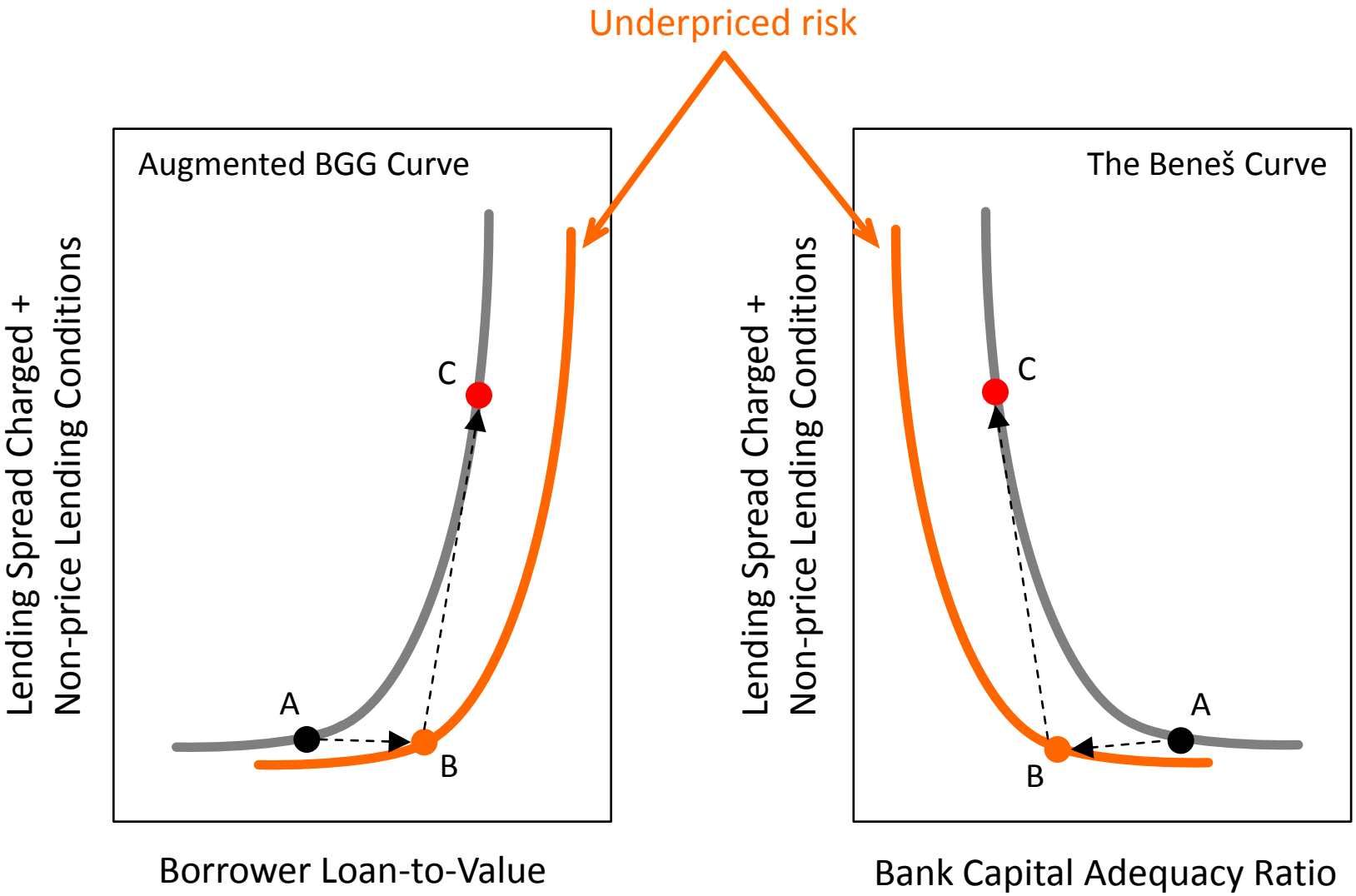




Two Fundamental Nonlinearities



Two Fundamental Nonlinearities

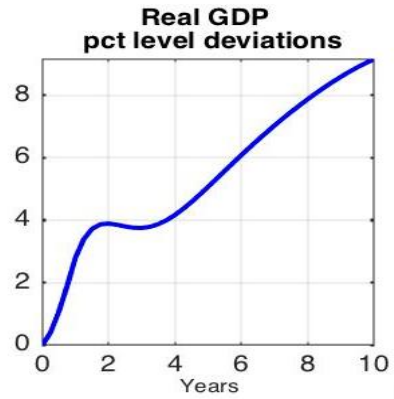


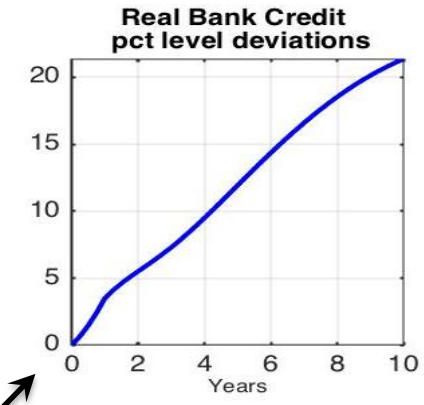
Simulations: Good and Bad Credit Expansions

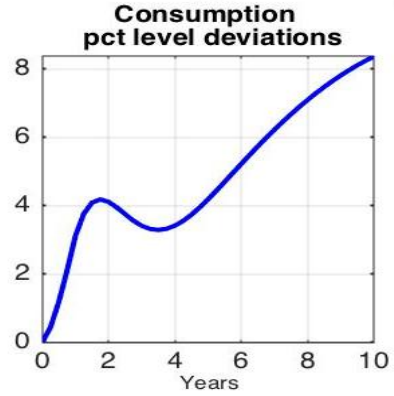
1. Good Credit Expansion: *Higher Growth*
2. Bad Credit Expansion: *Growth Expectations*
3. Bad Credit Expansion: *Underpriced Risk*
4. Really Bad Credit Expansion: *Combine 2 & 3*

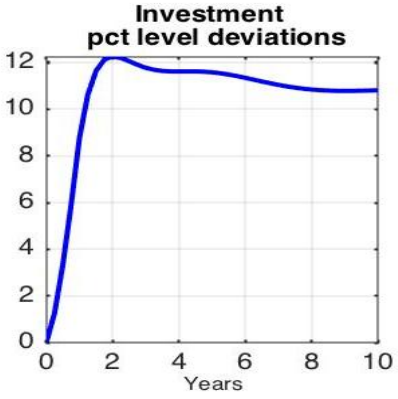
1. Good Credit Expansion: Higher Growth

- Households and firms expect higher productivity growth over the next decade
- Expectations turn out to be correct







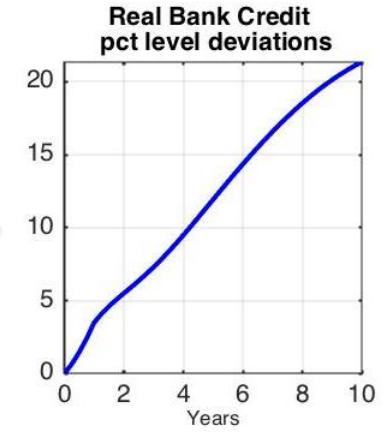


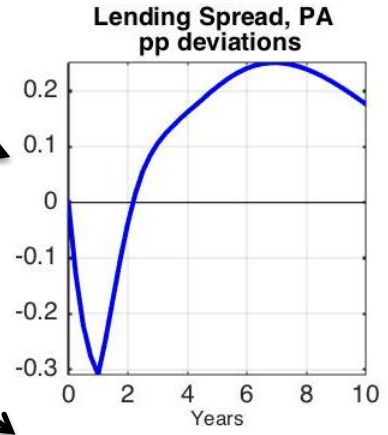
Banks make loans that facilitate adjustment to the new steady state.

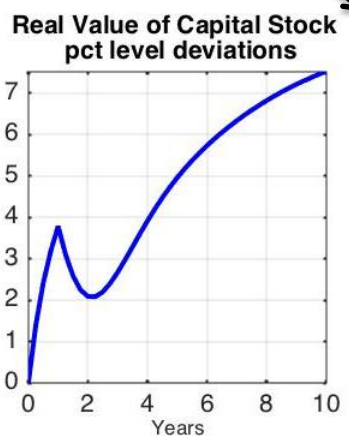
Result: higher levels of consumption, investment, wages, employment and real income.

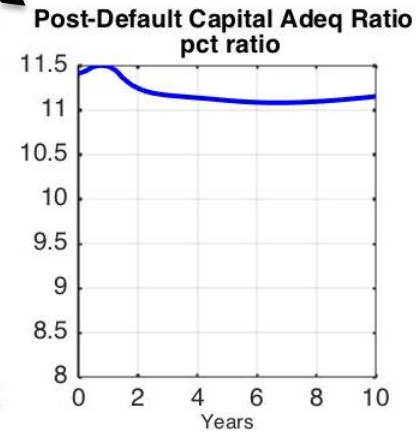
In the short run, lending increases, lending spreads decline, banks reduce their capital buffers, …

…and asset prices rise.

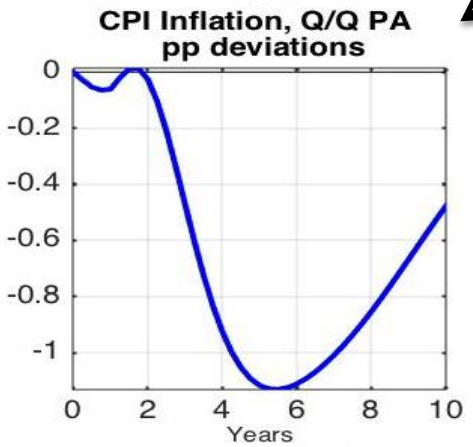


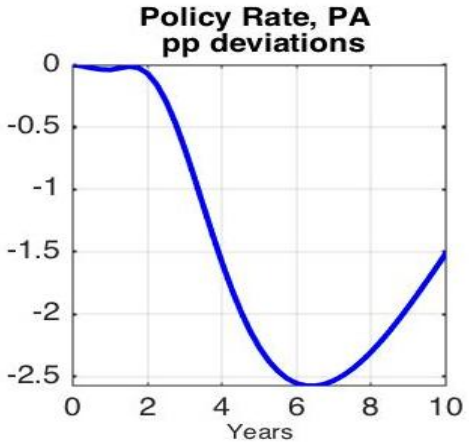


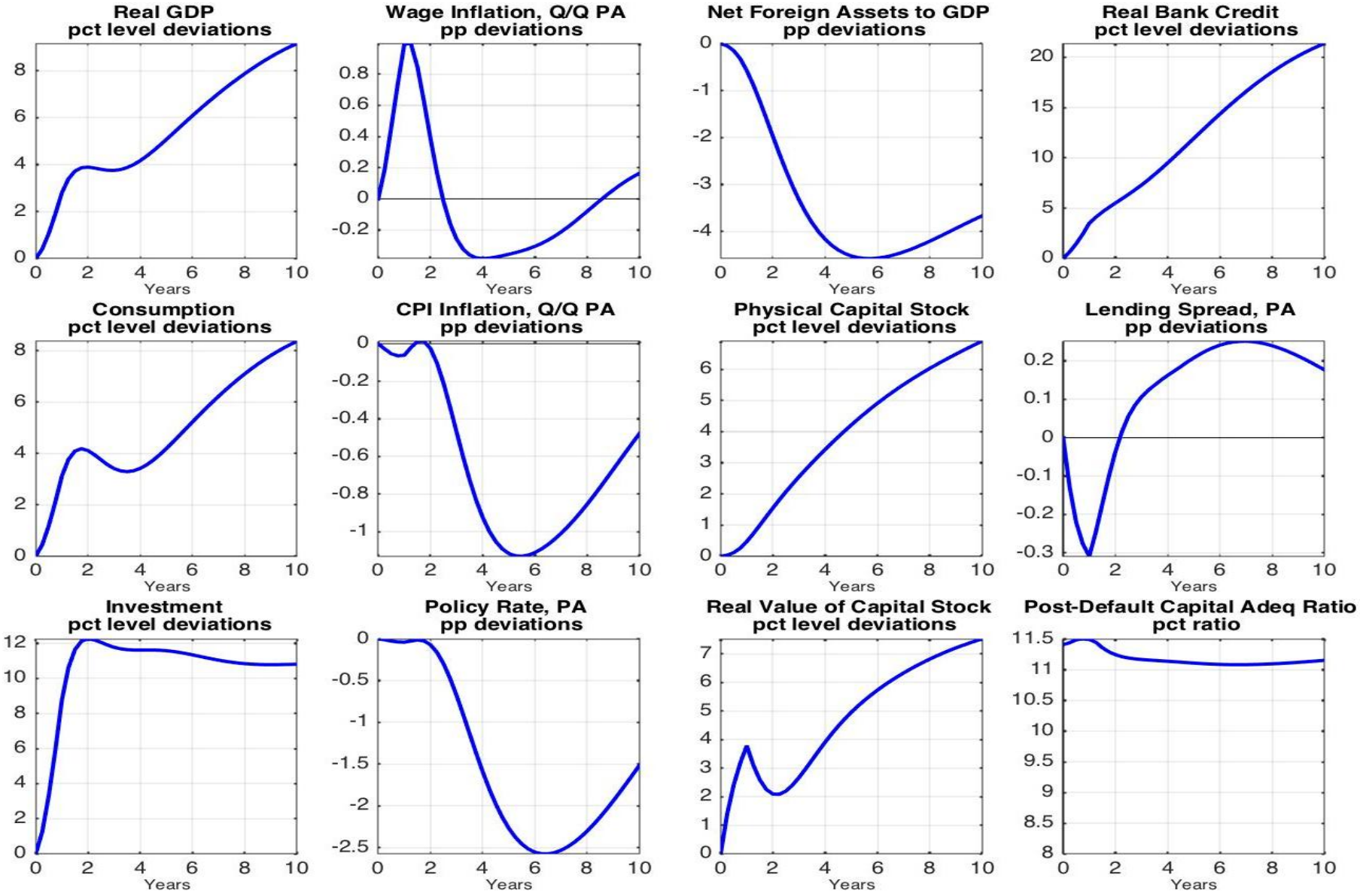




Headline inflation falls and the central bank cuts the policy rate

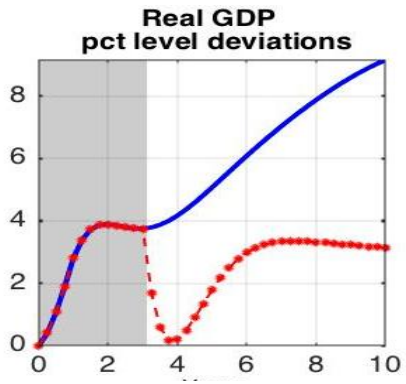





Real GDP
pct level deviations
Wage Inflation, Q/Q PA
pp deviations
Net Foreign Assets to GDP
pp deviations
Real Bank Credit
pct level deviations
Consumption
pct level deviations
CPI Inflation, Q/Q PA
pp deviations
Physical Capital Stock
pct level deviations
Lending Spread, PA
pp deviations
Investment
pct level deviations
Policy Rate, PA
pp deviations
Real Value of Capital Stock
pct level deviations
Post-Default Capital Adeq Ratio
pct ratio
Years
Good Credit Expansion: Higher Growth

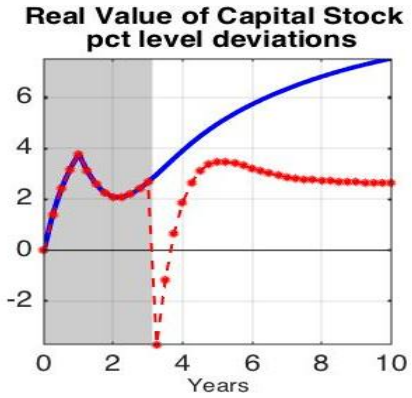
2. Bad Credit Expansion: Growth Expectations

- Households and firms expect higher productivity growth over the next decade
- After 3 years, expectations are revised downward

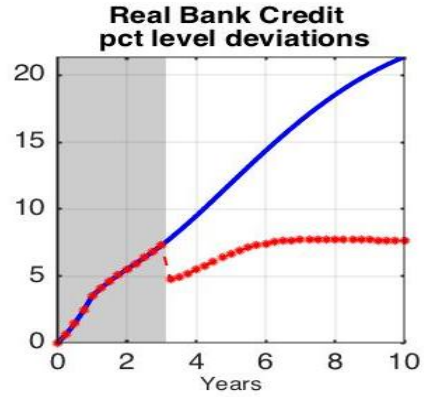


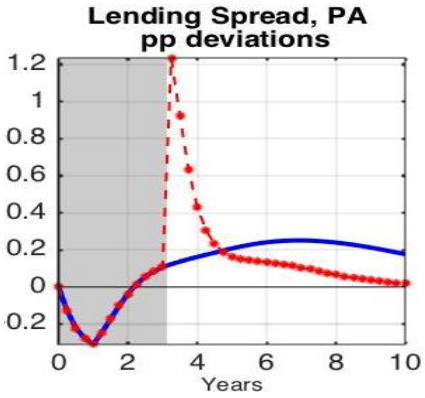
Blue line = previous scenario

Economy experiences a financial crash, resulting in vicious nonlinear interactions between the real and financial sectors.

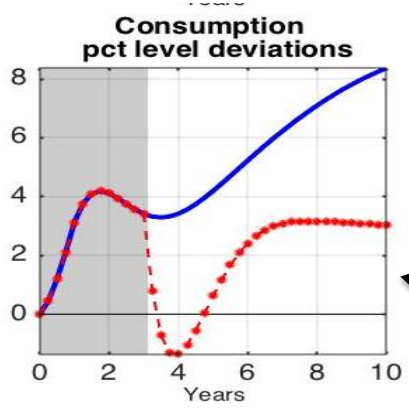


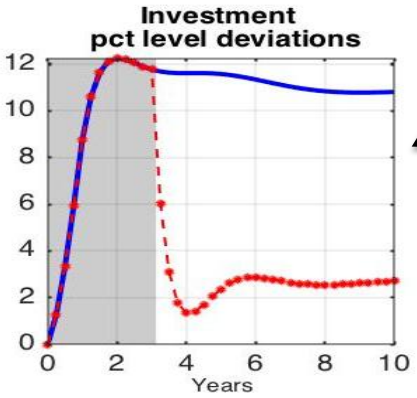
Banks impose tight credit conditions, through a combination of higher spreads and severe non-price credit rationing, …





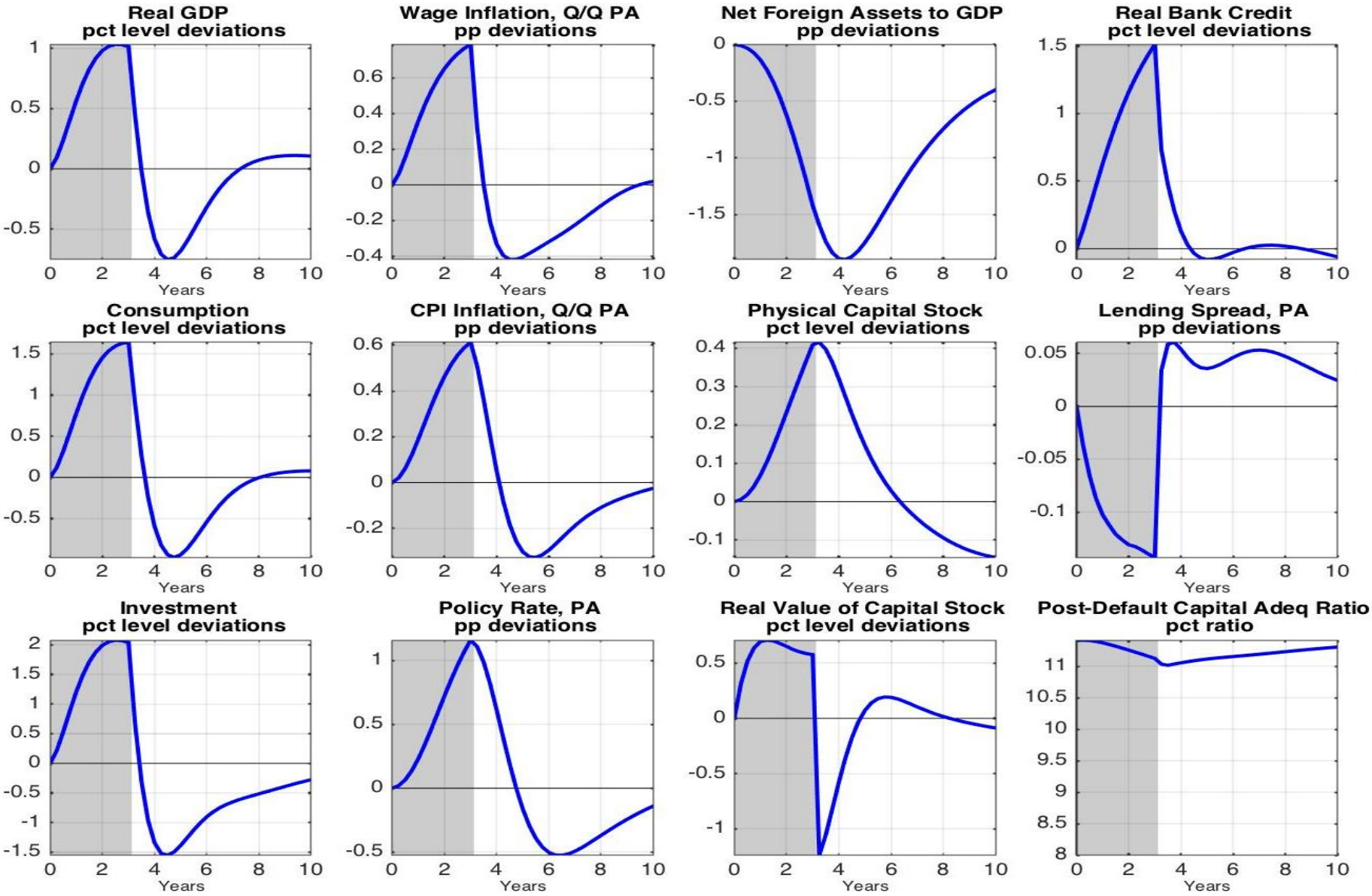
… just when the economy needs easier financial conditions.





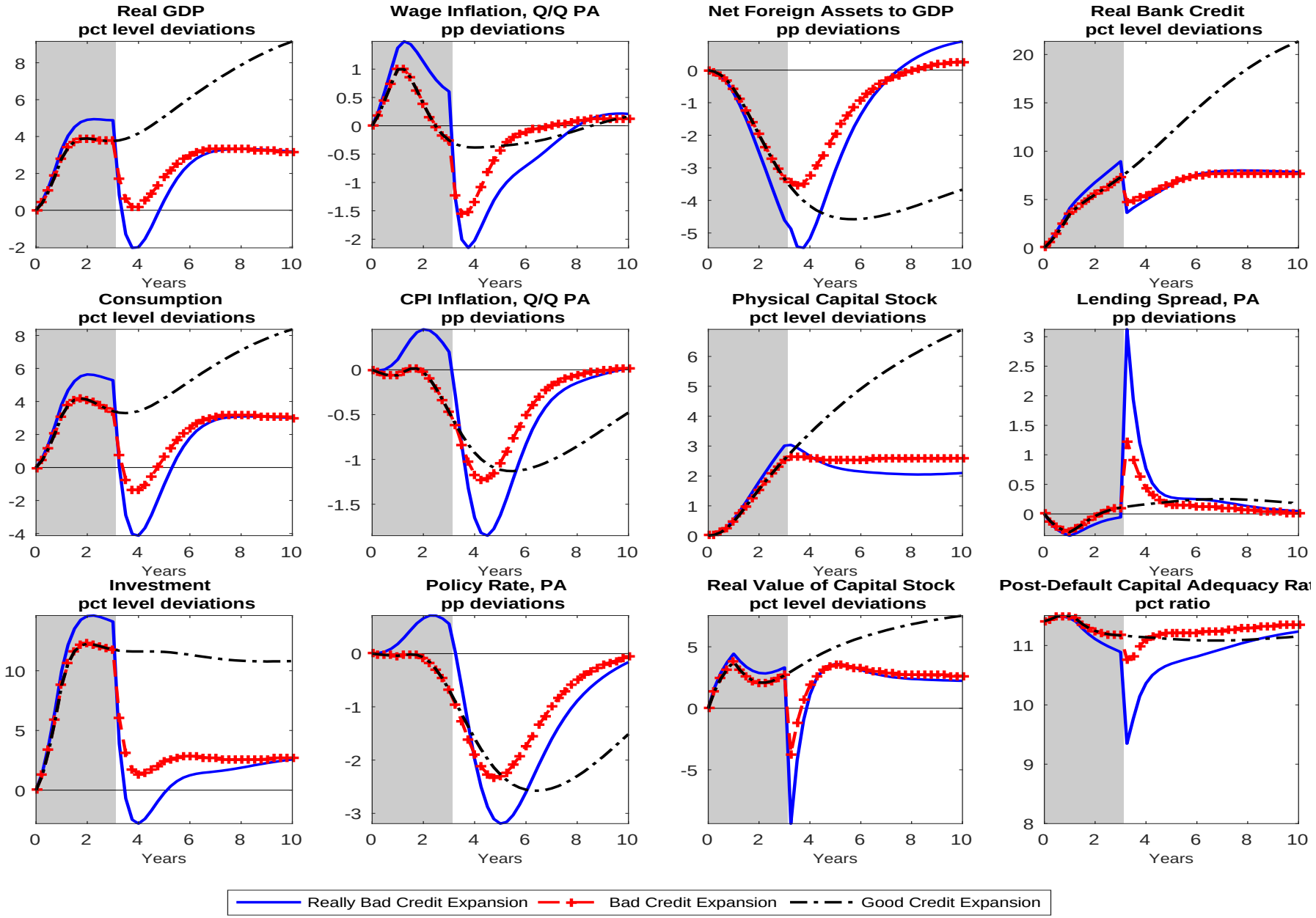
3. Bad Credit Expansion: Underpriced Risk

- Banks inappropriately reduce their estimates of overall credit risk and relax lending conditions ("NINJA loans")
- Underpriced risk builds up in bank portfolios. This risk is difficult to detect based on standard macro aggregates
- After three years, banks' assessment of risk becomes accurate again
- The economy goes through a deleveraging process with vicious nonlinear feedback effects between real and financial variables


Real GDP
pct level deviations
Wage Inflation, Q/Q PA
pp deviations
Net Foreign Assets to GDP
pp deviations
Real Bank Credit
pct level deviations
Consumption
pct level deviations
CPI Inflation, Q/Q PA
pp deviations
Physical Capital Stock
pct level deviations
Lending Spread, PA
pp deviations
Investment
pct level deviations
Policy Rate, PA
pp deviations
Real Value of Capital Stock
pct level deviations
Post-Default Capital Adeq Ratio
pct ratio
Years
Bad Credit Expansion: Easy Lending due to Underpriced Risk

4. Really Bad Credit Expansion

- Combine Examples 2 and 3:
  - Household and firms expect higher growth
  - Banks reduce their risk estimates
- After three years, both productivity expectations and risk estimates are corrected
- Nonlinearities magnify the feedback loop: The combined scenario produces outcomes that are much worse than just a simple sum of the two partial scenarios

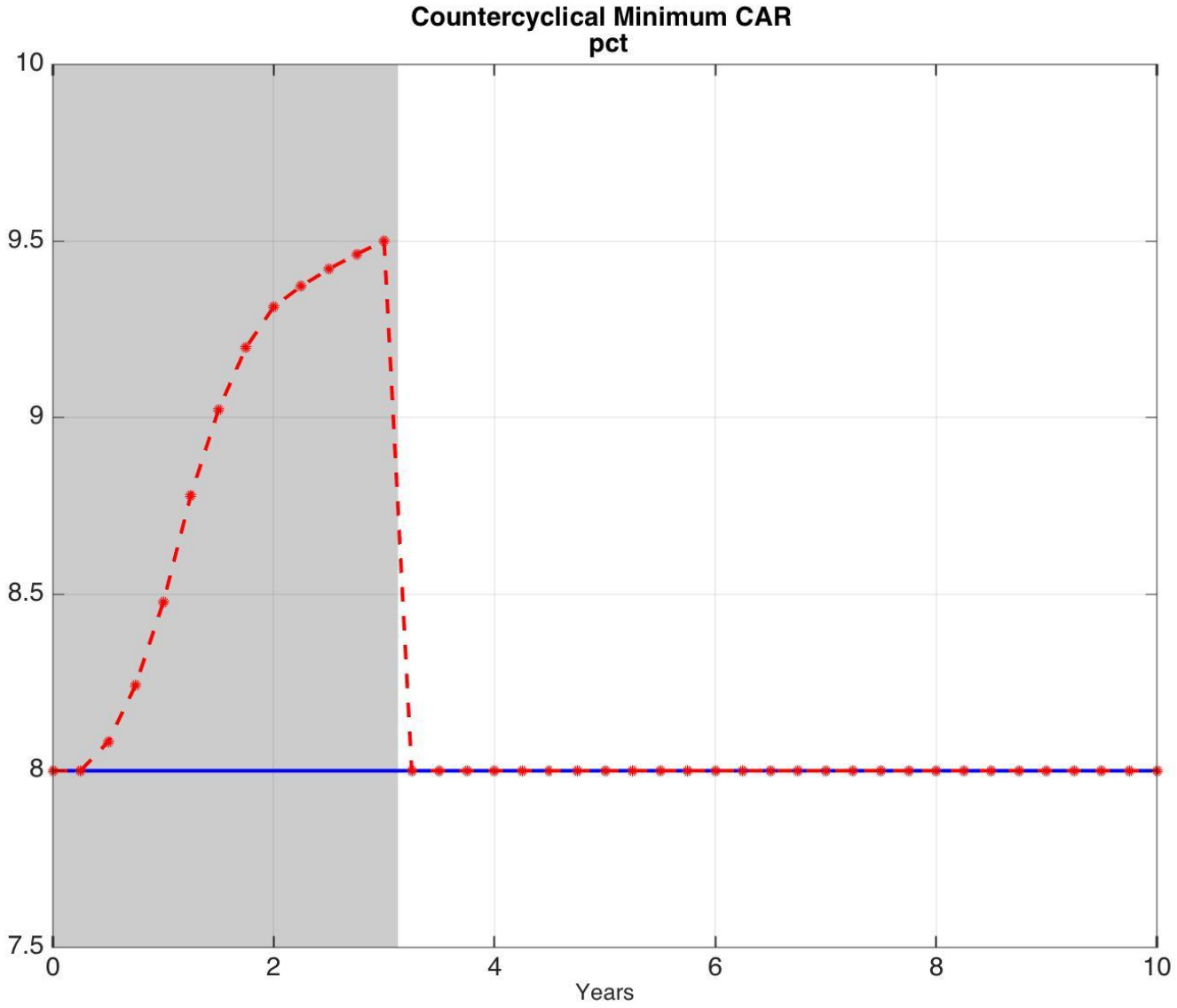

Real GDP
pct level deviations
Wage Inflation, Q/Q PA
pp deviations
Net Foreign Assets to GDP
pp deviations
Real Bank Credit
pct level deviations
Consumption
pct level deviations
CPI Inflation, Q/Q PA
pp deviations
Physical Capital Stock
pct level deviations
Lending Spread, PA
pp deviations
Investment
pct level deviations
Policy Rate, PA
pp deviations
Real Value of Capital Stock
pct level deviations
Post-Default Capital Adequacy Rat
pct ratio
Years
Really Bad Credit Expansion
Bad Credit Expansion
Good Credit Expansion

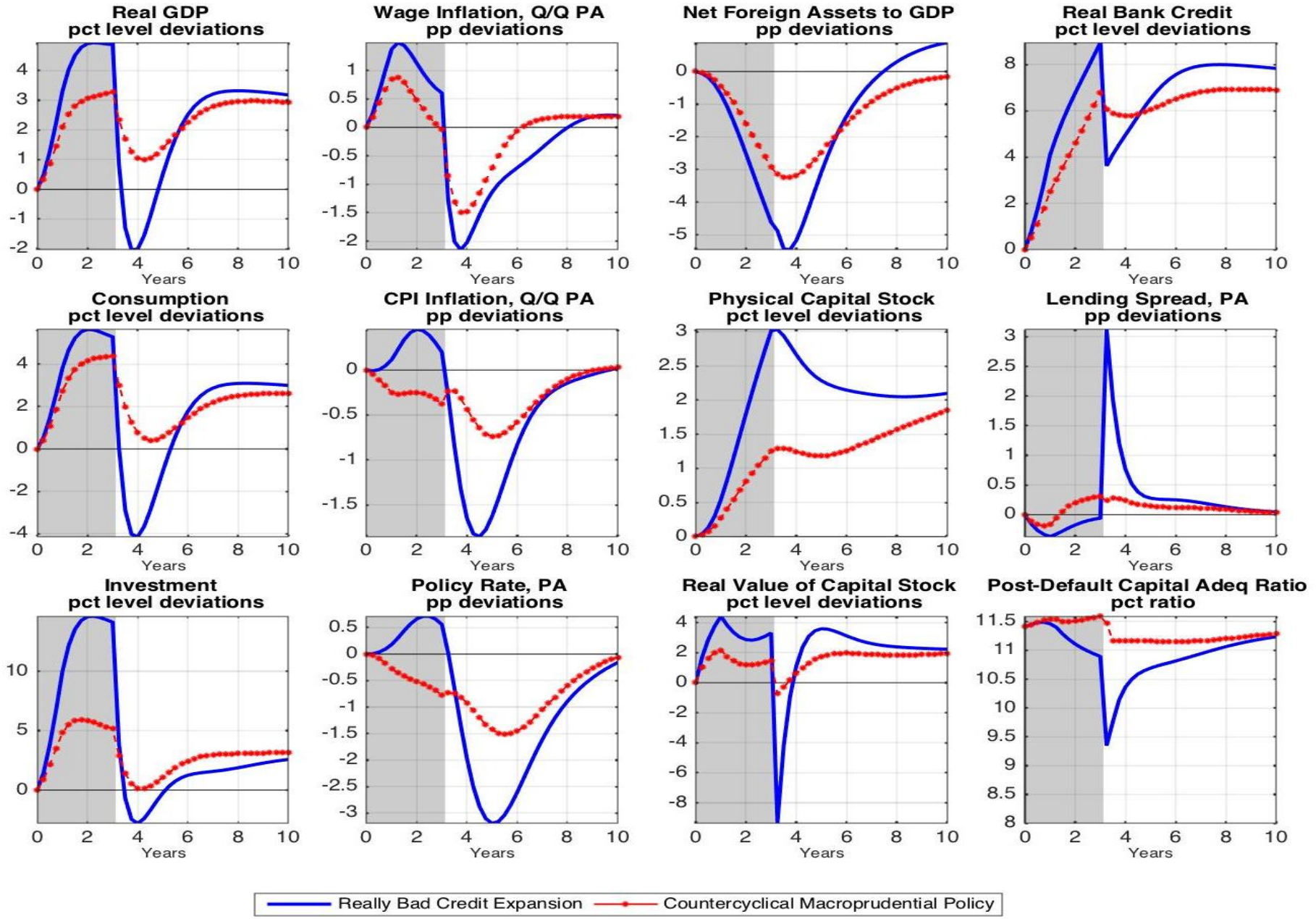
Macroprudential Policy Experiments

5. Countercyclical Macroprudential Policy
6. Permanent Increase in CAR: Steady State
7. Permanent Increase in CAR: Dynamics
8. Effects of Linearization

5. Countercyclical Macroprudential Policy

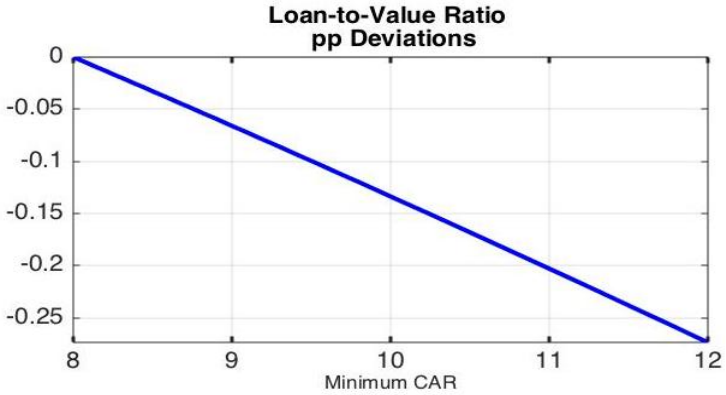
- Really bad credit expansion scenario again (with constant minimum CAR)
- Resimulate the scenario with countercyclical minimum CAR policy
- Simple countercyclical rule
  - During credit boom, respond to real credit growth in excess of "normal" growth to build buffers
  - When risks materialize, draw CAR down and release the buffers
  - See the functional form in the technical appendix

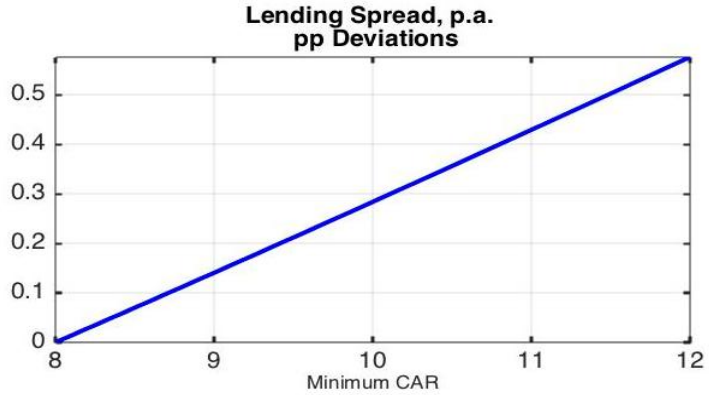

Countercyclical Minimum CAR
pct
10
9.5
9
8.5
8
7.5
0
2
4
6
8
10
Years

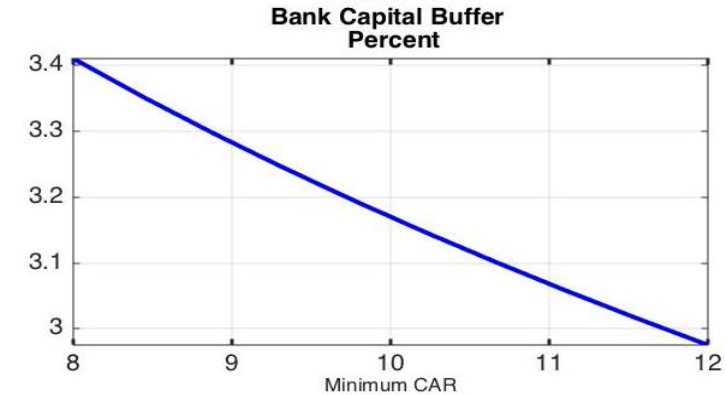

Real GDP
pct level deviations
Wage Inflation, Q/Q PA
pp deviations
Net Foreign Assets to GDP
pp deviations
Real Bank Credit
pct level deviations
Consumption
pct level deviations
CPI Inflation, Q/Q PA
pp deviations
Physical Capital Stock
pct level deviations
Lending Spread, PA
pp deviations
Investment
pct level deviations
Policy Rate, PA
pp deviations
Real Value of Capital Stock
pct level deviations
Post-Default Capital Adeq Ratio
pct ratio
Years
Really Bad Credit Expansion
Countercyclical Macroprudential Policy

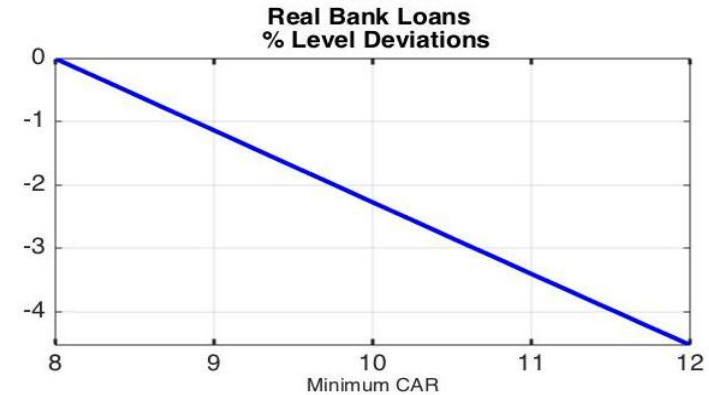
6. Permanent Increase in CAR: Steady State

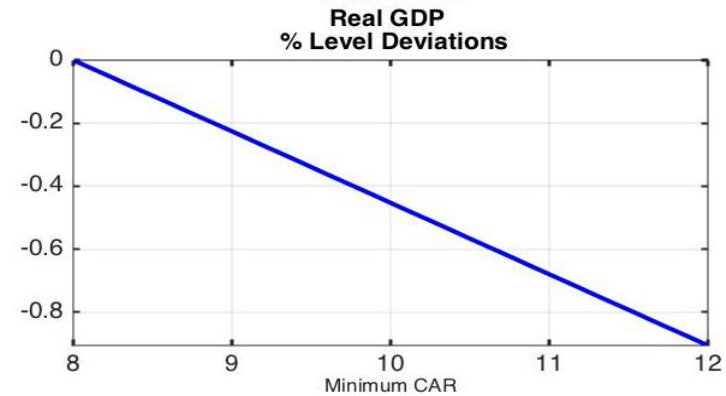
- Comparative statics
- Vary minimum CAR between 8% and 12%
- Report long-run effects on key macro variables

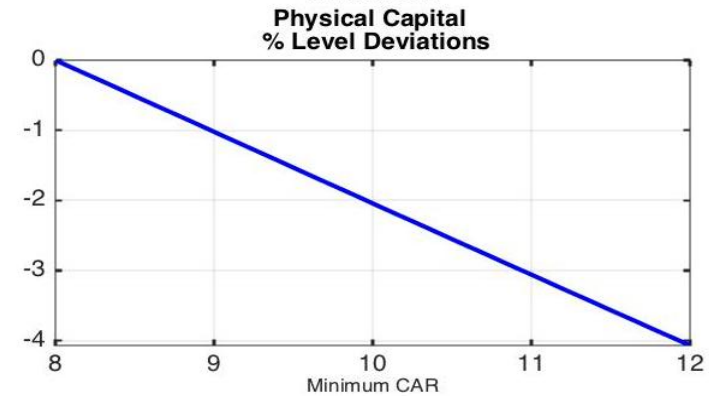

Loan-to-Value Ratio
pp Deviations
0
-0.05
-0.1
-0.15
-0.2
-0.25
8
9
10
11
12
Minimum CAR


Lending Spread, p.a.
pp Deviations
0.5
0.4
0.3
0.2
0.1
0
8
9
10
11
12
Minimum CAR


Bank Capital Buffer
Percent
3.4
3.3
3.2
3.1
3
8
9
10
11
12
Minimum CAR

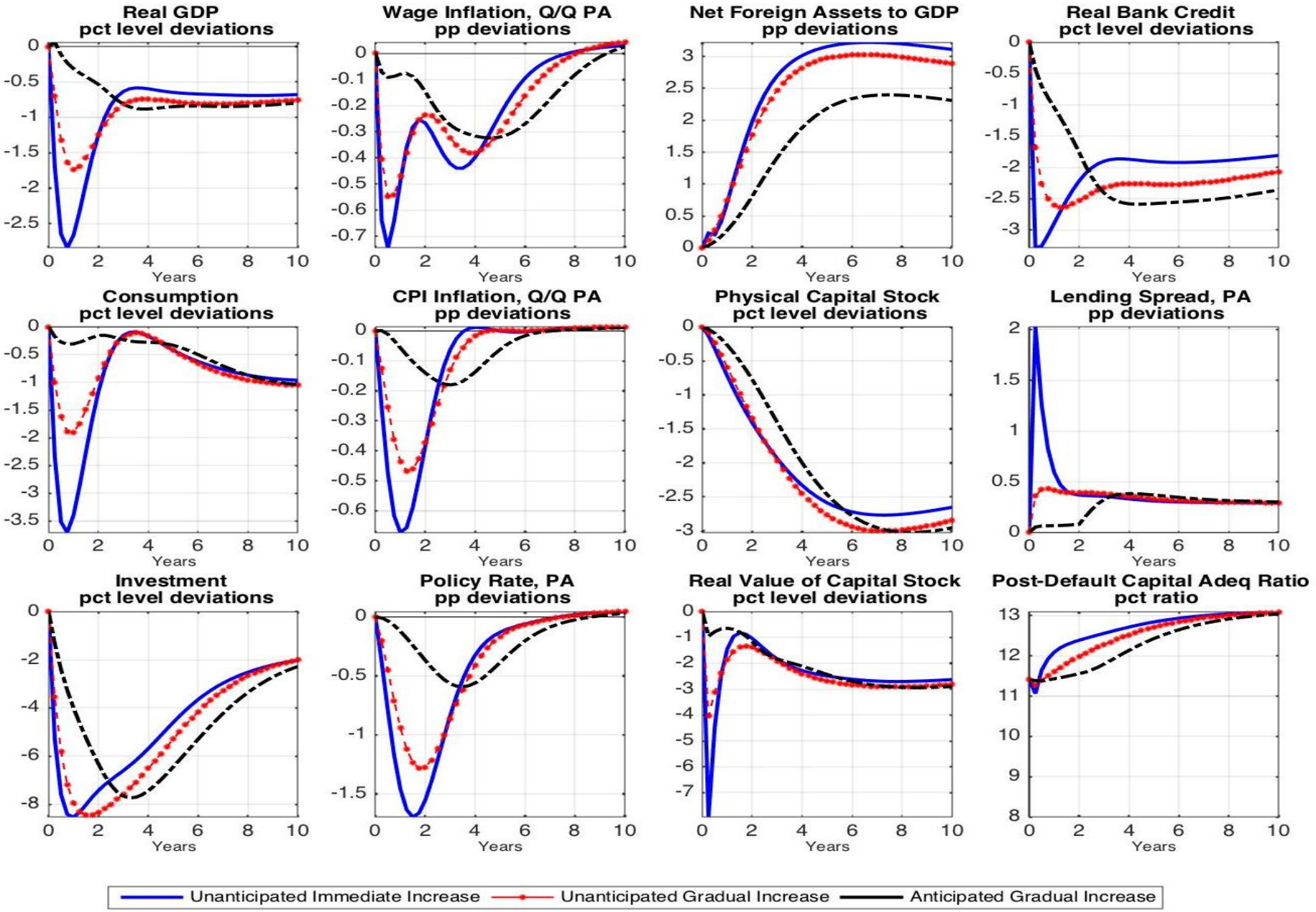

Real Bank Loans
% Level Deviations
0
-1
-2
-3
-4
8
9
10
11
12
Minimum CAR


Real GDP
% Level Deviations
0
-0.2
-0.4
-0.6
-0.8
8
9
10
11
12
Minimum CAR


Physical Capital
% Level Deviations
0
-1
-2
-3
-4
8
9
10
11
12
Minimum CAR

7. Permanent Increase in CAR: Dynamics

- Dynamic simulation
- Increase minimum CAR from 8% to 10% (permanently)
- Three different ways to do it
  - Unexpected immediate increase to 10%
  - Gradual increase distributed over about 4 years
  - Gradual increase announced 2 years in advance
- Long-run effects the same
- Medium-run adjustment much painful in the case of unexpected immediate increase


Real GDP
pct level deviations
Wage Inflation, Q/Q PA
pp deviations
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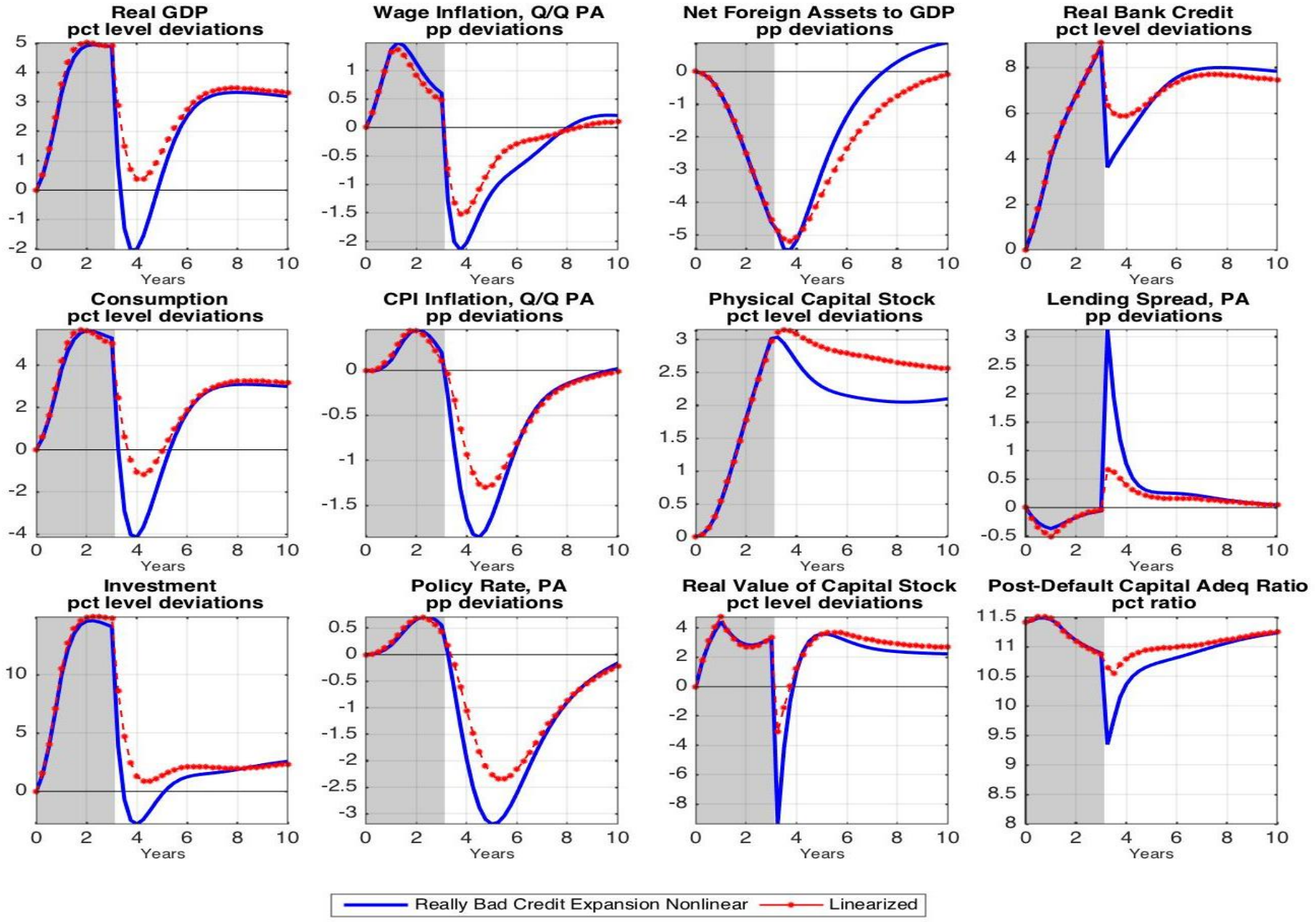
Real Bank Credit
pct level deviations
Consumption
pct level deviations
CPI Inflation, Q/Q PA
pp deviations
Physical Capital Stock
pct level deviations
Lending Spread, PA
pp deviations
Investment
pct level deviations
Policy Rate, PA
pp deviations
Real Value of Capital Stock
pct level deviations
Post-Default Capital Adeq Ratio
pct ratio
Years
Unanticipated Immediate Increase
Unanticipated Gradual Increase
Anticipated Gradual Increase

8. Effects of Linearization

- Re-simulate the really bad credit expansion scenario again, using a linearized version of the model
- The linearized simulation severely underestimates the vicious interactions between the real economy, asset prices, and financial conditions during a crisis


Real GDP
pct level deviations
Wage Inflation, Q/Q PA
pp deviations
Net Foreign Assets to GDP
pp deviations
Real Bank Credit
pct level deviations
Consumption
pct level deviations
CPI Inflation, Q/Q PA
pp deviations
Physical Capital Stock
pct level deviations
Lending Spread, PA
pp deviations
Investment
pct level deviations
Policy Rate, PA
pp deviations
Real Value of Capital Stock
pct level deviations
Post-Default Capital Adeq Ratio
pct ratio
Years
Really Bad Credit Expansion Nonlinear
Linearized

Conclusions and Future Work

- Successful macroprudential policies will actually destroy the empirical variation necessary for identifying key parameters
- Models like MAPMOD will be useful for
  - Studying the risks of bad credit expansions
  - Designing prudent policies to guard against them
- Of course, distinguishing good and bad credit expansions ex ante will also require a large amount of micro-level data analysis and judgment

The End