When Credit Bites Back: Leverage, Business Cycles, and Crises

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The Questions

- Is credit an epiphenomenon?

- If not, how does it relate to the business cycle?

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Credit and the Great Recession

- Mechanisms
  - Effects of deleveraging shocks: Koo (2009) and Eggertson and Krugman (2010); see also Kindleberger, Fisher,…
- Intranational evidence from the Great Recession
  - Household leverage predicts output and consumption decline across US counties (Mian and Sufi, 2009, 2011)
  - Household leverage drives employment across US states (Midrigan and Philippon, 2011)
  - Source of variation: US locations (2008 cross section)
  - An expanding literature…
- Our approach is complementary, international
  - Source of variation: country-year recession episodes (long panel of advanced countries over 100+ years)
  - More time and space; more macro, less granular

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The Approach

- Things we would like to know, and now do (Reinhart and Rogoff, and other sources over the years):

  - *Sovereign crisis data (0-1)* ✔
  - *Bank crisis data (0-1)* ✔
  - *Public debt level data* ✔
  - *Bank credit level data* ✘

- We have a new panel database of *private bank credit creation*:
  - 14 advanced countries, 1870 to 2008 (Schularick and Taylor 2012)

- Estimate impacts extending local projections (Jordà, 2005)
  - E.g., allows us to separate responses in normal and financial recessions, and do other conditioning (without VARs)

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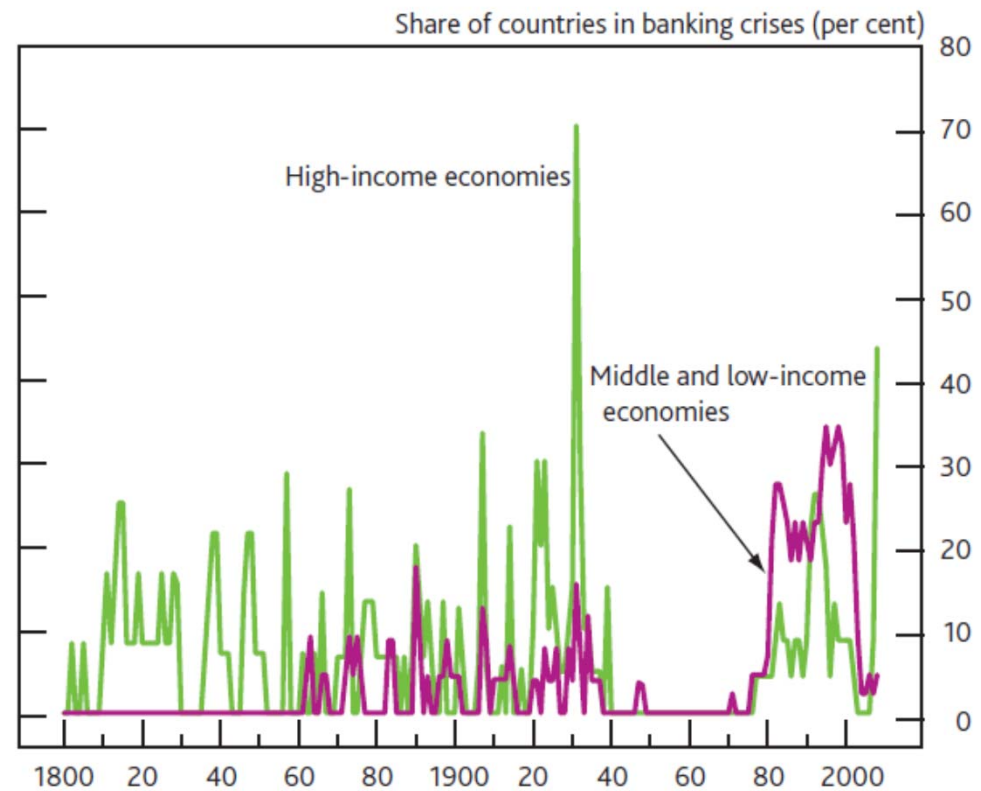
The Findings

- Build-up of excess credit during the expansion correlated with severity of subsequent recession.
  - *This relationship is more pronounced in financial crises but also present in normal recessions.*

- The costs of financial crises are high, variable:
  - Similar result to Cerra and Saxena (2008), Reinhart and Rogoff (2009a,b); Coelings and Zubanov (2010)
  - *But the magnitude of these costs depends on excess credit generated during the preceding expansion*

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The Full Dataset

- <u>14 countries:</u> Canada, Australia, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, U.K. and U.S.

- <u>Variables:</u> growth rate of real GDP and C per capita, real private loans, and real M2; I/GDP, and CA/GDP; CPI inflation, short- and long-term interest rates.

- <u>Recessions and Crises:</u> Bry and Boschan (1971) for recessions. Jordà, Schularick and Taylor (2011) split into normal vs. financial recessions.

Financial Crises Are Back

- A long standing problem

- Exception: 1940 to 1970 oasis of calm. Why?

Share of countries in banking crises (per cent)

High-income economies

Middle and low-income economies

Source: Qian, Reinhart and Rogoff (2010).

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Growth of Credit

Ratios

Bank assets/GDP

Broad money/GDP

Bank loans/GDP

1870 80 90 1900 10 20 30 40 50 60 70 80 90 2000 10
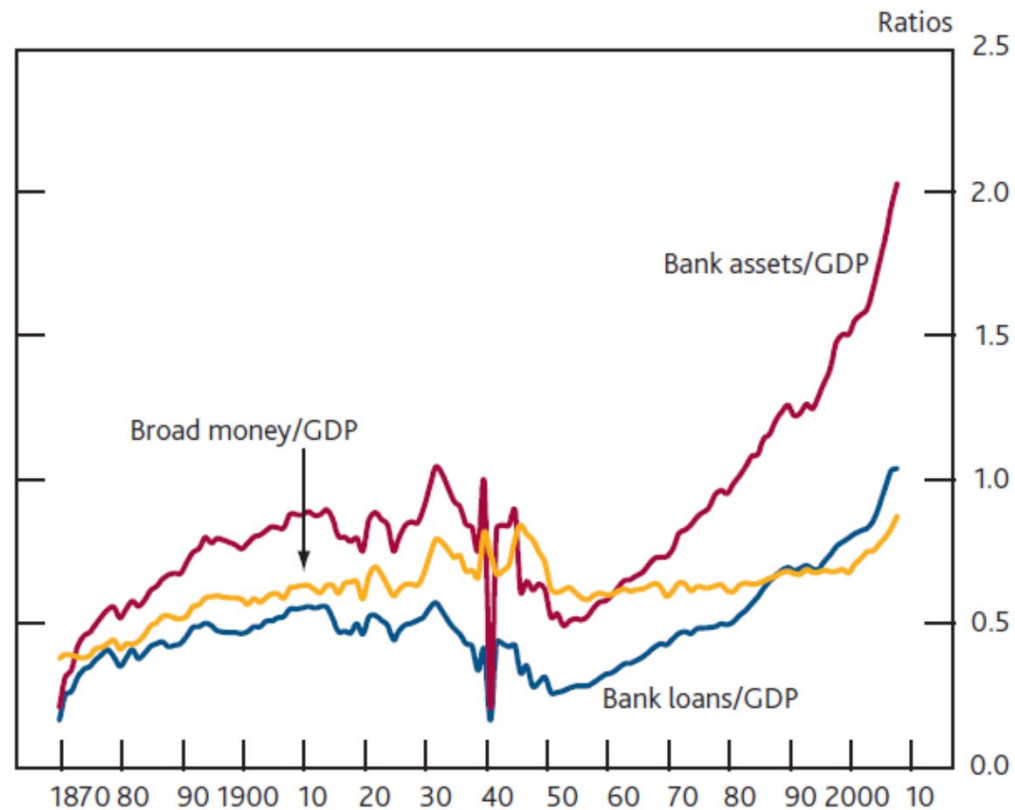
Source: Schularick and Taylor (2009).

(a) Fourteen-country averages by year.

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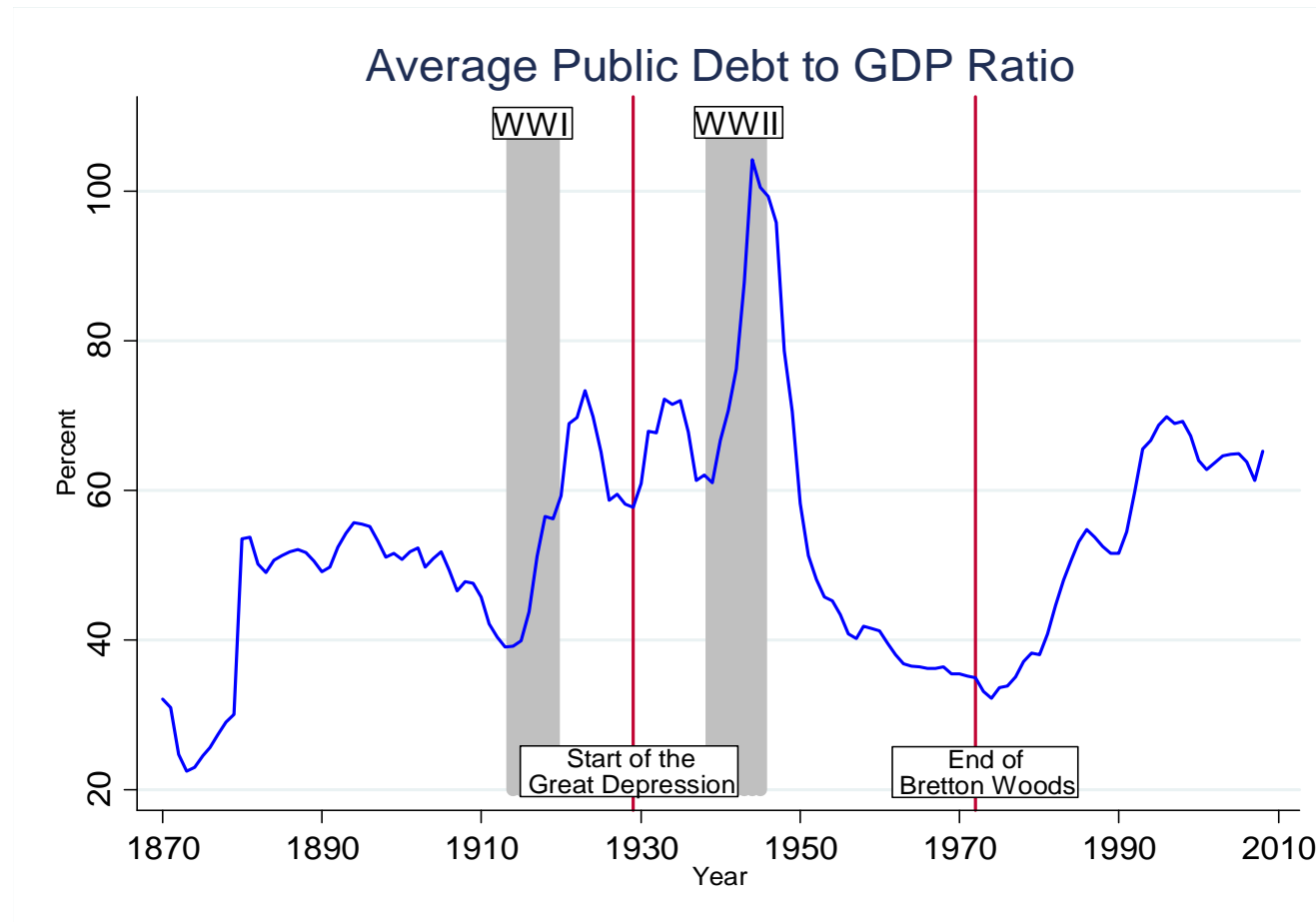
New: Share of Real Estate Lending

Ratio of Real Estate to Total Lending

Average of UK, Italy, Canada, Germany, Australia and Denmark against the US

Average Ratio

US Ratio

Source: Authors' calculations

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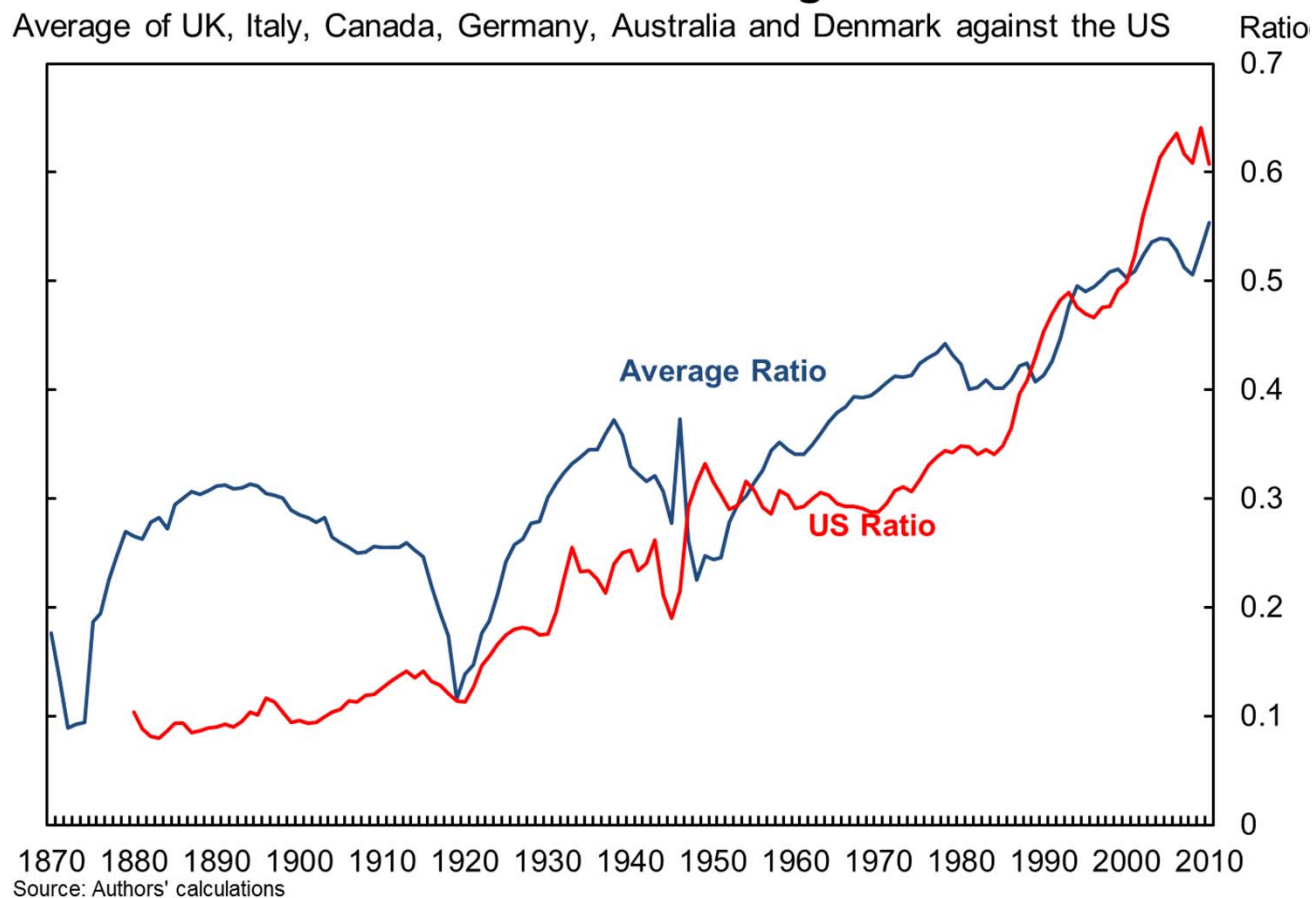
New: Public Debt over Time

Average Public Debt to GDP Ratio

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Stylized Facts:
The Cycle

- Pre-WWII:
  - GDP amplitude twice that of Loans.
  - Expansions are short but growth is rapid.

- Post-WWII:
  - Loan amplitude twice that of GDP.
  - Expansions last twice as long but rate of growth is half as fast

- Lending continues to grow even in recessions (in all eras, on average)

The End of Bretton Woods

- In the U.S., the ratio of financial assets to GDP goes from 150% in 1975 to 350% in 2008

- In the U.K., the financial sector's balance sheet was 34% in 1964. By 2007 it was 500%

- For the 14 countries in our sample the ratio of bank loans to GDP almost doubled since 1970

Credit and the Boom

- After WWII, credit appears to be correlated with the expansion phase trend of GDP
- When credit is above the mean:

  - Expansions last longer: $8.9 \rightarrow 9.7$ years
  - Consequently GDP amplitude is higher: $28\% \rightarrow 38\%$
  - Rate of growth is also higher $2.7\% \rightarrow 3.4\%$

- All good? Is credit welfare enhancing?
  - What happens in the subsequent recession?

Cerra and Saxena (2008)

Banking crises
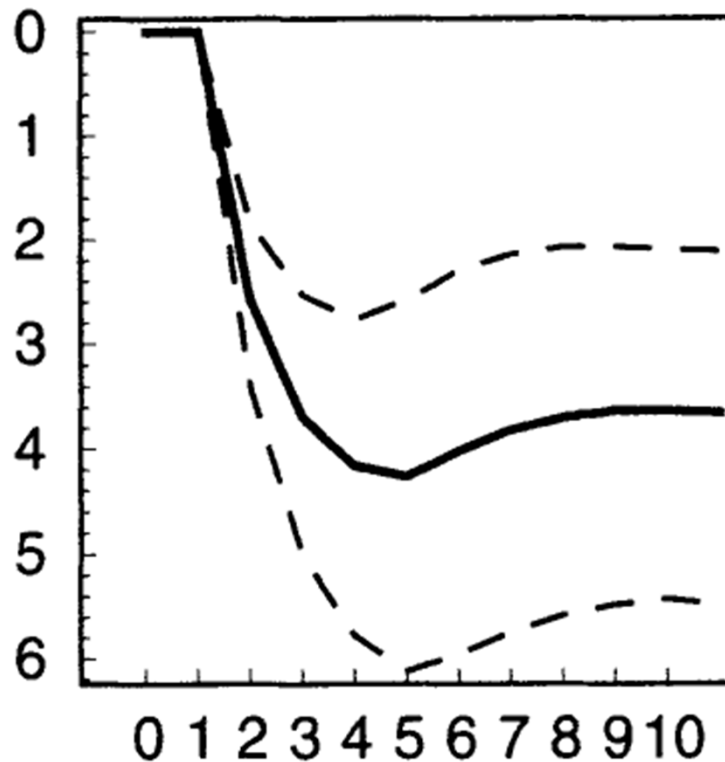
- 190 countries World Bank's World Development Indicators
- 1960 -2001
- Crisis dates: Caprio and Klingebiel (2003) and Kamisnky and Reinhart (1999)

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Credit and the Recession: A Simple Picture of 140 Years and 14 countries

Cumulative Percent Change From the Start of the Recession

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A Motivating Picture

Real GDP per capita

Normal recessions:
+ Excess credit = 1,2,3 %GDP/year

Financial recessions
+ Excess credit = 1,2,3 %GDP/year

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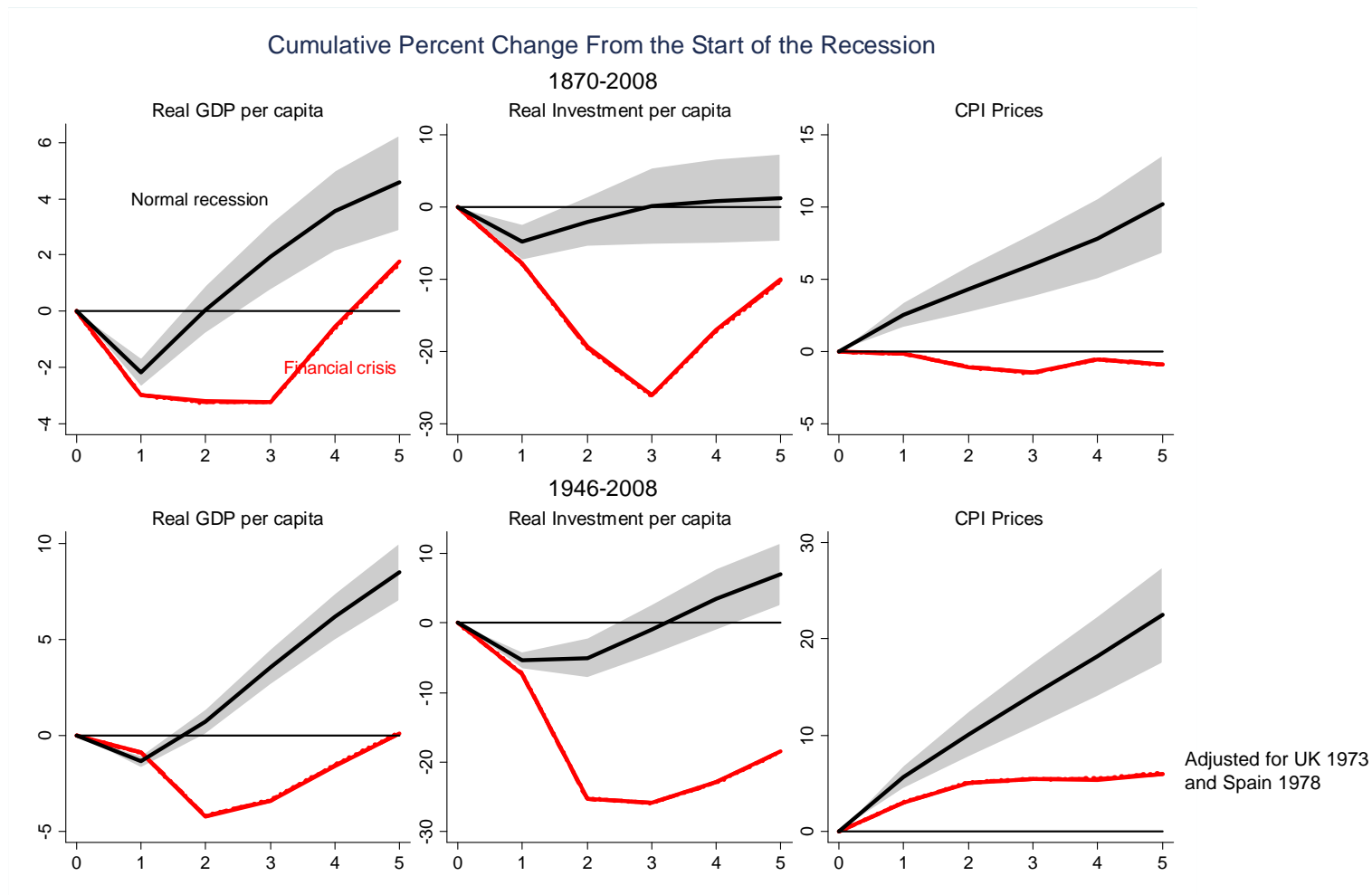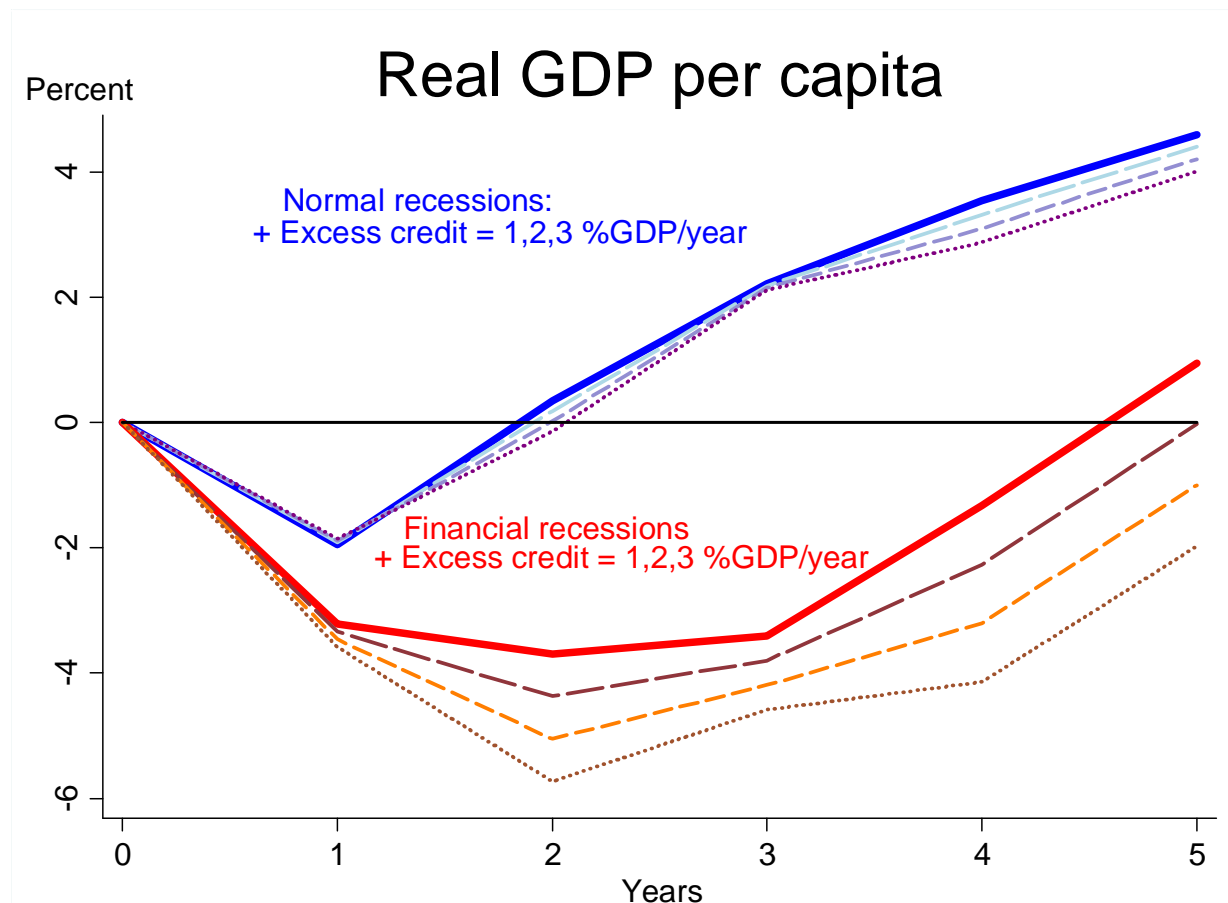
Table 1: Unconditional Paths, Normal v. Financial Bins with Hi-Lo Excess Credit

	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5
Normal recession	-2.046*	-0.0498	1.954*	3.251*	4.531*
	(0.187)	(0.312)	(0.436)	(0.585)	(0.664)
Financial recession, lo boom	-3.577*	-3.400*	-3.858*	-1.274	1.164
	(0.578)	(0.967)	(1.350)	(1.815)	(2.059)
Financial recession, hi boom	-2.904*	-4.394*	-3.154*	-1.935	0.152
	(0.595)	(0.995)	(1.389)	(1.868)	(2.119)
Norm	173.00	173.00	173.00	173.00	173.00
Fin1	18.00	18.00	18.00	18.00	18.00
Fin2	17.00	17.00	17.00	17.00	17.00
p_diff1	0.01	0.00	0.00	0.02	0.12
p_diff2	0.17	0.00	0.00	0.01	0.05
Observations	208	208	208	208	208

Standard errors in parentheses

Dependent variable: log real gdp per capita

$+$ $p < 0.10$, * $p < 0.05$

The Scorecard so far

Real GDP per capita
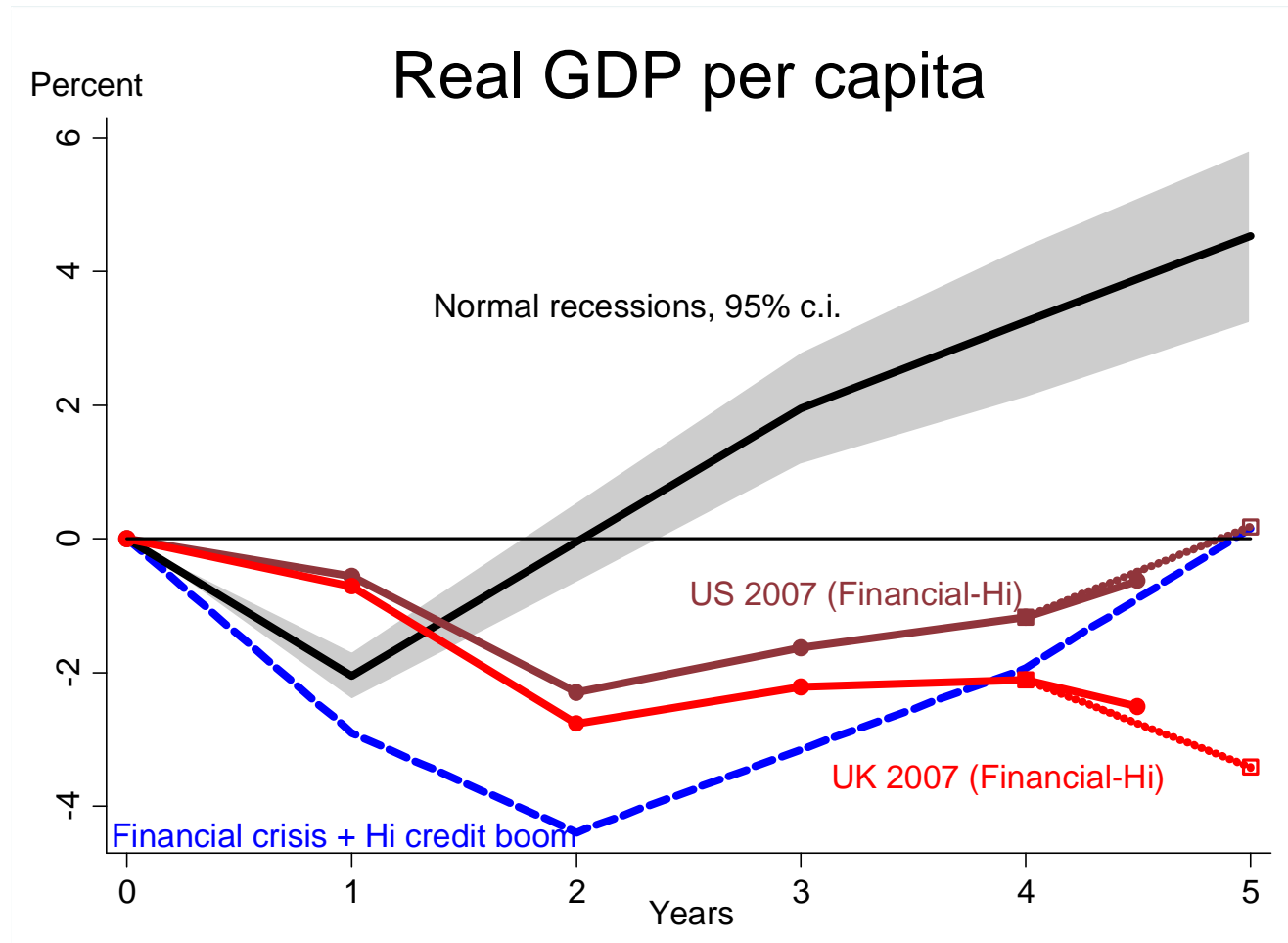
Percent

- Normal recessions, 95% c.i.
- US 2007 (Financial-Hi)
- UK 2007 (Financial-Hi)
- Financial crisis + Hi credit boom

Years

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Table 1: Unconditional Paths, Normal v. Financial Bins and Excess Credit

	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5
Normal recession	-1.947*	0.344	2.213*	3.535*	4.592*
	(0.233)	(0.386)	(0.566)	(0.761)	(0.879)
Financial recession	-3.215*	-3.691*	-3.405*	-1.331	0.947
	(0.419)	(0.694)	(1.018)	(1.370)	(1.583)
Exc cred x Norm recn	0.0303	-0.163	-0.0329	-0.221	-0.195
	(0.113)	(0.187)	(0.274)	(0.369)	(0.427)
Exc cred x Fin recn	-0.123	-0.680*	-0.394	-0.937$^+$	-0.975
	(0.168)	(0.279)	(0.408)	(0.550)	(0.635)
Norm	119.00	119.00	119.00	119.00	119.00
Fin	35.00	35.00	35.00	35.00	35.00
p_diff1	0.01	0.00	0.00	0.00	0.05
Observations	154	154	154	154	154

Standard errors in parentheses

LM test: All excess credit coefficients equal zero: $F(10,750) = 3.995$; $p = 0.000$

Dependent variable: log real gdp per capita

$^+$ $p < 0.10$, * $p < 0.05$

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The Dynamics of Excess Credit

- Our focus is the recession/recovery path as a function of credit during the prior boom.
  - Business cycle, usual normalization (e.g. Romer and Romer, 1989) = start of the recession.
  - Financial crisis, usual normalization (e.g. Reinhart and Rogoff, 2008 et seq.) = financial crisis date.
- But we also want to condition on pre-existing economic conditions reflected in the context of a system of variables (as in a VAR), as well as allow for various "treatments."

Calculating the Conditional Cumulative Response

- <u>Objective:</u> calculate a cumulative "treatment" effect due to excess credit in the boom on to a system of variables, conditional on all that information and lags.

- Unfortunately, no exogenous source of variation nor natural experiment.

- However, by conditioning on lots of other information, we make it less likely to find an independent effect through credit.

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Definition

- *Cumulated response*:

$$CR(\Delta_h y^k_{it(r)+h}, \delta) =$$

$$E_{it(r)}(\Delta_h y^k_{it(r)+h} | x_{it(r)} = \overline{x} + \delta; Y_{it(r)}, Y_{it(r)-1}, ...)$$

$$- \quad E_{it(r)}(\Delta_h y^k_{it(r)+h} | x_{it(r)} = \overline{x}; Y_{it(r)}, Y_{it(r)-1}, ...)$$

- h denotes horizon, k variable in the system, i country, r recession, $t(r)$ calendar time for r-th recession
- x is the treatment variable, δ is the treatment
- $Y_{it} = [\Delta y^1_{it}, ..., \Delta y^J_{it}, y^{J+1}_{it}, ..., y^K_{it}]'$
- $\Delta_h y_{t+h} = y_{t+h} - y_t$

Estimation

- Apply *local projection* approach
- Panel, fixed effects:

$$\Delta_h y_{it(r)+h}^k = \alpha_i + \theta_N + \theta_F + \beta_{h,N}^k (x_{t(r)} - \overline{x}_N) + \beta_{h,F}^k (x_{t(r)} - \overline{x}_F)$$

$$+ \sum_{j=0}^{p} \Gamma_j^k Y_{it(r)-j} + u_{it(r)}^k; \quad k = 1, .., K; \quad h = 1, ..., H$$

- Then $\widehat{CR}_N(k, h, \delta) = \hat{\beta}_{h,N}^k \delta$ and similarly for financial recessions.
- x is percentage point deviation in loans to GDP ratio from trough to peak (peak = start of recession)

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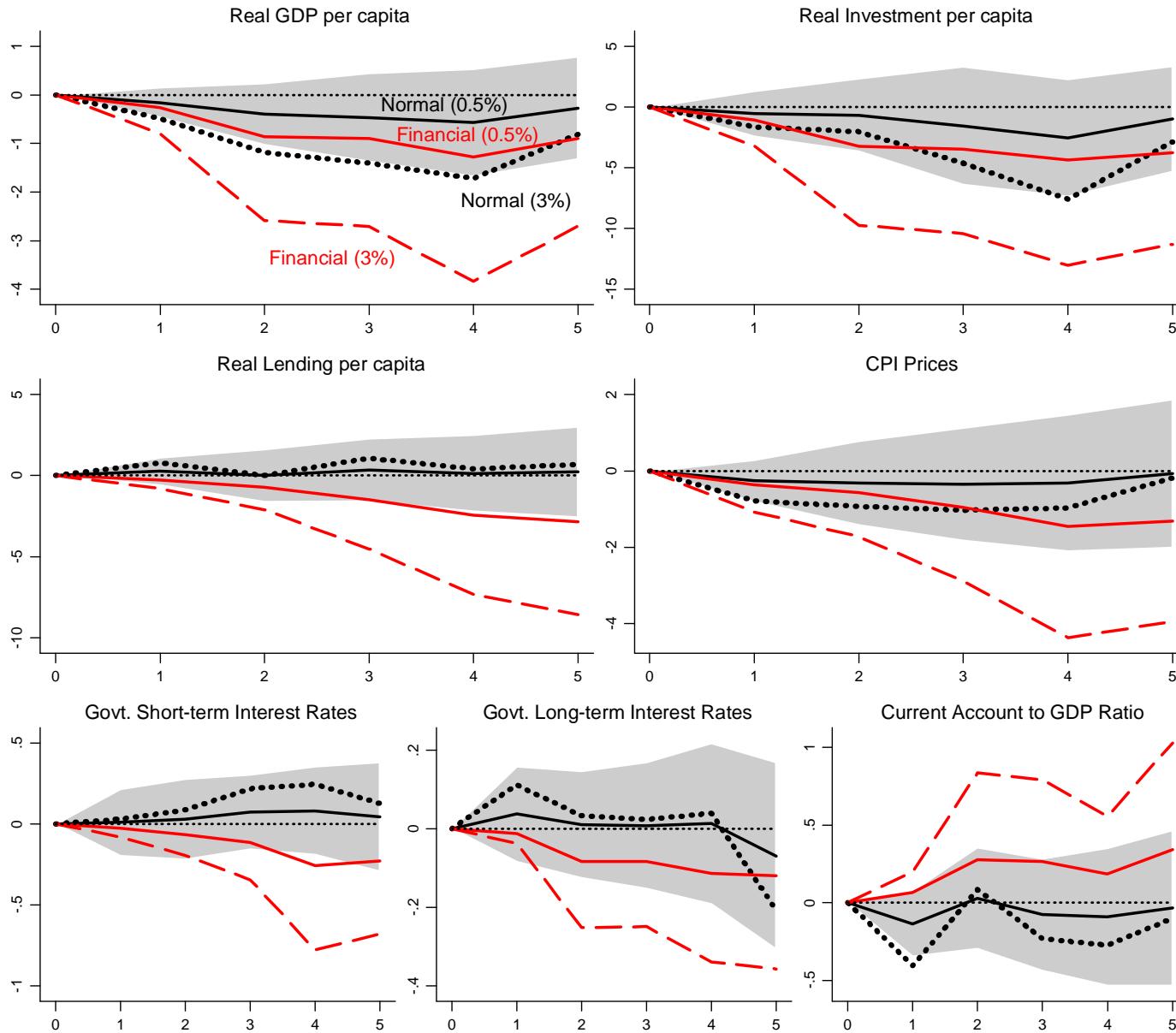
The System

Seven variable system:
- Real per capita GDP growth
- Real per capita investment growth
- Real per capita private lending growth (*stack the case against x)
- Inflation (CPI)
- Short-term (usually 3-months) interest rates (on government bonds).
- Long-term (usually 5-years) interest rates (on government bonds).
- Current account to GDP ratio

Marginal Contribution of Excess Credit in the Expansion to the Cummulative Percent Change from the Start of the Recession

Experiment: Excess credit at 0.5 %pts per year vs. 3 %pts per year

1870-2008

Real GDP per capita

Normal (0.5%)

Financial (0.5%)

Normal (3%)

Financial (3%)

Real Investment per capita

Real Lending per capita

CPI Prices

Govt. Short-term Interest Rates

Govt. Long-term Interest Rates

Current Account to GDP Ratio

25

Marginal Contribution of Excess Credit in the Expansion to the Cummulative Percent Change from the Start of the Recession

Experiment: Excess credit at 0.5 %pts per year vs. 3 %pts per year

1946-2008
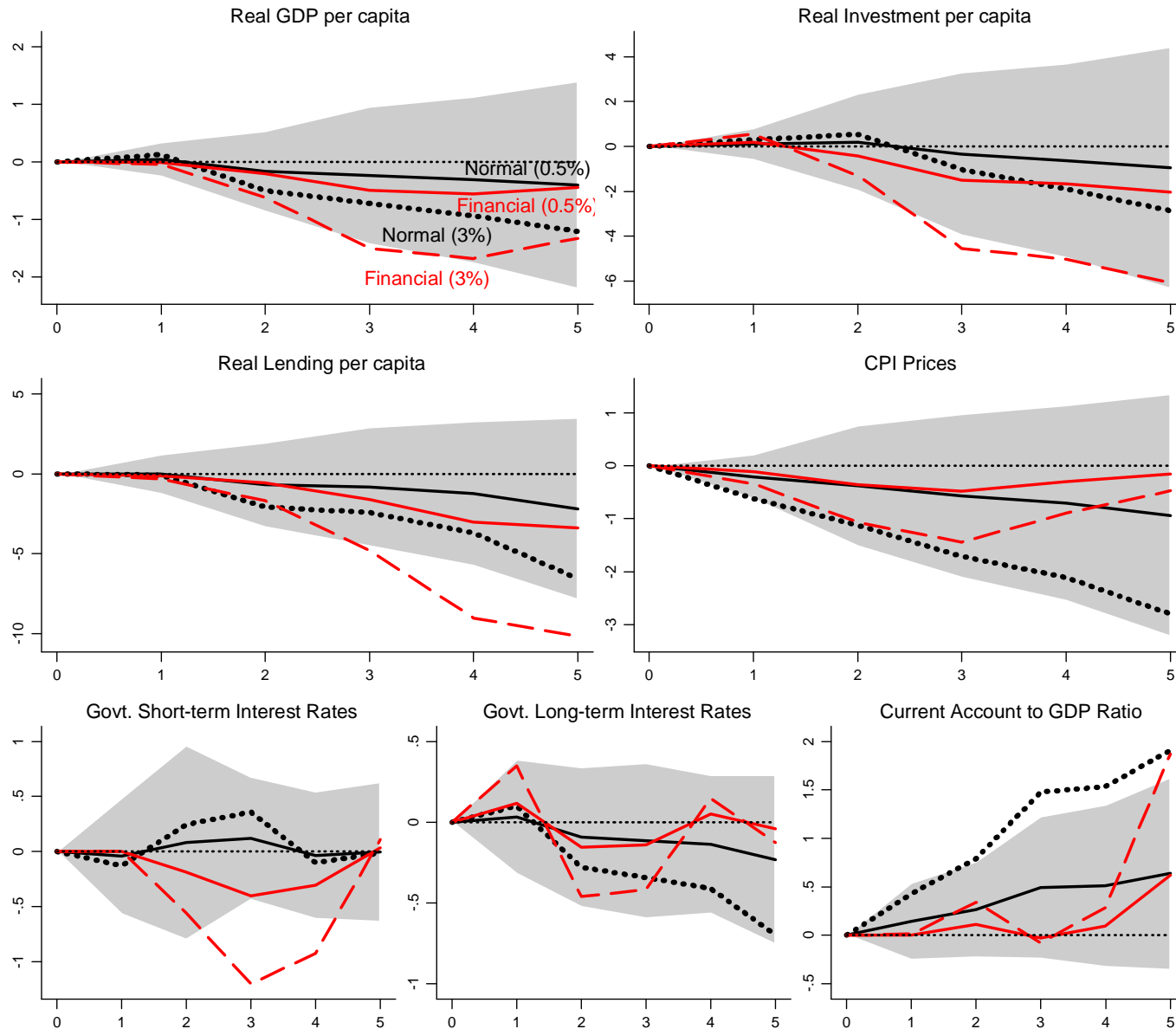

Real GDP per capita — Normal (0.5%), Financial (0.5%), Normal (3%), Financial (3%)

Real Investment per capita

Real Lending per capita

CPI Prices

Govt. Short-term Interest Rates

Govt. Long-term Interest Rates

Current Account to GDP Ratio

Table 1: LP Conditional Paths – 7 Variable System, Normal v. Financial Bins and Excess Credit

	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5
Normal recession	-1.909*	0.909	2.892$^+$	2.888	2.414
	(0.674)	(1.171)	(1.589)	(2.060)	(2.257)
Financial recession	-3.434*	-3.328*	-3.372$^+$	-3.362	-3.635
	(0.813)	(1.414)	(1.918)	(2.486)	(2.725)
Exc cred x Norm recn	-0.147	-0.465$^+$	-0.575	-0.769	-0.575
	(0.158)	(0.276)	(0.374)	(0.485)	(0.531)
Exc cred x Fin recn	-0.357$^+$	-0.985*	-0.464	-1.205$^+$	-0.808
	(0.206)	(0.359)	(0.487)	(0.631)	(0.692)
p_diff1	0.01	0.00	0.00	0.00	0.00
Observations	121	121	121	121	121

Standard errors in parentheses

LM test: All excess credit coefficients equal zero: $F(10,585) = 2.186$; $p = 0.017$

Dependent variable: log real gdp per capita

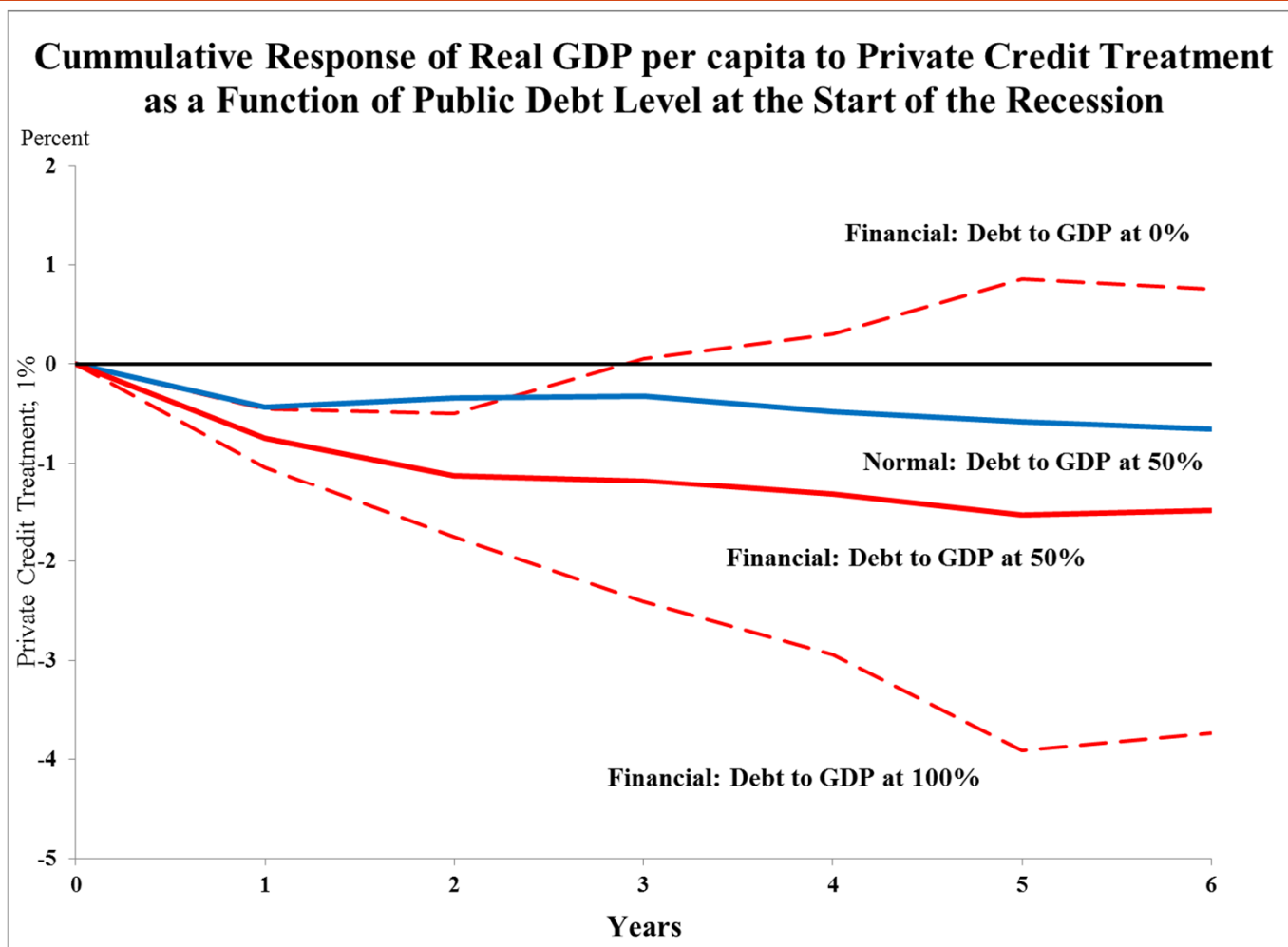Year 0 controls not shown: drprv dlrgdp dlcpi dlriy stir ltrate cay

l.drprv l.dlrgdp l.dlcpi l.dlriy l.stir l.ltrate l.cay

$^+$ $p < 0.10$, * $p < 0.05$

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Remarks

- Numbers in the ball-park of those calculated by Cerra and Saxena (2008) –7.5% GDP loss over 10 years– or Reinhart and Rogoff (2009a,b) –peak to trough decline is about 9%.

- But the effects on lending and investment can be quite nasty.

- In the U.S. given excess leverage into the 2008 financial crises about 7% drop in I/Y and 10% in lending

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What About Public Debt? A Preview

Cummulative Response of Real GDP per capita to Private Credit Treatment as a Function of Public Debt Level at the Start of the Recession

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A Calibrated Example: The U.S.

- Suppose in 2008 excess leverage close to the 3% mark (due to shadow banking, say).

- <u>Implications:</u>

  - Trim GDP forecasts in 2012-2014 by about 0.5-0.75% relative to normal

  - Trim inflation forecasts in 2012-2014 by about 0.75-1% relative to normal

- Suggests the policy balance of risks should be tilted toward closing the output gap rather than on inflation

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Leverage and the Cost of Financial Crises

- In a financial crisis, 1 SD excess leverage from mean results in about 2-3% accumulated per capita GDP loss over 6 years.

- In normal recessions the cumulated drop in lending is about 5%. It is 3 times that in financial recession and add an extra 5-10% more if leverage coming into the recession is high.

- Interest rates also drop by a larger amount in financial crises and considerably more if there is excess credit creation in the preceding boom

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Leverage and the Cost of Financial Crises (cont.)

- A fall in lending and a fall in interest rates seems to suggest the story is: demand for credit shrivels
- This conclusion is premature:
  - The analysis makes no effort to address the issue of endogeneity. Why was credit formation more elevated during the preceding expansion?
  - The data on interest rates refer to government securities. Unfortunately we do not have data on rates for private loans. There could be a significant spread.

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Conclusion

- The credit intensity of the boom matters for the path of the recession.

- Leveraged economies more vulnerable to shocks.

- These effects are compounded in a financial crisis.

- But in looking at the economic costs of crises, inflation does not seem to be major cause for concern.

- Clearly, this has important policy implications in the current environment.

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Future Research

- So far the analysis is deliberately descriptive.
- But we hope to make progress toward more causal explanations.
- We have merged in data on the public sector – many have argued that the level of public AND private indebtedness matters during a financial crisis and we want to look into this.
- We have also (just now) collected 100+ years of disaggregated credit data (housing/mortgage, industrial, other,…)
- Stay tuned…

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