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

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The Debt-Deflation Theory of Great Depressions

Irving Fisher (1933):

> "I venture the opinion, subject to correction on submission of further evidence, that, in the great booms and depressions, each of the above-named factors has played a subordinate rôle as compared with two dominant factors, namely over-indebtedness to start with and deflation following soon after; also that where any of the other factors do become conspicuous, they are often merely effects or symptoms of these two."

The Question

Is credit an epiphenomenon?

And if not, how does it affect the business cycle?

Credit and leverage have an important role in shaping the business cycle, in particular, the intensity of recessions and the likelihood of financial crisis.

The Approach

- The influential work of Reinhart and Rogoff (2009ab) looks at history of public-sector debt and its links to crises and economic performance.
- We have at our disposal a new panel database of *private bank credit creation*:
  - 14 advanced countries
  - Yearly from 1870 to 2008
  - Local projections (Jordà 2005)
  - Separate responses in normal and financial recessions

The Findings

- A close relationship exists between the build-up of leverage during the expansion and the severity of the subsequent recession.
- This relationship is more pronounced in financial crises but still visible in normal recessions.
- This relationship has evolved somewhat over time but the core has remained remarkably unchanged.

The Findings II

- In a financial crisis, the more credit builds up in the expansion:
  - The deeper the fall in output, consumption and investment and the slower the recovery.
  - The bigger the fall in lending.
  - In the aftermath of credit-fueled expansions that end is a systemic financial crisis, downward pressured on inflation are pronounced and long-lasting.

The Findings III

- The costs of financial crises are high:
  - Similar result to Cerra and Saxena (2008), Reinhart and Rogoff (2009ab), Coelings and Tzubanov (2010).
  - But the magnitude of these costs depends on the leverage incurred during the preceding expansion.

The Implications

- For policy:
  - In the aftermath of the most severe financial crisis of the last 80 years, fear of inflation appears to be a phantom menace. Inflation targeting alone is not sufficient.
  - Rethink how macro-finance interactions integrated into broader policy framework.
  - Important to monitor credit as it can affect the severity of the recession.
  - Credit and systemic risk also appear to go hand-in-hand.

- For Macro:
  - Credit does not seem to be an epiphenomenon, but rather an integral part of how economies behave over the business cycle. And this is true even during normal recessions. Models need to reflect this.

Where We Fit

- Economic History:
  - Reinhart and Rogoff (2009ab).
  - Mendoza and Terrones (2008).
  - Hume and Sentence (2009).
  - Reinhart and Reinhart (2010).
  - Bordo and Haubrich (2010).

- Macro Policy:
  - The “BIS view”: Borio, White, et al.
  - Recent trends in regulatory/supervisory reform.

Relevant Literature I

- Irving Fisher (1933) and Hyman Minsky (1986).
- Bernanke and Gertler (1990) *financial accelerator.*
- Battacharya, Goodhart, Tsomocos and Vardoulakis (2011) periods of prolonged prosperity induce financial institutions to invest in riskier assets.
- Geanakoplos (2009) leverage as an equilibrium outcome independently determined from prices.

Relevant Literature II

Supply:

- Krozsner, Laeven and, Klingebiel (2007) on credit rationing to industries with promising outlooks.
- Abiad, Dell'Ariccia and Li (2011) impaired financial intermediation can lead to slow "creditless recoveries."

Demand:

- Mian and Sufi (2011): higher income leverage associated with weaker spending growth (U.S. county-level data).

Data

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

- Variables: 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.

- Recessions and Crises: Bry and Boschan (1971) for recessions. Jordà, Schularick, and Taylor (2011) for normal vs. financial recessions.

Four Eras of Financial Development

- From Schularick and Taylor (2012)

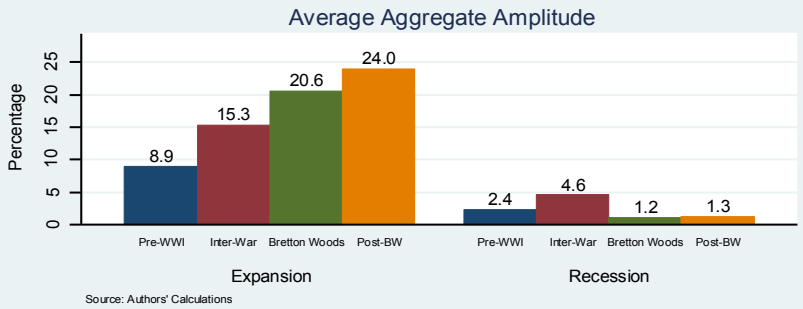
1. Pre-WWI: stable ratio of loans to GDP, with leverage and economic growth in sync.

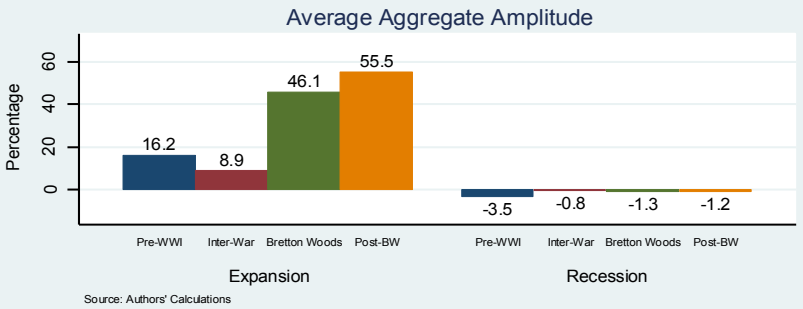
2. Interwar period: break-down of the gold standard and the Great Depresssion.

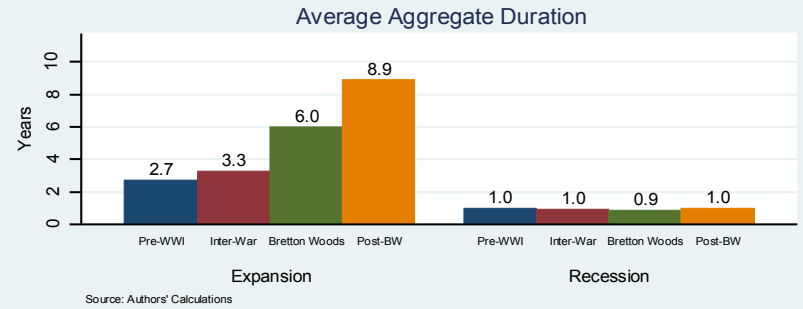
3. Bretton Woods: a new international financial regulatory framework and the *oasis of calm*.

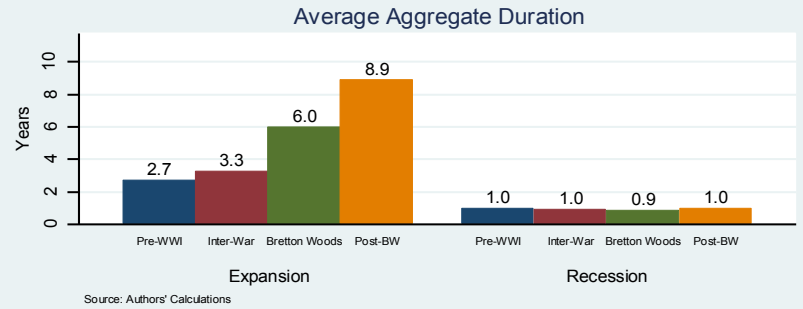
4. Post-Bretton Woods: abandonment of the gold stantard, deregulation and explosion of credit.

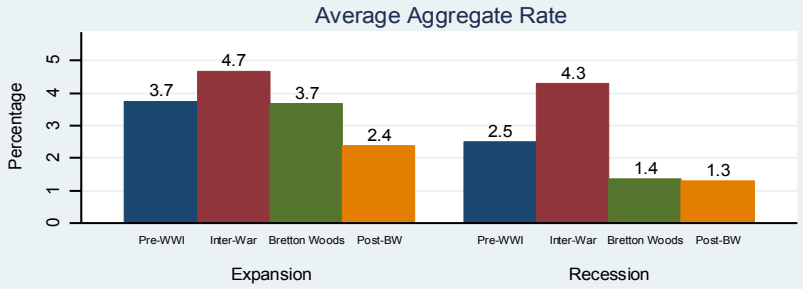
Four Eras and the Business Cycle

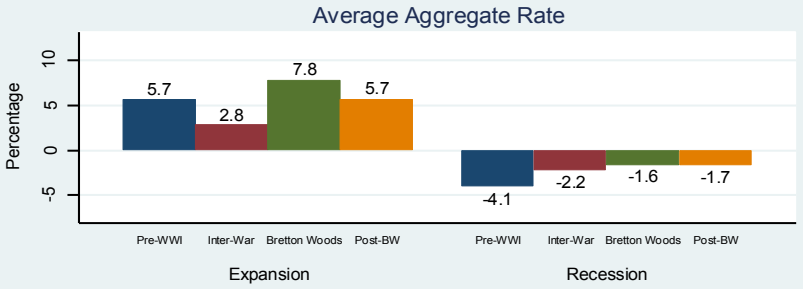












Stylized Facts

- 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.

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

Table 2: Expansions and Leverage

	Amplitude		Duration		Rate	
	Low Leverage	High Leverage	Low Leverage	High Leverage	Low Leverage	High Leverage
Full Sample						
Mean	16%	19%	4.0	5.5	4.3%	3.4%
Standard Deviation	(23)	(28)	(5.5)	(5.6)	(2.5)	(1.9)
Observations	87	159	87	159	87	159
Pre–World War II						
Mean	12%	10%	2.6	3.1	5.0%	3.5%
Standard Deviation	(12)	(8)	(2.0)	(2.8)	(2.6)	(2.0)
Observations	59	110	59	110	59	110
Post–World War II						
Mean	28%	38%	8.9	9.7	2.7%	3.4%
Standard Deviation	(35)	(45)	(8.0)	(7.3)	(1.4)	(1.7)
Observations	36	41	36	41	36	41

Notes: Amplitude is peak to trough change in real GDP per capita. Duration is peak to trough time in years. Rate is peak to trough growth rate of real GDP per capita. High leverage denotes credit/GDP above its full sample mean at the peak. Low leverage denotes credit/GDP above its full sample mean at the peak.

Credit and the Boom

- After WWII, credit appears to:
  - Lengthen the expansion phase
  - Consequently GDP amplitude is higher
  - Curiously the rate of growth is also higher
- Is credit welfare enhancing?

Motivating Regressions

- Regress (1)-(4) over the recession on excess loan/GDP growth rate in the preceding expansion (*x*).
- E.g. +1 SD deviation of *x* reduces per capita GDP growth by 0.63% per year.
- Robust to inclusion of expansion growth rate (not significant).

Table 3: Recession characteristics versus excess loan growth in prior expansion

	(1) Growth rate of Y	(2) Growth rate of C	(3) Duration	(4) Peak-Trough Amplitude
Excess loan/GDP growth rate	-0.0063***	-0.0050*	-0.0089	-0.0140***
	(0.0019)	(0.0030)	(0.0628)	(0.0048)
Observations	187	167	187	187

Notes: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Independent variables are for the prior expansion and are standardized. Country fixed effects not shown. Y is real GDP per capita. C is real consumption per capita.

Adjusting for Financialization

Table 4: Recession characteristics versus excess loan growth and loan/GDP level in prior expansion

	(1) Growth rate of Y	(2) Growth rate of C	(3) Duration	(4) Peak-Trough Amplitude
Excess loan/GDP growth rate	-0.0069***	-0.0121***	0.0091	-0.0113**
	(0.0022)	(0.0032)	(0.0739)	(0.0053)
Loan/GDP level	0.0020	0.0135***	-0.0095	0.0028
	(0.0030)	(0.0047)	(0.0995)	(0.0071)
Excess × Loan/GDP level	-0.0048*	-0.0194***	-0.0254	-0.0054
	(0.0026)	(0.0038)	(0.0884)	(0.0063)
Observations	186	166	186	186

Notes: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Independent variables are for the prior expansion and are standardized. Country fixed effects not shown. Y is real GDP per capita. C is real consumption per capita.

By Subsample

Table 5: Recession characteristics versus excess loan growth in prior expansion, subsamples

	(1) All	(2) Financial Crisis	(3) No Financial Crisis	(4) Hi Leverage	(5) Low Leverage
(a) Growth rate of Y					
Excess loan/GDP growth rate	-0.0063***	-0.0103*	-0.0058***	-0.0168***	-0.0022
	(0.0019)	(0.0051)	(0.0019)	(0.0049)	(0.0019)
Observations	187	51	136	63	124
(b) Growth rate of C					
Excess loan/GDP growth rate	-0.0050*	-0.0123	-0.0039	-0.0321***	0.0025
	(0.0030)	(0.0081)	(0.0029)	(0.0093)	(0.0026)
Observations	167	44	123	47	120
(c) Duration					
Excess loan/GDP growth rate	-0.0089	0.2450**	-0.1240*	-0.0242	0.0025
	(0.0628)	(0.1180)	(0.0719)	(0.1170)	(0.0026)
Observations	187	51	136	63	120
(d) Peak-Trough Amplitude					
Excess loan/GDP growth rate	-0.0140***	-0.0048	-0.0195***	-0.0265***	-0.0071
	(0.0048)	(0.0099)	(0.0055)	(0.0087)	(0.0058)
Observations	187	51	136	63	124

Notes: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Independent variables are for the prior expansion and are standardized. Country fixed effects not shown. Y is real GDP per capita. C is real consumption per capita.

Summary

- Credit expansion in the boom matters even in normal recessions.
- A 1 SD deviation of excess leverage can generate a 1% drag on output and consumption in a financial crisis.
- Financial crises last much longer than non crisis recessions.
- Cumulative loss larger in high leverage environments.

The Dynamics of Leverage: Methods

- Focus: the recession and the recovery as a function of credit during the boom.
- The usual normalization (e.g. Romer and Romer, 1989) by the start of the recession so as to then calculate time profiles is too crude: countries experiences are wildly different.
- And we also want to normalize by pre-existing economic conditions reflected in the context of a system of variables.
- The analysis is not causal and we know that.

Local Projections and Dynamic Multipliers

- Let $y_{k,t}$ denote the vector of $n \times 1$ country-observations for variable k at time t in the system of $k = 1, \ldots, K$ variables for $t = 1, \ldots, T$ periods.

- Collect the K variables into Y_t.

- Let x_t denote the excess leverage indicator amplitude of loan growth relative to GDP divided by duration. (This is a rate of excess loan formation per year.)

The Response

- We are interested in the *linear projection*:

$$R(y_{k,t(r)}, h, \delta) =$$
$$E_{t(r)}(y_{k,t(r)+h} | x_{t(r)} = \bar{x} + \delta; Y_{t(r)}, Y_{t(r)-1}, \ldots) -$$
$$E_{t(r)}(y_{k,t(r)+h} | x_{t(r)} = \bar{x}; Y_{t(r)}, Y_{t(r)-1}, \ldots)$$

- The notation *t(r)* denotes the calendar time period *t* associated with the *r-th* recession
- δ denotes a "treatment" if it were exogenous (and then *R (.)* would be an average treatment effect).
- $E_{t(r)}$ denotes the linear projection operator.

Estimation

- Local projections: fixed-effects panel-data.
- Nickell (1986) of little concern: low serial correlation, reasonably long sample. Arellano and Bond (1991) type estimation problematic. Could introduce bias (weak instruments) and variance
- Method has the flavor of a conditional direct forecast

The System

- 9 variables
  - Real per capita GDP growth
  - Real per capita consumption growth
  - Real growth in private loans
  - Real growth in M2
  - Inflation (CPI)
  - Short-term (usually 3-months) interest rates (on government bonds).
  - Long-term (usually 5-years) interest rates (on government bonds).
  - Investment to GDP ratio
  - Current account to GDP ratio

Warm-up: Cumulative Effects

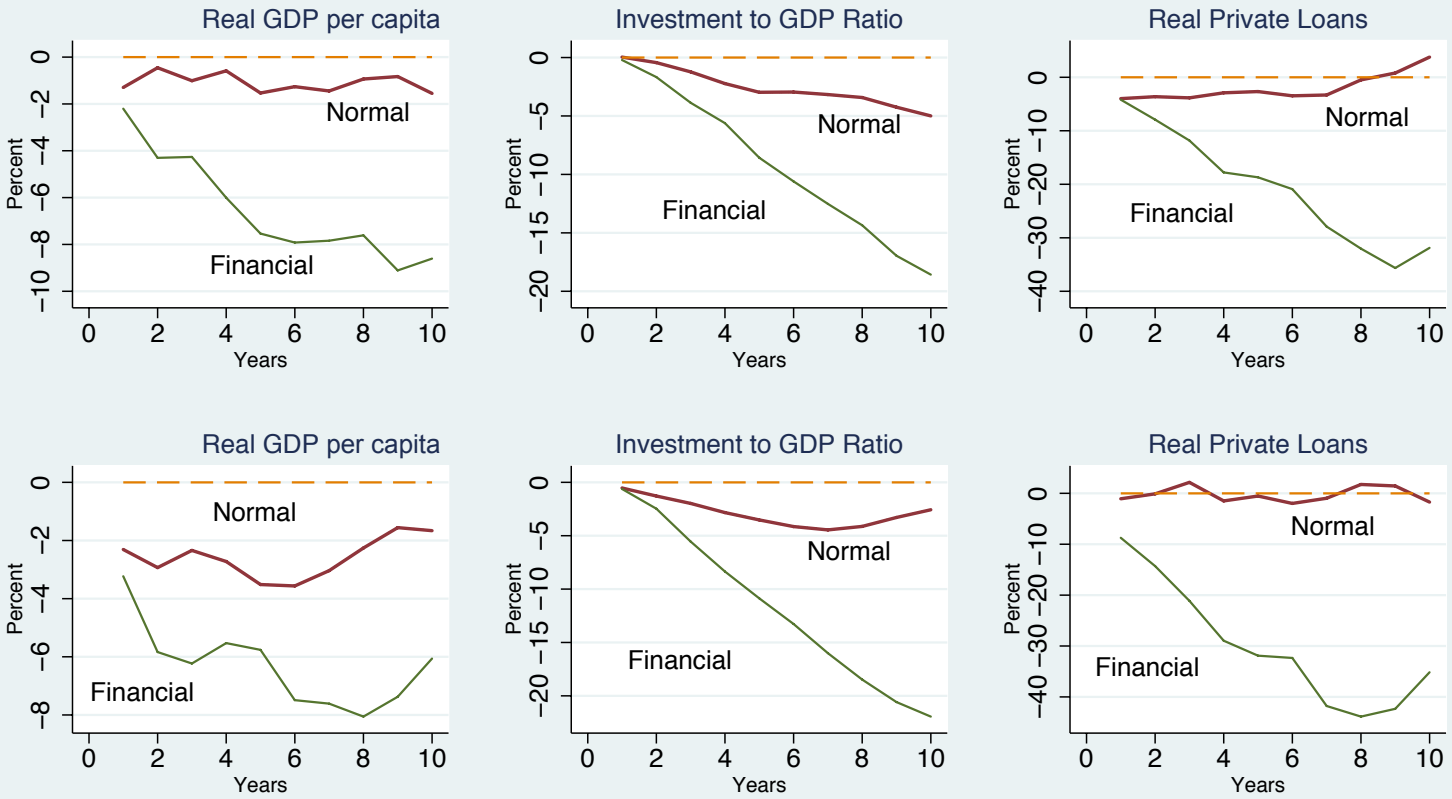
- Some derivative plots that tell the story by cumulating the response over time.
- Experiment: 10% excess loan growth relative to GDP per year. Average over the sample is 1.5% with 6.5% S.E. so yes, high, but makes scaling easy
- U.S. in 2008 recession: excess leverage about 3.5% (adding in shadow banking, perhaps as high as 5%)
- The effects reported are *marginal* because, while still not making causal claims, less problematic

Cumulated Dynamic Multiplier

Cumulated Dynamic Multiplier Effect During Normal and Financial Recessions

Experiment: 10% per Year Excess Leverage

FULL SAMPLE



Post–WWII SAMPLE

Remarks

- Numbers in same ballpark as those of Cerra and Saxena (2008), Reinhart and Rogoff (2009ab):
  - 7.5% GDP loss over 10 years.
  - Peak to trough decline is about 9%.

- But the effects on lending and investment can be quite nasty.
- Calibrated thought experiment:
  - In the U.S. given excess leverage into the 2008 financial crises (3 to 3.5%), scale by 1/3. So let's say about 7% drop in I/Y and 10% in lending…

Leverage and the Recession Path

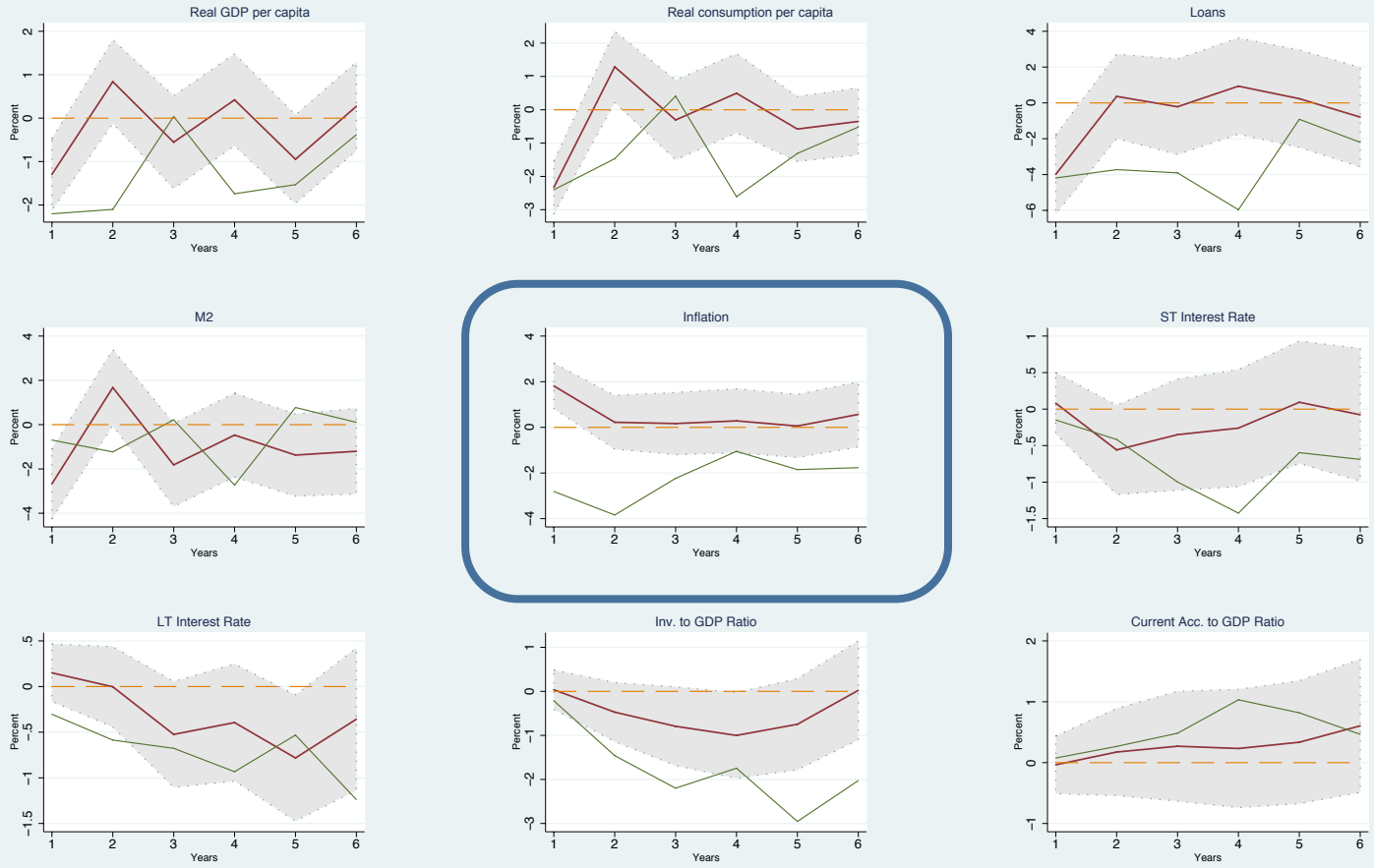
- Now let's look at the year-to-year variation.
- Look at all the variables in the system.
- Add some error-bands.
- Use the same experiment (10% excess leverage) to facilitate scaling.
- Still only considering *marginal* effects.

The Dynamic Multiplier: Full Sample

The Dynamic Multiplier Effect of Leverage on Normal and Financial Recessions

Experiment: 10% per Year Excess Loan to GDP Growth in the Preceding Expansion

FULL SAMPLE



Remarks

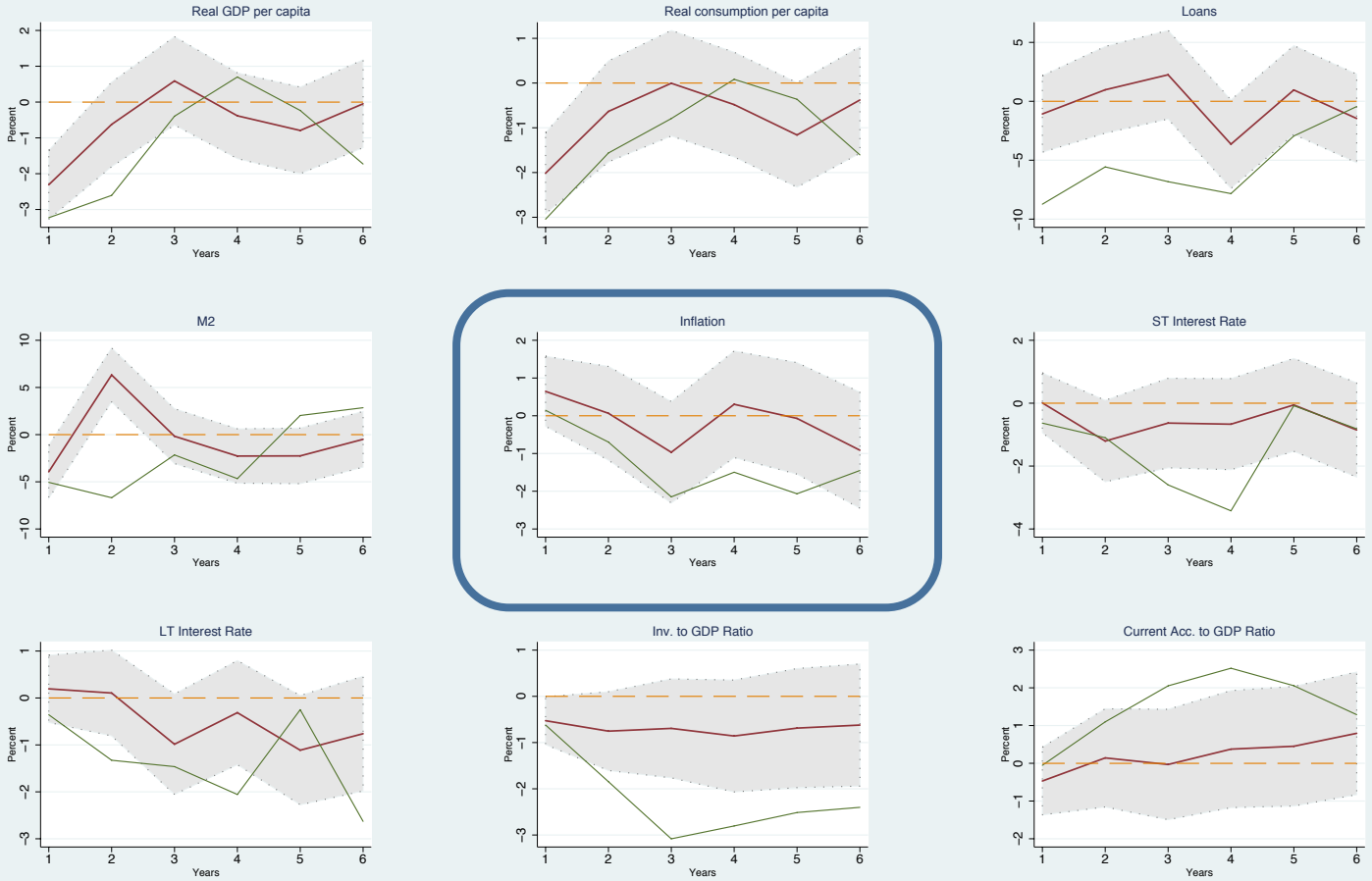
- Initial decline in output/consumption twice as large in a financial crisis.
- Lending recovers quickly in a normal recession but very slowly in a financial crisis.
- Investment reflects these differences well.
- Despite a concomitant fall in interest rates, prices face downward pressure.
- Does this mean that credit contraction is demand driven? Can't tell, we do not have interest rates on private loans. Don't have a grip on exogeneity.

The Dynamic Multiplier: Post WWII

The Dynamic Multiplier Effect ot Leverage on Normal and Financial Recessions

Experiment: 10% per year Excess Loan to GDP Growth in the Preceding Expansion

Post WWII SAMPLE



Remarks

- Post WWII results are qualitatively the same.
- The initial declines in output and consumption are larger but less persistent.
- But the basic responses of lending, hence investment; the benign response of prices and drops in interest rates are all preserved.

A Calibrated Example: The U.S.

- Suppose in 2008 excess leverage close to the 5% mark (due to shadow banking, say).

- Implications:
  - 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 output gap rather than on inflation.

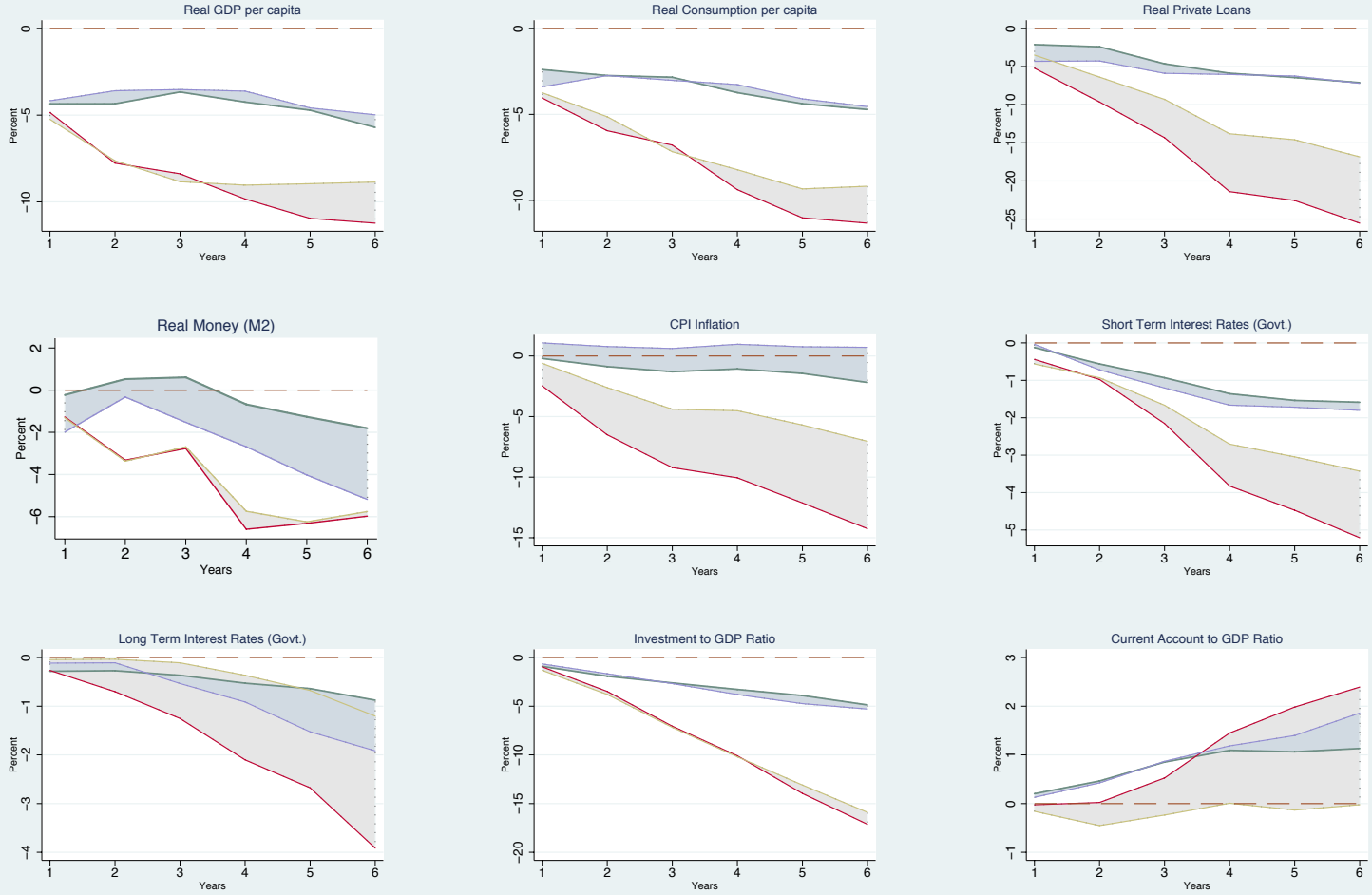
Leverage and the Cost of Financial Crises

- Many have looked at the costs of financial crises:
  - Cerra and Saxena (2008), Reinhart and Rogoff (2009a,b, 2010), Teulings and Zubanov (2010), Schularick and Taylor (forthcoming), Claessens, Kose and Terrones (2011) and Howard, Martin and Wilson (2011).
- Our twist: look at normal versus financial recessions at average levels of credit expansion over the boom, and then when the credit expansion is +1 SD above the mean.
- Now it is no longer about the marginal effect. This is the real deal.

The Cumulative Effects of Leverage: Part II

Cumulative Effects of Normal vs. Financial Recessions: FULL SAMPLE

Excess Leverage at the Mean and one S.D. from the Mean



Remarks I

- 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.

Remarks II

- 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.
- And what about the Great Depression?

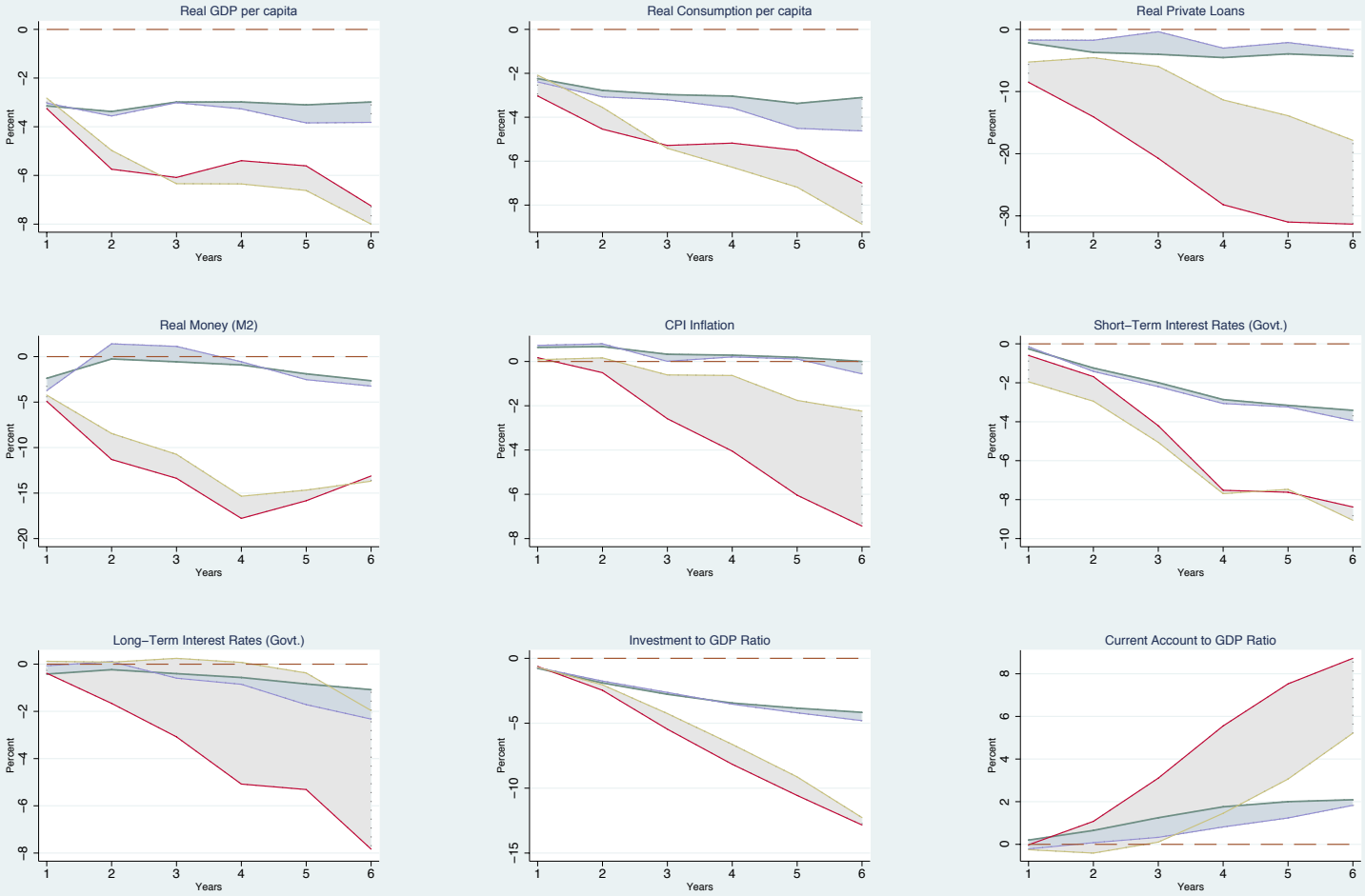
Robustness

- Look at post-WWII data to avoid the Great Depression
- The normalization changes a bit:
  - In the full sample, excess leverage averages to 1.2% in normal recessions, 2.3% in financial recessions, in both cases with SD of about 6.5%
  - Post-WWII, excess leverage in normal recessions is 2.9%, 5.8% in financial recessions, with SD about 4-5%
- Do the results hold up? By and large, yes.

Post-WWII Analysis

Cumulative Effects of Normal vs. Financial Recessions: Post–WWII

Excess Leverage at the Mean and one S.D. from the Mean



Conclusion

- The credit intensity of the boom matters for the path of the recession.
- Leverage can make 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 cause for concern (quite the contrary).
- Clearly, this has important policy implications in the current environment.

Future Research

- So far the analysis is deliberately descriptive.
- But we hope to make progress toward more causal explanations: does the supply or the demand for credit shift?
- And we have collected 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. Stay tuned…