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

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Disclaimer: The views expressed herein are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Federal Reserve Bank of San Francisco or the Board of Governors of the Federal Reserve System.
The Questions

- Is credit an epiphenomenon?
- If not, how does it relate to the business cycle?
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
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)
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*
The Full Dataset

• **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) split into normal vs. financial recessions.
Financial Crises Are Back

• A long standing problem

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

Source: Qian, Reinhart and Rogoff (2010).
Growth of Credit
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

Source: Authors’ calculations

When Credit Bites Back: Leverage, Business Cycles and Crises • Óscar Jordà, Moritz Schularick and Alan M. Taylor
New: Public Debt over Time

Average Public Debt to GDP Ratio

Start of the Great Depression

End of Bretton Woods


Year

Percent

10 20 30 40 50 60 70 80 90 100
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 → 9.7 years
  • Consequently GDP amplitude is higher: 28% → 38%
  • Rate of growth is also higher 2.7% → 3.4%

• All good? Is credit welfare enhancing?
  • What happens in the subsequent recession?
Cerra and Saxena (2008)

- 190 countries World Bank’s World Development Indicators
- 1960 -2001
Credit and the Recession: A Simple Picture of 140 Years and 14 countries

Cumulative Percent Change From the Start of the Recession

1870-2008

Real GDP per capita

Normal recession

Financial crisis

Real Investment per capita

CPI Prices

1946-2008

Real GDP per capita

Real Investment per capita

CPI Prices

Adjusted for UK 1973 and Spain 1978
A Motivating Picture

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

Financial recessions
+ Excess credit = 1,2,3 %GDP/year
Table 1: Unconditional Paths, Normal v. Financial Bins with Hi-Lo Excess Credit

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Standard errors in parentheses
Dependent variable: log real gdp per capita
\[ p < 0.10, \, * \, p < 0.05 \]
### Table 1: Unconditional Paths, Normal v. Financial Bins and Excess Credit

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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
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

- **Objective**: 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.
Definition

- **Cumulated response:**

\[ CR(\Delta_h y_{it(r)+h}^k, \delta) = \]
\[ E_{it(r)}(\Delta_h y_{it(r)+h}^k | x_{it(r)} = \bar{x} + \delta; Y_{it(r)}, Y_{it(r)-1}, ...) \]
\[ - E_{it(r)}(\Delta_h y_{it(r)+h}^k | x_{it(r)} = \bar{x}; Y_{it(r)}, Y_{it(r)-1}, ...) \]

- \( h \) denotes horizon, \( k \) variable in the system, \( i \) country, \( r \) recession, \( t(r) \) calendar time for \( r \)-th recession

- \( x \) is the treatment variable, \( \delta \) is the treatment

- \( Y_{it} = [\Delta y_{it}^1, ..., \Delta y_{it}^J, y_{it}^{J+1}, ..., y_{it}^K]' \)

- \( \Delta_h y_{t+h} = y_{t+h} - y_t \)
Estimation

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

\[
\Delta_h y_{it(r)+h}^k = \alpha_i + \theta_N + \theta_F + \beta_{h,N}^k (x_{t(r)} - \bar{x}_N) + \beta_{h,F}^k (x_{t(r)} - \bar{x}_F) \\
+ \sum_{j=0}^{p} \Gamma_{j}^k y_{it(r)-j} + u_{it(r)}^k; \quad k = 1, ..., K; \quad h = 1, ..., H
\]

- Then \( \hat{CR}_N(k, h, \delta) = \hat{\beta}_{h,N}^k \delta \) and similarly for financial recessions.
- \( x \) is percentage point deviation in loans to GDP ratio from trough to peak (peak = start of recession)
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 Cumulative 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
- 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
Marginal Contribution of Excess Credit in the Expansion to the Cumulative Percent Change from the Start of the Recession

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

1946-2008
Table 1: LP Conditional Paths – 7 Variable System, Normal v. Financial Bins and Excess Credit

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<td>Year 5</td>
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<tr>
<td>Normal recession</td>
<td>-1.909*</td>
<td>0.909</td>
<td>2.892+</td>
<td>2.888</td>
<td>2.414</td>
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<td>(0.674)</td>
<td>(1.171)</td>
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<td>(2.060)</td>
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<td>(0.813)</td>
<td>(1.414)</td>
<td>(1.918)</td>
<td>(2.486)</td>
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<td>Exc cred x Norm recn</td>
<td>-0.147</td>
<td>-0.465+</td>
<td>-0.575</td>
<td>-0.769</td>
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<td>(0.158)</td>
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<td>Exc cred x Fin recn</td>
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<td>-1.205+</td>
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<td>(0.487)</td>
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</tbody>
</table>

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 dlny stir lrate lcy

+ p < 0.10, * p < 0.05
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
What About Public Debt? A Preview

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

- Financial: Debt to GDP at 0%
- Normal: Debt to GDP at 50%
- Financial: Debt to GDP at 50%
- Financial: Debt to GDP at 100%

Years

Private Credit Treatment, %

Percent

0 1 2

-5 -4 -3 -2 -1 0

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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).

• 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 the output gap rather than on inflation
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.
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.
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.
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…