When Credit Bites Back

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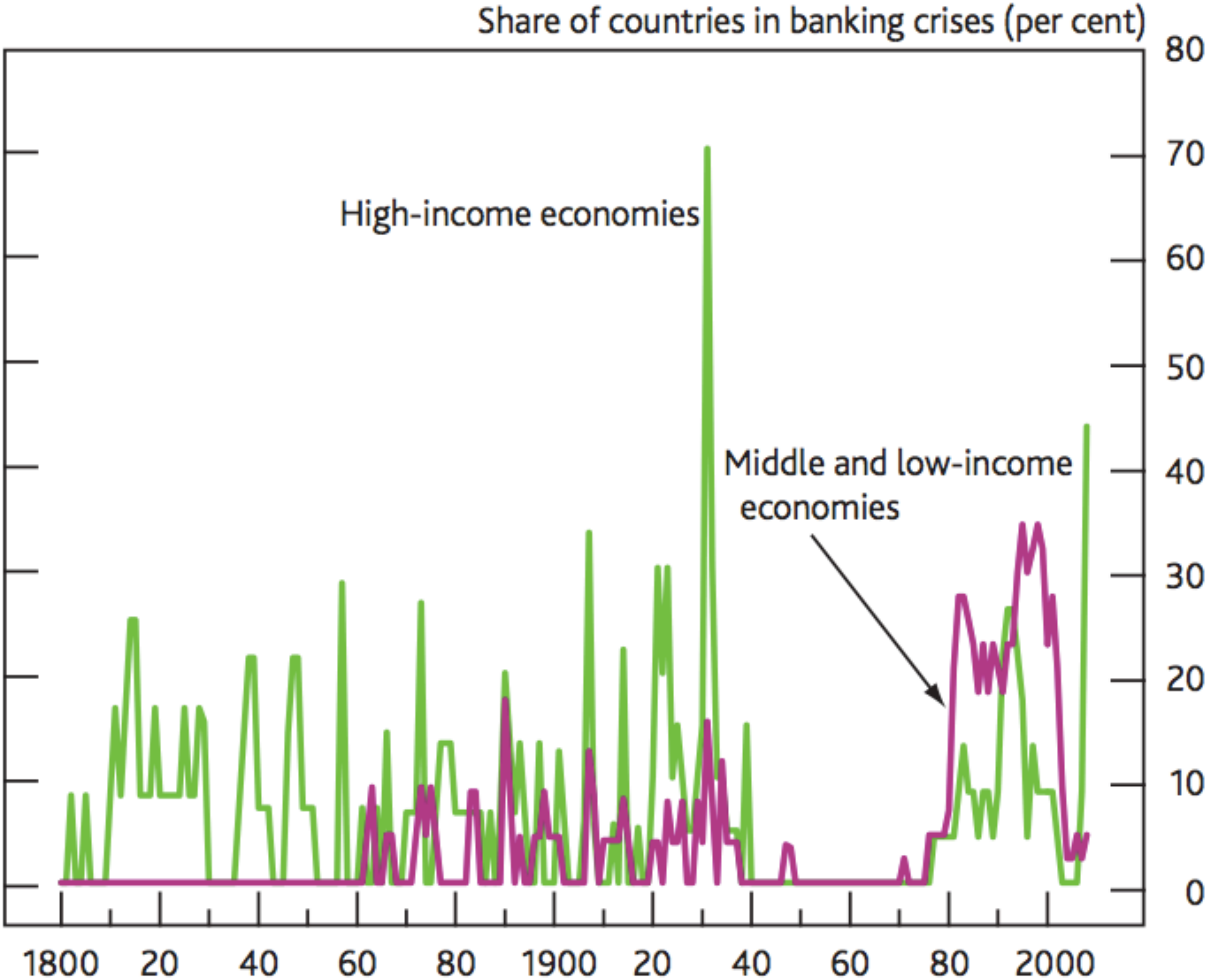
MOTIVATION



Source: Qian, Reinhart and Rogoff (2010).

The Question: Credit and the Cycle

- Role of financial factors in the business cycle
  - Debate goes back to Fisher, Minsky, Schumpeter, et al.
    - James Tobin: "Credit is Achilles Heel of Capitalism"
- Debate about the aftermath of financial crises
  - What is the benchmark for a "normal recovery"?
  - Crisis + debt overhang & recovery speed
  - See, e.g., P. Krugman versus J. Taylor.
- Economic history has a lot to offer
  - Long narrative tradition but little formal modeling
  - The return of large T: rare events, structural shifts etc.
    - The influential work of Reinhart and Rogoff looks at *public debt* and its links to economic performance, e.g. RR (TTID, AER, 2009, 2010)
  - Focus in our research is on private sector credit and the business cycle

Data: The Missing Link

- What do/did we know? Data availability before 2009...

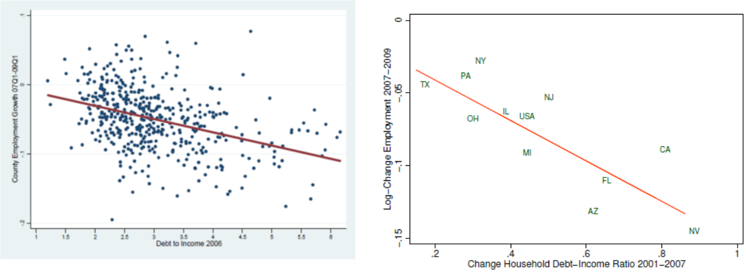
	Sovereign Crises	Financial Crises
Timing of Events	**YES** Lindert and Morton, Bordo et al., Reinhart-Rogoff,...	**YES** Bordo et al., Caprio et al., Laeven-Valencia, Cerra -Saxena, Reinhart-Rogoff,...
Aggregate Size of Balance Sheet	**YES** Bordo et al., Reinhart-Rogoff,...	**?**

- We have filled the gap: a panel database of *private bank credit*
  - New dataset: Schularick/Taylor (AER, 2012)
  - Analyses: Jordà/Schularick/Taylor (IMFER 2011 + ongoing)
  - N=14 advanced countries; yearly from 1870 to 2008 (N=17 soon)
  - We use aggregate credit (better disagg. data coming soon)

Lifting the Veil: Recessions, Crises, and Leverage

- Ongoing debate about channels/effects of leverage in the Great Recession on via credit demand and credit supply sides
    - Household leverage and outcomes
        - US evidence (Mian/Sufi; Midrigan/Philippon)
    - Persistent effects of deleveraging
        - "Balance sheet recessions" (Koo; Eggertsson/Krugman)
    - "The BIS view"
        - Showdown at Jackson Hole (Borio/White et seq.)
    - This time was different? More credit, but in new forms?
        - Traditional v market banking, collateral/repo, fragile intermediary balance sheets (Adrian/Shin; Brunnermeier/Sannikov; Metrick/Gorton)
- Allow for effects of leverage but in the tradition of empirical studies that condition on crisis events.
    - Bordo, Eichengreen, Klingebiel, and Martinez-Peria (2001)
    - Reinhart and Rogoff (2009)

Recent Evidence: U.S. Leverage and the Great Recession



Source: Left = Mian & Sufi, Right = Midrigan & Phlippon

- Analogy: US 2008 cross-section v long-run historical global panel
- Empirical regularity? What about other times and places?
- Change the unit of observation

WHAT WE FIND AND WHY IT MATTERS

The Findings: In Brief

- New important stylized fact of the modern business cycle: *"Credit Bites Back"*
  - A close relationship exists between build-up of leverage in the expansion and the severity of the subsequent recession.
- This result is not based on a small sample
  - Based on 200+ recession episodes in modern advanced countries
  - Not a sample; actually close to the population
- More credit intensive booms tend to be followed by deeper recessions/slower recoveries
- This relationship is more pronounced in financial crises but still visible in normal recessions

The Findings: Implications and Broader Context

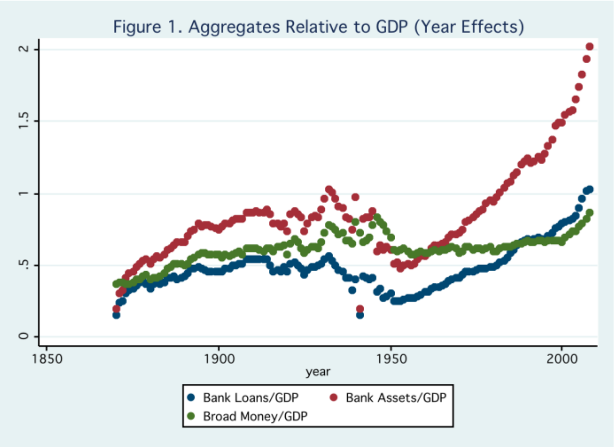
- New agendas already emerging from the wreckage sorting...
- For policy:
    - Rethink macro-finance interactions in a broader policy framework. Inflation targeting alone appears insufficient.
    - In aftermath of most severe financial crisis of the last 80 years, fear of inflation appears to be a phantom menace.
    - Important to monitor credit as it affects not only the crisis probability, but the severity of the recession.
- For macro:
    - Credit is an integral part of how economies behave over the business cycle.
    - This is true even during normal recessions (not just crises).
    - Models need to reflect this.

DATA AND OTHER PRELIMINARIES

Our Data

- 138 years: 1870–2007 (+ up to 2011 in our next update)
- 14 countries: Canada, Australia, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, U.K. and U.S. (+ Belgium, Finland and Portugal in our next update)
- 7 key variables: Growth rate of real GDP per capita, Investment/GDP, real private bank loans, and CA/GDP. CPI inflation, short- and long-term interest rates.
- Recession and Crisis Dates:
  - Bry and Boschan (1971) for recessions
  - JST (2011) to sort these into normal vs. financial recessions

Key New Variable: Trends in Global Leverage



- Schularick & Taylor AER 2012: source for the data; show this variable contains predictive information about financial crisis probability
- This paper: also has predictive information about recession path, even conditional on crisis/noncrisis outcome

Business Cycle Chronology

N = normal recession; F = financial crisis recession

AUS	N	1875	1878	1881	1883	1885	1887	1889	1896	1898	1900	1904	1910
		1913	1926	1938	1943	1951	1956	1961	1973	1976	1981		
	F	1891	1894	1989									
CAN	N	1871	1877	1882	1884	1888	1891	1894	1903	1913	1917	1928	1944
		1947	1953	1956	1981	1989	2007						
	F	1874	1907										
CHE	N	1875	1880	1886	1890	1893	1899	1902	1906	1912	1916	1920	1933
		1939	1947	1951	1957	1974	1981	1990	1994	2001			
	F	1871	1929	2008									
DEU	N	1879	1898	1905	1913	1922	1943	1966	1974	1980	1992	2001	
	F	1875	1890	1908	1928	2008							
DNK	N	1870	1880	1887	1911	1914	1916	1923	1939	1944	1950	1962	1973
		1979	1987	1992									
	F	1872	1876	1883	1920	1931	2007						
ESP	N	1873	1877	1892	1894	1901	1909	1911	1916	1927	1932	1935	1940
		1944	1947	1952	1958	1974	1980	1992					
	F	1883	1889	1913	1925	1929	1978	2007					
FRA	N	1872	1874	1892	1894	1896	1900	1905	1909	1912	1916	1920	1926
		1933	1937	1939	1942	1974	1992						
	F	1882	1907	1929	2007								

- Peaks and troughs from Bry-Boschan algorithm
- $F = 1 \iff$ financial crisis with ± 2 years; else $N = 1$

Business Cycle Chronology

N = normal recession; F = financial crisis recession

continued...

GBR	N	1871	1875	1877	1883	1896	1899	1902	1907	1918	1925	1929	1938
		1943	1951	1957	1979								
	F	1873	1889	1973	1990	2007							
ITA	N	1870	1883	1897	1918	1923	1925	1932	1939	1974	1992	2002	2004
	F	1874	1887	1891	1929	2007							
JPN	N	1875	1877	1880	1887	1890	1892	1895	1898	1903	1919	1921	1929
		1933	1940	1973	2001	2007							
	F	1882	1901	1907	1913	1925	1997						
NLD	N	1870	1873	1877	1889	1894	1899	1902	1913	1929	1957	1974	1980
		2001											
	F	1892	1906	1937	1939	2008							
NOR	N	1876	1881	1885	1893	1902	1916	1923	1939	1941	1957	1981	2008
	F	1897	1920	1930	1987								
SWE	N	1873	1876	1881	1883	1885	1888	1890	1899	1901	1904	1913	1916
		1924	1939	1976	1980								
	F	1879	1907	1920	1930	1990	2007						
USA	N	1875	1887	1889	1895	1901	1909	1913	1916	1918	1926	1937	1944
		1948	1953	1957	1969	1973	1979	1981	1990	2000			
	F	1873	1882	1892	1906	1929	2007						

- Peaks and troughs from Bry-Boschan algorithm
- $F = 1 \iff$ financial crisis with ± 2 years; else $N = 1$

Four Eras of Financial Development

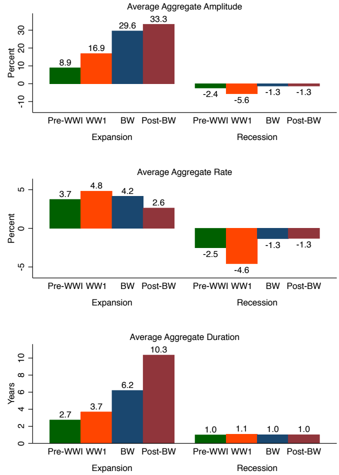
Some background on the evolution of credit in the long run

- Pre-WWI: relatively stable ratio of loans to GDP, with leverage and economic growth in sync.
- Interwar period: break-down of the gold standard and the Great Depression.
- Bretton Woods: a new international financial regulatory framework and the oasis of calm.
- Post-Bretton Woods: abandonment of the gold standard, deregulation and explosion of credit; decoupling of money and credit aggregates.

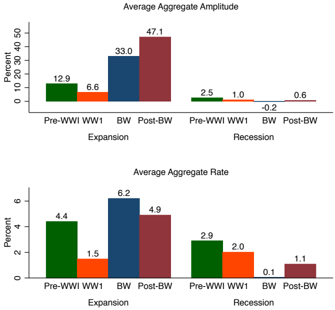
Four Eras and the Business/Financial Cycle

Cyclical Properties of Output and Credit in Four Eras

Real GDP per capita



Real Loans per capita



Change in loans/GDP ("excess credit") in the upswing

amplitude = peak to trough change
duration = peak to trough time
rate = peak to trough time

Table : Real GDP per capita in Expansions and "Excess Credit"

	Amplitude		Duration		Rate	
	Low excess credit	High excess credit	Low excess credit	High excess credit	Low excess credit	High excess credit
Full Sample						
Mean	13.6%	21.2%	3.7	5.6	4.1%	3.5%
Standard Deviation	(12.9)	(33.9)	(3.5)	(6.6)	(2.2)	(2.0)
Observations	83	126	83	126	83	126
Pre–World War II						
Mean	11.9%	9.4%	2.7	2.8	4.8%	3.5%
Standard Deviation	(9.8)	(9.1)	(1.9)	(2.2)	(2.3)	(2.1)
Observations	52	90	52	90	52	90
Post–World War II						
Mean	22.9%	47.8%	6.9	11.8	3.0%	3.5%
Standard Deviation	(21.4)	(55.3)	(5.1)	(9.4)	(1.3)	(1.9)
Observations	35	32	35	32	35	32

RECESSIONS, CRISES AND CREDIT

"Treatment" Variables

Table : Summary Statistics for the Treatment Variables

	(1) All recessions mean	(s.d.)	(2) Financial recessions ($F = 1$) mean	(s.d.)	(3) Normal recessions ($N = 1$) mean	(s.d.)
Financial recession indicator (F)	0.29		1		0	
Observations	223		50		173	
Normal recession indicator (N)	0.71		0		1	
Observations	223		50		173	
Excess credit measure (ξ), ppy	0.47	(2.17)	1.26	(2.51)	0.24	(2.01)
Observations	154		35		119	

- Treatment-response framework
- Regress change in log real GDP per capita from peak to year h on treatments: normal/financial recession and excess credit
- Look at unconditional expected paths
- Excess credit is percentage pts per year in prior expansion

Unconditional recession paths

Table : Unconditional Recession Paths, Normal v. Financial Bins

Log real GDP per capita (relative to Year 0, $\times$100)	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5
Normal recession (N)	-2.0*	-0.0	2.0*	3.3*	4.5*
	(0.2)	(0.3)	(0.4)	(0.6)	(0.7)
Financial recession (F)	-2.7*	-3.1*	-2.5*	-0.9	1.0
	(0.3)	(0.6)	(0.8)	(1.1)	(1.2)
F-test Equality of coefficients, Normal=Financial (p)	0.11	0.00	0.00	0.00	0.01
Observations, Normal	173	173	173	173	173
Observations, Financial	50	50	50	50	50
Observations	223	223	223	223	223

Dependent variable: $\Delta_h y_{it(r)+h}$ = (Change in log real GDP per capita from Year 0 to Year h)$\times$100.
Standard errors in parentheses. $+$ $p < 0.10$, * $p < 0.05$

Bringing in excess credit terciles

Table : Normal v. Financial Bins split into Excess Credit Terciles

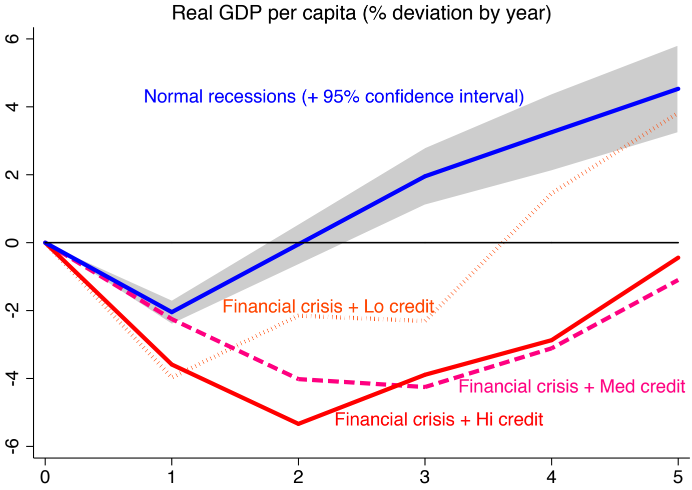
Log real GDP per capita (relative to Year 0, $\times$100)	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5
Normal recession (N)	-2.0*	-0.0	2.0*	3.3*	4.5*
	(0.2)	(0.3)	(0.4)	(0.6)	(0.7)
Financial recession $\times$ lo excess credit ($F \times lo$)	-4.0*	-2.1+	-2.3	1.5	3.8
	(0.7)	(1.2)	(1.7)	(2.3)	(2.6)
Financial recession $\times$ med excess credit ($F \times med$)	-2.3*	-4.0*	-4.3*	-3.1	-1.1
	(0.7)	(1.2)	(1.7)	(2.2)	(2.5)
Financial recession $\times$ hi excess credit ($F \times hi$)	-3.6*	-5.3*	-3.9*	-2.9	-0.4
	(0.7)	(1.2)	(1.7)	(2.2)	(2.5)
F-test Equality of coefficients, Normal=Financial lo (p)	0.01	0.10	0.02	0.45	0.79
F-test Equality of coefficients, Normal=Financial med (p)	0.78	0.00	0.00	0.01	0.03
F-test Equality of coefficients, Normal=Financial hi (p)	0.04	0.00	0.00	0.01	0.06
Observations, Normal	173	173	173	173	173
Observations, Financial lo	11	11	11	11	11
Observations, Financial med	12	12	12	12	12
Observations, Financial hi	12	12	12	12	12
Observations	208	208	208	208	208

Dependent variable: $\Delta_h y_{it(r)+h}$ = (Change in log real GDP per capita from Year 0 to Year h)$\times$100.

Standard errors in parentheses. + $p < 0.10$, * $p < 0.05$

Notes: Financial recessions are divided into terciles (lo-med-hi) based on the excess credit variable (ξ), and a separate indicator is constructed for each of the respective bins.

Bringing in excess credit terciles



Excess credit as a continuous treatment

Table : Normal v. Financial Bins with Excess Credit as a Continuous Treatment in Each Bin

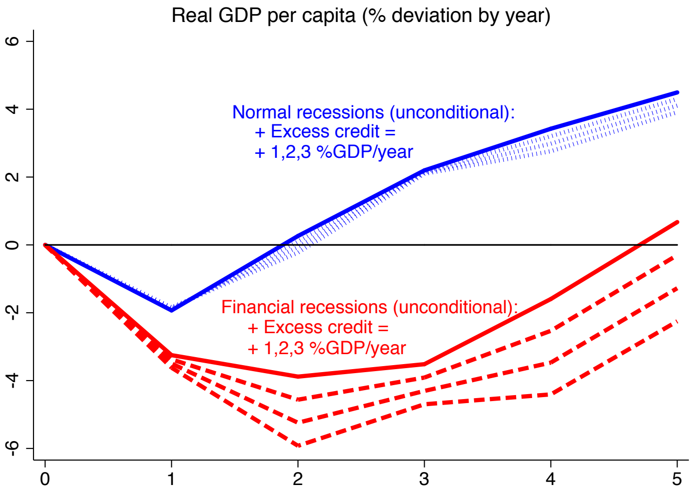
Log real GDP per capita (relative to Year 0, $\times$100)	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5
Normal recession (N)	-1.9*	0.3	2.2*	3.4*	4.5*
	(0.2)	(0.4)	(0.5)	(0.7)	(0.9)
Financial recession (F)	-3.3*	-3.9*	-3.5*	-1.6	0.7
	(0.4)	(0.7)	(1.0)	(1.4)	(1.6)
Excess credit $\times$ normal recession ($N \times (\xi - \overline{\xi_N})$)	0.0	-0.2	-0.0	-0.2	-0.2
	(0.1)	(0.2)	(0.3)	(0.4)	(0.4)
Excess credit $\times$ financial recession ($F \times (\xi - \overline{\xi_F})$)	-0.1	-0.7*	-0.4	-0.9+	-1.0
	(0.2)	(0.3)	(0.4)	(0.6)	(0.6)
F-test Equality of coefficients, Normal=Financial (p)	0.01	0.00	0.00	0.00	0.03
F-test Equality of coefficients, interaction terms (p)	0.45	0.13	0.46	0.28	0.31
Observations, Normal	119	119	119	119	119
Observations, Financial	35	35	35	35	35
Observations	154	154	154	154	154

Dependent variable: $\Delta_h y_{it(r)+h}$ = (Change in log real GDP per capita from Year 0 to Year h)$\times$100.

Standard errors in parentheses. + $p < 0.10$, * $p < 0.05$

Notes: In each bin, recession indicators (N, F) are interacted with demeaned excess credit, $(\xi - \overline{\xi_N}, \xi - \overline{\xi_F})$.

Excess credit as a continuous treatment



CONDITIONAL PATHS

Conditional path

- So far, approach very similar to simple event study
- Now: allow for more texture by adding more covariates (and their lags) in a set of controls Y
- Analogy: Like a VAR with regimes
  - But without all the parameters and assumptions thanks to the use of the local projection method
  - What is the effect on the expected path of the economy, conditional on a rich set of covariates Y, if credit measure in the expansion deviates from its unconditional mean by δ (treatment)

Local Projection

- How does leverage change the expected path of macro variables in vector Y after the peak?
- Local projection method (Jordà 2005): flexible direct forecast model, re-estimated for each future period
- Response of y, k-th variable in the system, h periods in the future when treatment x deviates by δ
- Response is similar to average treatment effect if exogenously determined (we don't claim it is) equation

$$\begin{aligned} CR(\Delta_h y^k_{it(r)+h}, \delta) &= E_{it(r)}(\Delta_h y^k_{it(r)+h} | x_{it(r)} = \overline{x} + \delta; Y_{it(r)}, Y_{it(r)-1}, \ldots) \\ &\quad - E_{it(r)}(\Delta_h y^k_{it(r)+h} | x_{it(r)} = \overline{x}; Y_{it(r)}, Y_{it(r)-1}, \ldots) \end{aligned} \quad (1)$$

(where $k = 1, \ldots, K$; $h = 1, \ldots, H$.)

Calculating the cumulative response

- Country fixed-effects panel, directly estimate effect from t to $t+h$
- At each horizon allow a discrete treatment depending on whether the recession is financial or not (N, F)
- And a continuous treatment, based on excess credit variable (ξ)
- We focus on the "treatment effects": coefficients θ, β
- Contemporaneous and 1-year lagged values of Y at $h = 0$.

$$\begin{aligned} \Delta_h y^k_{it(r)+h} = \alpha^k_i + \theta^k_N N + \theta^k_F F \\ + \beta^k_{h,N} N(\xi_{t(r)} - \overline{\xi_N}) + \beta^k_{h,F} F(\xi_{t(r)} - \overline{\xi_F}) \\ + \sum_{j=0}^{p} \Gamma^k_j Y_{it(r)-j} + u^k_{it(r)} \end{aligned} \tag{2}$$

(where k=1,...,K; h=1,...,H.)

With/without the Great Depression

Table : LP — 7 Variable System, Normal v. Financial Bins

(a) Full sample					
Log real GDP per capita (relative to Year 0, $\times 100$)	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5
Normal recession (N)	-1.5*	0.0	2.6*	3.1*	4.0*
	(0.3)	(0.6)	(0.9)	(1.1)	(1.2)
Financial recession (F)	-3.0*	-4.6*	-3.9*	-3.4+	-2.0
	(0.5)	(1.0)	(1.4)	(1.8)	(1.9)
F-test Equality of coefficients, Normal=Financial (p)	0.00	0.00	0.00	0.00	0.00
Observations, Normal	101	101	101	101	101
Observations, Financial	31	31	31	31	31
Observations	132	132	132	132	132
(b) Excluding the Great Depression (omit 1928–38)					
Normal recession (N)	-1.5*	0.2	2.6*	3.8*	5.1*
	(0.3)	(0.6)	(0.7)	(0.9)	(1.0)
Financial recession (F)	-2.6*	-4.2*	-2.4*	-0.69	0.9
	(0.5)	(1.0)	(1.2)	(1.6)	(1.6)
F-test Equality of coefficients, Normal=Financial (p)	0.03	0.00	0.00	0.00	0.01
Observations, Normal	94	94	94	94	94
Observations, Financial	24	24	24	24	24
Observations	118	118	118	118	118

Dependent variable: $\Delta_h y_{it(r)+h}$ = (Change in log real GDP per capita from Year 0 to Year h)$\times$100.

Standard errors in parentheses.+ $p < 0.10$, * $p < 0.05$. Fixed effects not shown. See text for a list of controls not shown here.

Panel (a): LM test: normal and financial coefficients equal at each horizon: $F(10,640) = 9.208$; $p = 0.000$.

Panel (b): LM test: normal and financial coefficients equal at each horizon: $F(10,570) = 5.651$; $p = 0.000$.

Conditional path, continuous treatment

Table : LP — 7 Variable System, Normal v. Financial Bins and Excess Credit

Log real GDP per capita (relative to Year 0, $\times$100)	(1) Year 1	(2) Year 2	(3) Year 3	(4) Year 4	(5) Year 5
Normal recession (N)	-1.3*	0.7	3.2*	3.8*	4.8*
	(0.4)	(0.6)	(0.9)	(1.1)	(1.2)
Financial recession (F)	-2.8*	-4.1*	-3.6*	-2.8	-1.4
	(0.6)	(1.0)	(1.4)	(1.8)	(1.9)
Excess credit $\times$ Normal recession ($N \times (\xi - \overline{\xi_N})$)	-0.3	-0.7*	-0.8+	-0.9+	-0.7
	(0.2)	(0.3)	(0.4)	(0.5)	(0.6)
Excess credit $\times$ Financial recession ($F \times (\xi - \overline{\xi_F})$)	-0.4+	-1.0*	-0.4	-1.3+	-0.9
	(0.2)	(0.4)	(0.5)	(0.7)	(0.7)
F-test Equality of coefficients, Normal=Financial (p)	0.01	0.00	0.00	0.00	0.00
F-test Equality of coefficients, interaction terms (p)	0.57	0.47	0.49	0.62	0.82
Observations, Normal	92	92	92	92	92
Observations, Financial	29	29	29	29	29
Observations	121	121	121	121	121

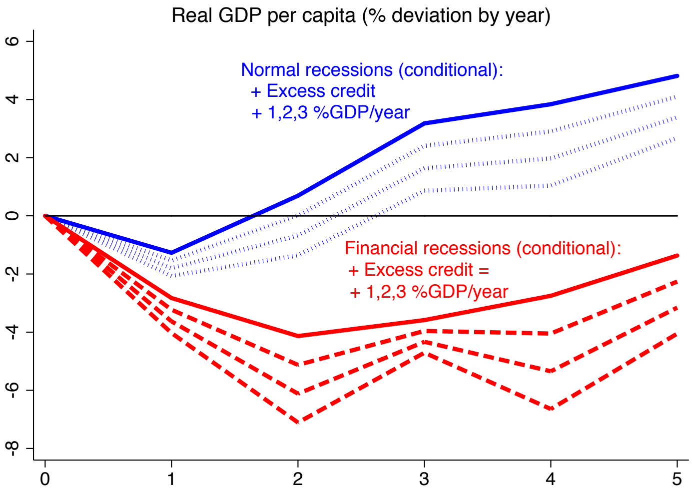
Dependent variable: $\Delta_h y_{it(r)+h}$ = (Change in log real GDP per capita from Year 0 to Year h)$\times$100.

Standard errors in parentheses.+ $p < 0.10$, * $p < 0.05$. Fixed effects not shown. See text for a list of controls not shown here.

LM test: All excess credit coefficients equal zero: $F(10{,}585) = 3.026$; $p = 0.001$.

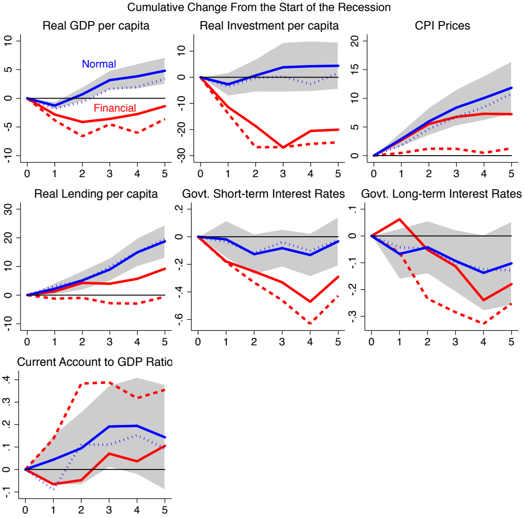
Notes: In each bin, recession indicators (N, F) are interacted with demeaned excess credit, $(\xi - \overline{\xi_N}, \xi - \overline{\xi_F})$.

Conditional path, continuous treatment



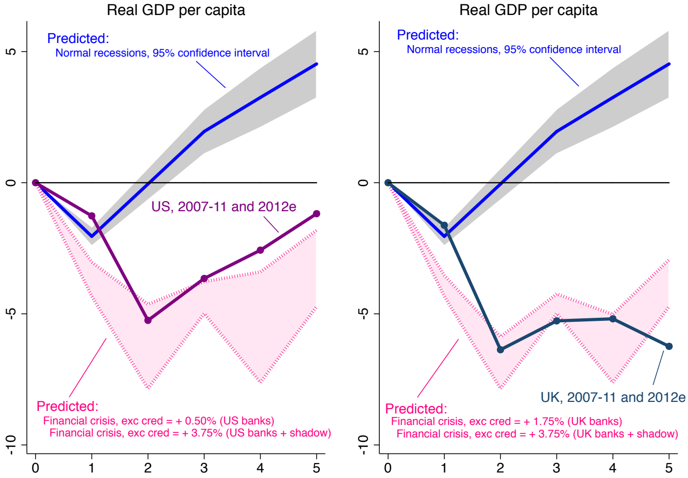
Conditional path, responses of other variables

Remarkable for being unremarkable... Baseline (solid) + excess credit (dashed)



FACT-CHECKING ECONOMIC PERFORMANCE

Example: US v UK recovery



See Vox article by Schularick and Taylor 2012, http://www.voxeu.org/article/fact-checking-financial-recessions

Summing Up

The credit intensity of the boom matters for output path...
... and this is true in any kind of recession (normal/financial)
= new stylized fact.

- Stay tuned, more to come:
- Question of net effects of leverage will be an important topic for future research — gains in booms v losses in busts?
- We have collected data on public sector — many have argued that the level of public AND private indebtedness matters in a financial crisis and we want to look into this.
- Also will look at fiscal/monetary policy impacts, and disaggregated lending patterns (especially housing v. other types of debt).