Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises

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General goal and three main questions

General goal

Lift the veil of finance to reexamine the link between financial structure and real activity in the past or present.

Three main questions

1. Which stylised facts can we derive from the long-run trends in money and credit aggregates?
2. How have the monetary policy responses to financial crises changed over time?
3. What role do credit and money play as a cause of financial crises?

Related literature and contribution of this paper

Related literature

- McKinnon and Pill (1998)
- Kaminsky and Reinhart (1999)
- Gourinchas, Valdes, and Landerretche (2001)

Focus: developing countries
Observation period: last 30 or 40 years

Contribution of this paper

- Focus: 14 developed countries
- Observation period: almost 140 years (1870-2008)
- A new long-run historical dataset with detailed annual financial and other macroeconomic data.

Money, credit, and crises in the long-run

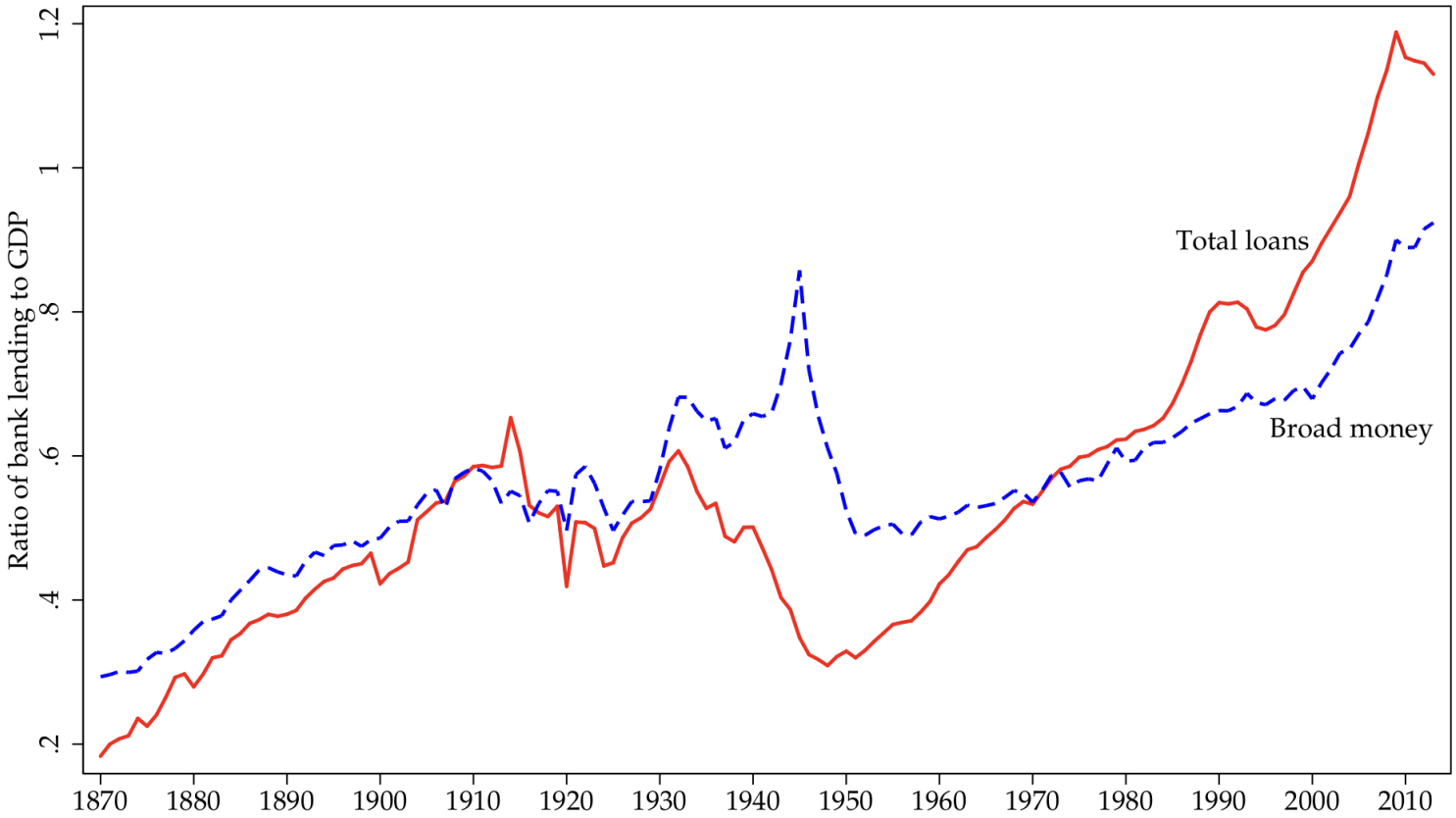


Figure: Total bank loans to the non-financial private sector

Source: Schularick, Moritz and Alan M.Taylor, Credit Booms Gone Bust: Monetary Policy, Leverage Cycles and Financial Crises 1870-2012, American Economic Review, 2012

Stylised facts: two eras of finance capitalism

Pre - WW II (1870-1939)

- Money and credit were volatile.
- Money and credit relative to GDP maintained roughly stable.
- Money growth and credit growth were essentially two sides of the same coin $\Rightarrow$ money view.

Post - WW II (1945 - today)

- Credit grew stronger relative to GDP $\Rightarrow$ much larger financial systems $\Rightarrow$ age of unprecedented financial risk and leverage.
- Credit grew stronger relative to broad money.
- Money view does no longer fit $\Rightarrow$ credit view.

Possible reasons for this change of eras

Monetary and regulatory framework

- Higher leverage and new sources of funding (debt securities creating more nonmonetary bank liabilities).
- Gold $\Rightarrow$ fiat money.
- Greater role of activist macroeconomic policies (lender of last resort).
- Introduction of deposit insurance.

What influence does credit have in the conduct of monetary policy?

Credit influence on monetary policy

Can financial crises be seen as credit booms gone wrong?

- Lagged credit growth seems to be a highly significant predictor of financial crises.
- Financial stability risks and the frequency of financial crises increase with the size of the financial sector.

Does the recent history of credit growth help to predict a financial crisis?

Development of the baseline model

Probabilistic model of a financial crisis event in country "i" in year "t"

$$Logit(P_{it}) = b_{0i} + b_1(L)Dlog(CREDIT_{it}) + b_2(L)X_{it} + e_{it} \qquad (1)$$

Aim of the regression:
Measure the influence of credit on the probability of a financial crisis.

$Logit(P) = ln(\frac{P}{1-P}) \Leftrightarrow$ log of the odds ratio

$L \Leftrightarrow$ lag operator

D $\Leftrightarrow$ dummy variable for a financial crisis

CREDIT $\Leftrightarrow$ total bank loans deflated by the CPI

$b_{0i} \Leftrightarrow$ fixed effect country

$b_1(L) \Leftrightarrow$ lag polynomial, contains lag orders 1 to 5

$b_2(L) \Leftrightarrow$ control for other factors X_{it}

$e_{it} \Leftrightarrow$ well behaved error term

Baseline model

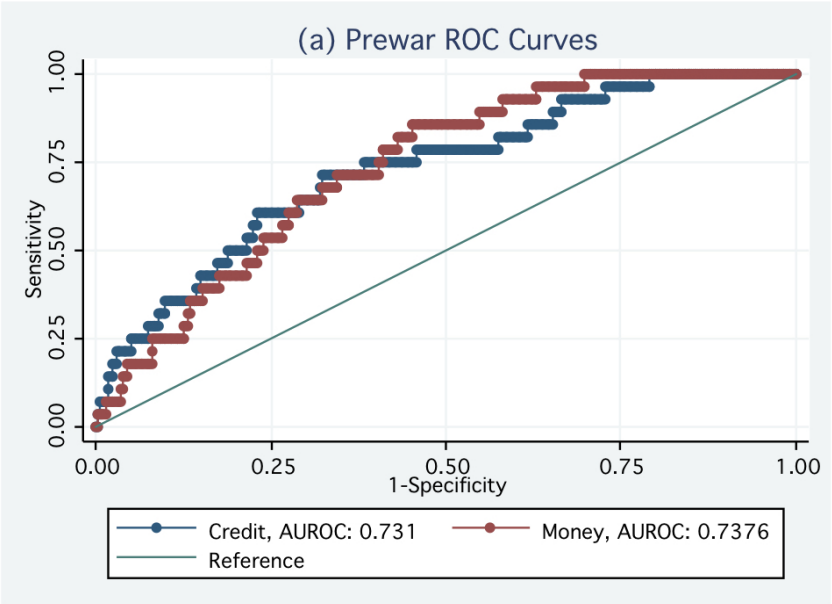
Baseline model and alternative measures of money and credit

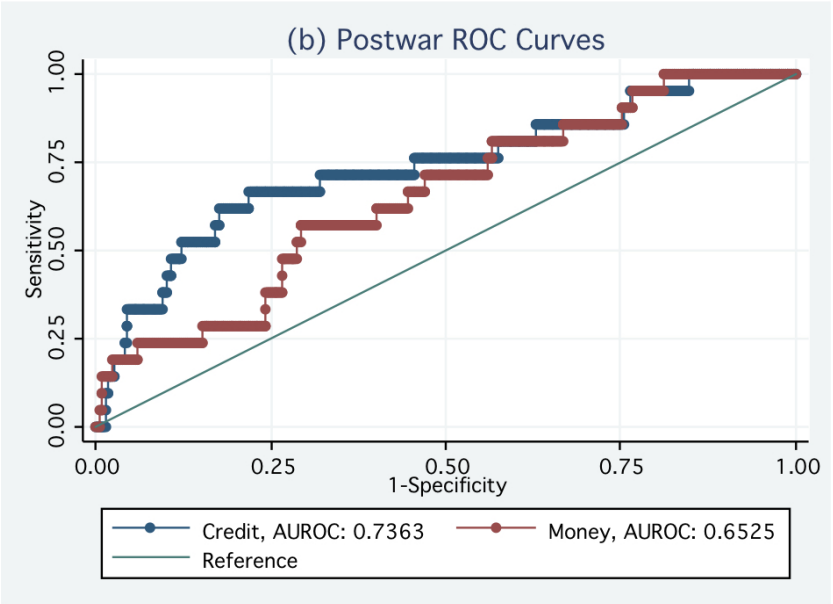
Specification (Logit country effects)	(6) Baseline	(7) Replace loans with broad money	(8) Replace loans with narrow money
L.Dlog(loans/P)	-0.108	1.942	-0.890
	(2.05)	(2.94)	(1.37)
L2.Dlog(loans/P)	7.215***	5.329**	2.697
	(1.99)	(2.52)	(1.68)
L3.Dlog(loans/P)	1.785	2.423	2.463
	(1.83)	(2.63)	(1.77)
L4.Dlog(loans/P)	0.0517	-1.742	-2.244
	(1.49)	(2.51)	(1.65)
L5.Dlog(loans/P)	1.073	4.275*	1.210
	(1.78)	(2.30)	(1.82)
Observations	1285	1361	1394
Groups	14	14	14
Avg. obs. per group	91.79	97.21	99.57
Sum of lag coefficients	10.02***	12.23***	3.235
se	3.235	3.544	3.129
Test for all lags = 0, χ^2	17.22***	18.35***	5.705
p value	0.0041	0.0025	0.3360
Test for country effects = 0, χ^2	7.789	9.333	8.627
p value	0.857	0.747	0.800
Pseudo R^2	0.0596	0.0481	0.0343

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses.

Source: Schularick, Moritz and Alan M.Taylor, Credit Booms Gone Bust: Monetary Policy, Leverage Cycles and Financial Crises 1870-2012, American Economic Review, 2012

Credit versus money as crisis predictors





- Before WW II credit and money make similar predictions
  $\Rightarrow$ money view.
- After WW II the credit predictions are far more accurate
  $\Rightarrow$ credit view.

Source: Schularick, Moritz and Alan M.Taylor, Credit Booms Gone Bust: Monetary Policy, Leverage Cycles and Financial Crises 1870-2012, American Economic Review, 2012

Robustness checks

Add 5 lags of...	**Significant?**	**Credit significant?**	**AUROC**
Real GDP growth	Yes	Yes	0.711
Inflation	Yes	Yes	0.756
Nominal interest rate	No	Yes	0.712
Real interest rate	Yes	Yes	0.744
Investment/GDP ratio	Yes	Yes	0.737
BASELINE MODEL	-/-	Yes	0.697

Table: Effect of additional control variables

Adding additional control variables does not lead to statistically significant improvement in predictive ability (measured by AUROC).

Source: Schularick, Moritz and Alan M.Taylor, Credit Booms Gone Bust: Monetary Policy, Leverage Cycles and Financial Crises 1870-2012, American Economic Review, 2012

Financial crises are credit booms gone bust

Conclusion

- Financial crises throughout modern history can be viewed as credit booms gone wrong.
- Past credit growth seems to be the single best predictor for financial fragility. Credit growth especially seems to be a better indicator than broad money.
- As credit growth decoupled from money growth, credit and money aggregates are no longer two sides of the same coin.
  Need for policy change: money view $\Rightarrow$ credit view.

Limits and open questions

- How can the insights gained be translated into effective policy?
- Influence of insurance of the financial systems by governments on the expansion of leverage?
- Why do agents borrow and lend so much if it predictably leads to a financially fragile economy?

References

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The end.

Thank you for your time and attention.

Do you have any questions?

Back-up material

Money view

Banks' liabilities were first and foremost monetary, and exhibited a fairly stable relationship to total credit. In that environment, by steering aggregate liabilities of the banking sector, the central bank could hope to exert a smooth and steady influence over aggregate lending.

Credit view

While central banks might still be able to steer aggregate credit through the monetary aggregates, it is also possible that the link between money and credit becomes looser than in a situation where banks' liabilities are predominantly or even exclusively monetary.
Banks' access to non-monetary sources of finance has become an important factor for aggregate credit provision. Thus, what happens in financial markets - borrowing conditions, liquidity, market confidence - starts to matter more than ever for credit creation and financial stability, possibly amplifying the cyclicality of financing in a major way.

Explanation of data and assumptions I

Data basis:

A new long-run historical dataset for 14 developed countries over almost 140 years (1870-2008).

Developed countries: United States, Canada, Australia, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom.

Core of the dataset: yearly data for aggregated bank loans; total balance sheet size of the banking sector; narrow (M0 or M1) and broad (M2 or M3) monetary aggregates; nominal and real output; inflation, investment.

Key sources of the dataset: US Federal Reserve's All Bank Statistics; Bundesbank's Geld- und Kreditwesenstatistik; David Sheppard's statistics for the British financial system; Malcolm Urquhart's work on Canadian financial statistics

Explanation of data and assumptions II

Core definitions:

Total lending, or bank loans, is defined as the end-of-year amount of outstanding domestic currency lending by domestic banks to domestic households and non-financial corporations (excluding lending within the financial system).

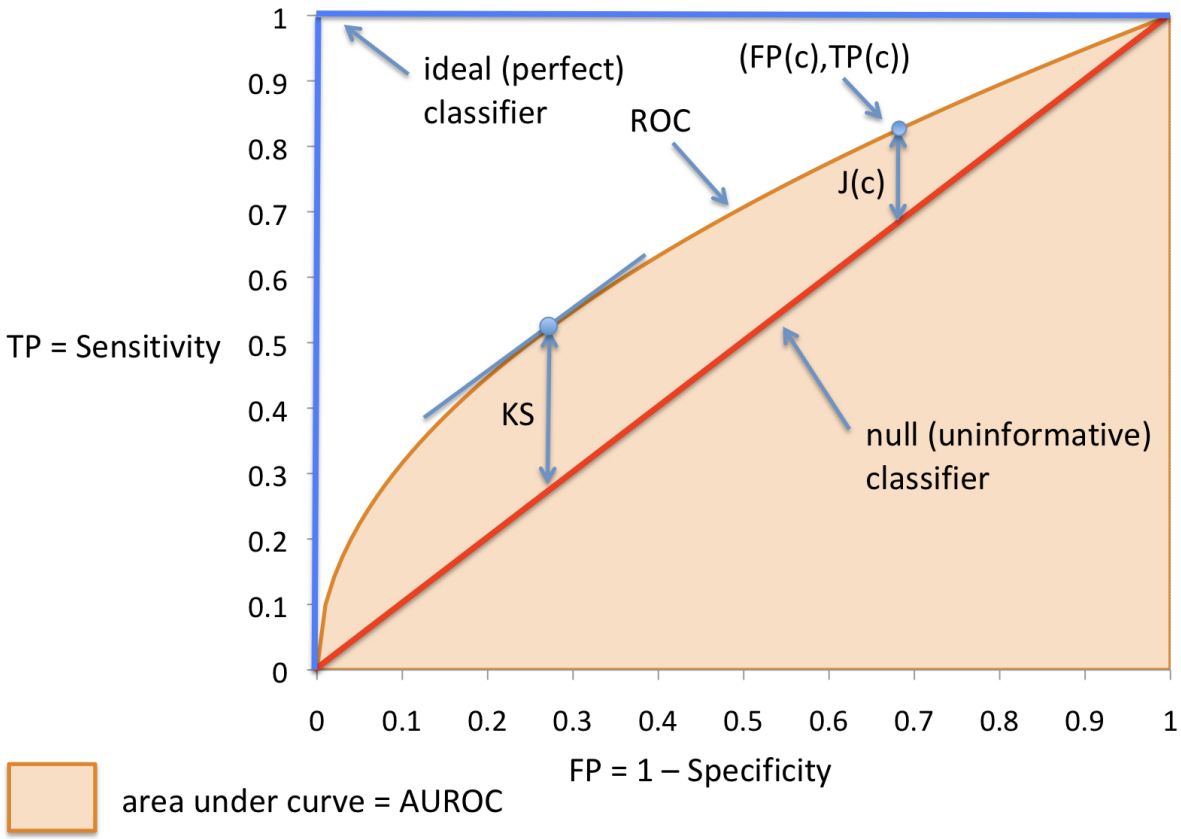
Banks are defined broadly as monetary financial institutions and include savings banks, postal banks, credit unions, mortgage associations, and building societies whenever the data are available. We excluded brokerage houses, finance companies, insurance firms, and other financial institutions.

Total bank assets is then defined as the year-end sum of all balance sheet assets of banks with national residency (excluding foreign currency assets).

Predictive ability testing: ROC curve and diagnostics

d = outcome (binary), $\hat{z} = \hat{\beta}X$ signal (continuous), c = threshold

$$TP(c) = P\left[\hat{z} \geq c | d = +1\right] \qquad FP(c) = P\left[\hat{z} \geq c | d = -1\right]$$



Source: This is a slide from Moritz Schularick, which he used within his Macro Finance PHD course

Digression: ROC, expected utility, and optimality

Is there an economic metric for classification performance?

Yes. Suppose π is frequency of crisis events (positives). Expected utility is

$$\begin{aligned} U(c) &= U_{TP}TP(c)\pi + U_{FN}(1 - TP(c))\pi + \\ &\quad U_{FP}FP(c)(1-\pi) + U_{TN}(1 - FP(c))(1-\pi). \end{aligned} \tag{2}$$

Differentiate. Slope of ROC curve at optimum threshold ($dU/dc = 0$) is

$$slope = \frac{dTP}{dFP} = \frac{1-\pi}{\pi}\frac{(U_{TN} - U_{FP})}{(U_{TP} - U_{FN})}. \tag{3}$$

When misclassification costs are equal for P and N, and $\pi = \frac{1}{2}$ you want to operate at the point furthest from diagonal (slope=1; *KS* test statistic).

In general, be conservative calling P when P's are rare (π low) or when FP error (v TN) more costly than FN error (v TP). [Set c high. Medical examples.]

Source: This is a slide from Moritz Schularick, which he used within his Macro Finance PHD course

Explanation video: ROC and AUC clearly explained

StatQuest with Josh Starmer

https://youtu.be/4jRBRDbJemM

Remaining questions for further research

Why do agents borrow and lend so much if it predictably leads to a financially fragile economy?

There are currently three possible explanations...

1. Liquidity view: sunspot shocks
2. Capital view: not enough skin in the game
3. Behavioural view

Liquidity view: sunspot shocks

Example: If agents believe for some reason that banks become fragile, they will run on banks and withdraw their deposits (Diamond Dybvig framework).
Even though banks might be healthy, they might get illiquid and are forced to fire sale their assets. As a result, a banking crisis might occur.
The key point: sunspot shocks and thus financial crisis cannot be predicted.
Further research: Krishnamurthy and Muir show that credit spreads are abnormally low before crises, indicating that nobody had a clue, which seems to be in line with this view. Finding sunspot shocks seems, however, to be difficult empirically.

Capital view: not enough skin in the game

Traditional finance literature would suggest that low capital must play a crucial role in predicting financial crisis. Low capital should induce banks to more risk taking as their limited liability approach makes their expected profit function convex. If equity holders win, they get all the excess profits. If they lose, most of the lost investment is borne by the creditors.
It seems as the capital view (not enough skin in the game) cannot be supported by evidence.

Behavioural view I

People are not rational. They are driven by investor sentiment which can (as already argued in López-Salido, Stein and Zakrajšek, 2017) drive credit spreads and supply. Mispricing and neglecting risk then lead to financial crises.

Further Research:

- Baron and Xiong (2017) show that even though market crash risk can be predicted, investors are not compensated for it. This is in stark contrast to conventional wisdom that investors should be compensated for risk. We can conclude that investors in fast loan growth episodes neglect risk.
- Fahlenbrach and Stulz (2011): explained that CEOs did not seem to predict the crisis. There has not been a sell off of their assets to escape the financial crisis. CEOs even increased their shares in the first quarter of 2008. This could also be seen as evidence that managers were not subject to moral hazard. Otherwise they would have tried to sell as much as possible.

Behavioural view II

- Fahlenbrach, Prilmeier and Stulz (2018) show that banks with the highest growth rates were typically those with the lowest subsequent returns. Thus, they seem to be too optimistic.
- Bordalo, Gennaioli and Shleifer (2018) explain that if we had good news recently, then we will become overconfident and vice versa. This triggers an inherent business cycle. If investors were successful in the past, they will become overoptimistic and neglect risk. As a result credit spreads fall. Since they mispriced assets, at some point the assets will fail and the portfolio will deteriorate. Thus, they will become overly pessimistic and credit spreads rise dramatically. As a result, credit spreads are too volatile compared to fundamentals and investors make predictable errors.

Behavioural view III

- Richter and Zimmermann exhibit that an increase in bank profits (ROE) leads to an increase in the subsequent credit supply. They exclude the possibility that this was due to credit demand shocks as asset prices subsequently fell after profitability increase. Using the Duke CFO survey, they find that an increase in ROE is correlated with optimism.

Conclusion

Due to the difficulties to support the liquidity and capital view empirically, the behavioural view seems currently to be most promising.