Credit Growth as a Predictor of Financial Crises

Why do agents borrow and lend so much

if it predictably leads to a financially fragile economy?

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Abstract

Based on the foundational work of Schularick and Taylor (2012) this essay discusses the role of credit growth as the single best predictor of financial crises.

In particular, it argues that the usage of credit growth as a predictor for financial crises clashes with the traditional assumption of rational expectations. What makes economic agents borrow and lend more than socially optimal? Within this essay macro finance meets behavioral finance. This essay highlights recent developments of the ongoing discussion in the literature covering a liquidity, capital and behavioral view. Empirical investigation suggests that the so-called behavioral view seems to be most promising.

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1 Introduction

Today, we are living in an age of unprecedented risk and leverage. To better understand the long-run relationship between real business cycles and the dynamics of financial aggregates, it is worth taking a step back and looking at how the dynamics of money, credit and macro-economy have changed over the long term.

As figure 1 illustrates, the bank-lending and broad money relative to GDP increased until the Great Depression in a roughly stable relationship. Afterwards, the bank-lending to GDP dropped until the end of the second world war and is rising ever since. It seems like the total loans are decoupled from broad money since 1945. Consequently, we can divide the development of the last 140 years in two sub periods. In the first sub period money and credit growth were essentially two sides of the same coin. Therefore, the money view and a single focus on broad money seemed feasible.[1] This changed after the second world war when credit decoupled from money. In light of this stylized fact, Schularick and Taylor (2012) argue that the money view does no longer fit and an additional focus on credit seems of high future importance.

In this essay, I explore the role of credit growth as a predictor of financial crises.

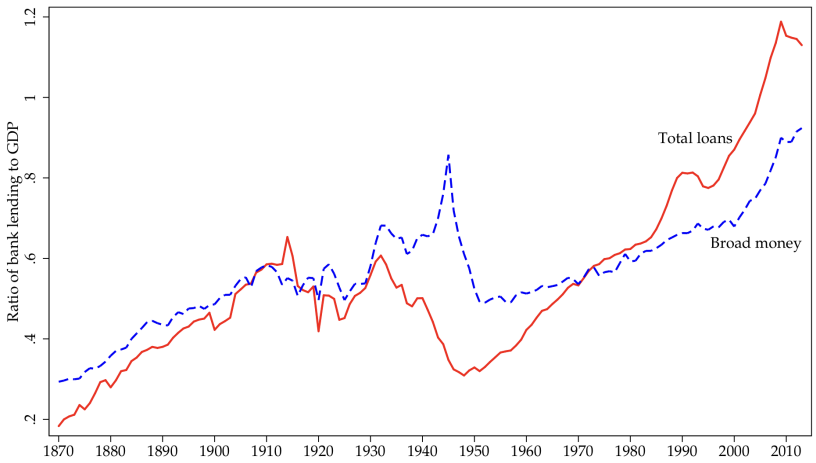

Figure 1: Total bank loans to the non-financial private sector
Source: Schularick and Taylor (2012)

[1] An explanation of the difference between money and credit view can be found in the appendix (Section 7).

2 Literature review

Since the late 90s and early 2000s, several studies (McKinnon and Pill (1998), Kaminsky and Reinhart (1999) and Gourinchas et al. (2001)) argue that financial crises in developing countries tend to be preceded by rapid expansions of credit. At the time of the financial crisis 2008 Mian and Sufi (2009) state the importance of credit growth for financial fragility by showing that the increase in household debt during the years leading up to the Great Recession predicts the severity of the downturn across the US. More recently, Schularick and Taylor (2012) offer a historical perspective of this phenomenon by contributing an enormous new data set of almost 140 years. Their main findings suggest that credit growth is the single best predictor for financial crises.[2]

In the next section, I describe why credit growth can be seen as a predictor of financial crises.

3 Credit growth as a predictor

According to Schularick and Taylor (2012), the regime switch between the money and credit sub period summarized in figure 1 is the consequence of a higher leverage by new sources of funding and regulatory framework changes. Moreover, they claim that financial stability risks as well as the frequency of financial crises increase with the financial sector and that lagged credit growth could be a significant predictor for financial crises. In other words, they ask if financial crises can be interpreted as credit booms gone wrong.

To answer this question, they develop a statistical model to investigate the relationship between credit and the probability of a financial crisis. They conduct a regression with different lag operators, a dummy variable for a financial crisis in country i in year t and several control variables.[3] The output indicates that an increase in credit growth over the previous five years raises the probability of a financial crisis significantly.[4]

Equipped with the model, they perform a receiver operating characteristic (ROC) analysis and use the area under the ROC (AUROC) as a measure to compare the predictions made by money and credit.[5]

[2] Details of the data basis of Schularick and Taylor (2012) can be found in the appendix (Section 7).

[3] The specification of the probabilistic model and the regression can be found in the appendix (Section 7).

[4] The output of the regression can be found in the appendix (Section 7).

[5] A link to a video explaining ROC and AUROC in further details can be found in the appendix (Section 7).

Figure 2 shows that the AUROC of money and credit in the first era is quite similar while the AUROC of credit in the second era is far greater. Accordingly, the predictions made by credit in the second era outperform the predictions made by money significantly.[6] Credit growth is the single best predictor for financial fragility and financial crises can be viewed as credit booms gone wrong.

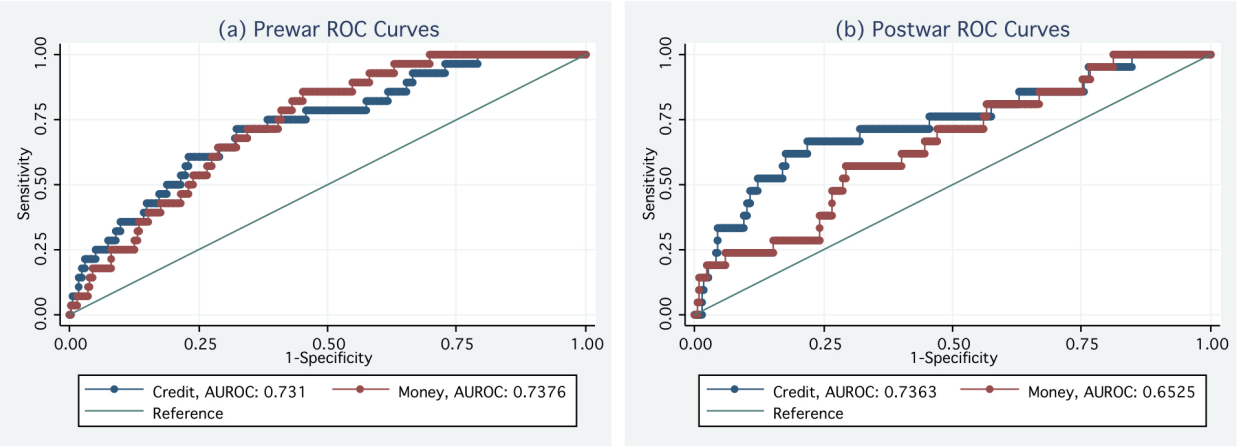

Figure 2: Credit versus money as crisis predictors
Source: Schularick and Taylor (2012)

This result clashes with the traditional assumption of rational expectations. Why do agents borrow and lend so much if it predictably leads to a financially fragile economy?

There are three views on the origins of financial crises - a liquidity, a capital and a behavioral view.

4 The liquidity view

In the liquidity view the economy is inherently fragile and rapid credit growth causes financial crises only in combination with sunspot shocks. According to Diamond and Dybvig (1983) even healthy banks might get illiquid and are forced to fire sale their assets if agents believe for some reason that banks become insolvent. These beliefs can be described as sunspot shocks, which are by definition unpredictable. Thus, the liquidity view states that financial crises cannot be predicted. Krishnamurthy and Muir (2017) support this view by showing that credit spreads are abnormally low before crises indicating that nobody had a clue about impending shocks. Since sunspot shocks

[6] Schularick and Taylor (2012) conduct several modifications of their model with further control variables to support their findings. An overview can be found in the appendix (Section 7).

are difficult to find empirically, it seems nearly impossible to prove this view. Still liquidity should be a concern during financial crises due to panic elements of banking crises.

5 The capital view

In the capital view rational agents borrow and lend more than socially optimal because they do not have enough skin in the game. Investors of highly-leveraged banks might take high risks in return for high dividends. However, even if investors do not want to take a lot of risk, the bank CEOs still have strong incentives to lever up. Their bonuses are usually based on yearly profits. Subsequently, the incentives of bank managers may lead them to take excessive risks. In theory, this makes financial crises part of agency costs. Further, Haldane and Alessandri (2009) argue that there is a repeated historical pattern of banks skimming private profits while socialising losses. An understanding of an implicit capital, deposit or liquidity insurance by the government as a public good causes a classical tragedy of the commons.

In contrast to the liquidity view, the capital view can be assessed empirically. In this respect, however, there is little empirical evidence that equity capital has a disciplining effect on bank risk-taking (Anderson et al. (2018)). While the capital ratio is insignificant, Schularick and Taylor (2012) find that credit growth is still a good predictor.

6 The behavioral view

The behavioral view claims that financial crises are caused by shocks of credit-related mis-pricing of assets and their sudden repricing. Agents borrow and lend more than socially optimal due to over-optimism and neglect of crash risk. Baron and Xiong (2017) explain that even though market crash risk can be predicted, investors are not compensated for it. This differs from the common understanding that investors should be compensated for risk. We can conclude that investors in fast loan growth episodes neglect risk.

In a closely related study, Fahlenbrach et al. (2018) describe that banks with the highest credit growth rates were typically those with the lowest subsequent returns. Thus, they seem to have been too optimistic. The behavioral view can be linked to the empirical findings of Schularick and

Taylor (2012) and is supported by further empirical findings. It seems possible that the behavioral view can explain why agents borrow and lend so much even though they could know that the credit growth predictably leads to a financially fragile economy.

7 Conclusion

In this essay we have discussed the role of credit growth. By using a historical perspective we have explained that credit growth decoupled from money growth. In this regard, we have suggested that financial crises can be seen as credit booms gone wrong and that credit growth is the single best predictor for financial crises.

In the second part of the essay, we have presented a few alternative views on the origins of financial crises and the question what makes economic agents borrow and lend more than socially optimal. We have come to the conclusion that the liquidity view cannot be empirically verified, that the capital view has only a thin empirical basis and that the behavioral view seems to be most promising.

The current financial market models are still predominantly based on rational expectations. It remains to be seen whether the empirical conclusions will lead to a stronger influence of behavioral finance on macroeconomic models.

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Appendix

1. Money and credit view

The modern approach to monetary policy transmission can be summarized under two headings: money view and credit view.

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

However, the link between money and credit is looser today than in a situation where banks' liabilities were predominantly or even exclusively monetary. So central banks might have problems to steer aggregate credit through the monetary aggregates. 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.

2. Data basis of Schularick and Taylor (2012)

Schularick and Taylor (2012) contribute a new long-run historical data set for 14 developed countries over almost 140 years (1870-2008) to the literature. They focus on developed countries like the United States, Canada, Australia, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland and the United Kingdom.

The core of their data set are yearly data series for aggregated bank loans, for total balance sheet size of the banking sector, for narrow (M0 or M1) and broad (M2 or M3) monetary aggregates, for nominal and real output, for inflation and yearly data series for investments.

The key sources of the data set are the US Federal Reserve's All Bank Statistics, the Bundesbank's Geld- und Kreditwesenstatistik, the David Sheppard's statistics for the British financial system and Malcolm Urquhart's work on Canadian financial statistics.

Schularick and Taylor (2012) define total lending or bank loans as the end-of-year amount of out-

standing domestic currency lending by domestic banks to domestic households and non-financial corporations (excluding lending within the financial system).

Schularick and Taylor (2012) define banks broadly as monetary financial institutions and include savings banks, postal banks, credit unions, mortgage associations, and building societies whenever the data are available. They excluded brokerage houses, finance companies, insurance firms, and other financial institutions.

Schularick and Taylor (2012) define total bank assets as the year-end sum of all balance sheet assets of banks with national residency (excluding foreign currency assets).

3. Specification of the probabilistic model and the regression

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 polynominal, contains lag orders 1 to 5

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

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

Source: Schularick and Taylor (2012)

4. Regression output

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 and Taylor (2012)

5. Explanation of ROC and AUROC

StatQuest with Josh Starmer: https://youtu.be/4jRBRDbJemM

6. Modifications of the probabilistic model

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

Source: Schularick and Taylor (2012)