

Slowdown in Bank Credit Growth: Aggregate Demand or Bank Non-performing Assets?

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We estimate the determinants of credit and of non-performing assets (NPAs) using a firm and a bank panel with data up to 2015 in order to test bank lending against the aggregate demand channel as an explanation for slow Indian credit growth. The results support demand as the key constraint. Only demand variables affect corporate credit for a broad set of firms. Balance sheet weakness reduced credit only for a narrow subset of indebted firms in a difference-in-difference type analysis. Even so, sales remained the dominant variable. From the bank panel, the asset quality review (AQR) did have a strong negative effect on advances but gross NPAs did not. While high interest rates and low growth raised NPAs, so did past credit. Low demand not only reduced credit, it also increased NPAs. That the capital adequacy ratio (CAR) significantly reduces NPAs points to the productivity of fund infusion. When other determinants are controlled, bank ownership does not affect NPA ratios, again supporting external shocks as causal. The results suggest that apart from structural reform to clean balance sheets, recovery of demand is necessary for revival of credit growth.

Keywords: Credit slowdown, Aggregate demand, Bank lending, Non-performing assets, Firm debt

JEL Classification: G21, E51

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1. INTRODUCTION

Growth fell and private investment stagnated over 2011–2017 in India. In high growth episodes in the past, bank credit¹ grew at least 15 per cent per annum. But by 2016, it had fallen steadily to below 5 per cent. Was this due to the increase in bank non-performing assets (NPAs) reflecting bad loans to corporates? This is puzzling, however, since NPAs were concentrated largely in public sector banks (PSBs) and corporate debt largely in infrastructure sector firms. They did not affect all banks and all firms. The average Indian debt–equity ratio was below unity² and average debt levels much below those in other emerging markets (EMs) (Table 1). That corporate credit from other sources also remained below past peaks until 2016³ suggests a generalised fall in credit demand. Was the problem then due to low demand? Indian macroeconomic policy was fighting high supply-shock driven inflation since 2011. Interest rates were kept high despite low growth, even as fiscal consolidation reduced deficits.⁴

This article sets out to test the bank lending channel against the aggregate demand channel as an explanation for slow credit growth. That is, it examines if corporate debt or bank NPAs that made banks reluctant to lend were the constraint on credit growth or if low demand and high interest rates raised NPAs as well as reduced credit growth in the period of analysis. Was the twin balance sheet problem primarily responsible or was it demand? Historically and internationally low interest rates and high growth have been the best conditions to bring down debt. India had the opposite conditions over 2011–2017.

In order to address these questions, we estimate the determinants of credit and of NPAs using two types of datasets: a bank panel on advances and NPAs and a firm level panel.

¹ The growth of bank credit was less than 15 per cent per annum since 2011 (compared to a peak of 30% per annum over 2004–2006) and fell to a low of 10 per cent in 2016 (Mundra, 2016). The increase in non-food bank credit was only 3.5 per cent in January 2017 and bank credit growth to industry actually became a negative 5.1 per cent (see https://rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=39692)

² For 4,388 non-government non-financial public limited companies, Rajakumar (2015) found the debt–equity ratio to be 0.44 in 2013–2014.

³ Although average corporate finance as a ratio of gross domestic product (GDP) was between 6 and 8 per cent of the GDP in 2016, this was much below a peak of almost 20 per cent in 2011. The 2 per cent from market borrowings (commercial paper, corporate bonds and syndicated loans) was also below a peak of almost 6 per cent in 2011; in 2016 another 2 per cent came from foreign direct investment and 2–4 per cent from bank credit. Net external commercial borrowings were negative (IMF, 2017, p. 8).

⁴ Inflation due to commodity price shocks reduced demand as well as raised real product interest rates for corporates. There was a gap between wholesale and consumer prices. From 2011 onwards, the real repo was positive with respect to core wholesale price inflation (WPI), which captures product prices. It increased since WPI fell, and from May 2014 became positive with respect to the headline inflation consumer price index (CPI) also, which the RBI began to target. Fiscal-monetary tightening aggravated negative aggregate demand shocks from the international slowdown.

Table 1 Core Debt Ratios to GDP in Q3 2016

	1	2	3	4	5	6
	Total Credit to the Non-financial Sector	Credit to Government	Total Credit to the Private Non-financial Sector	Total Credit to Households	Total Credit to Non-financial Corporations	Total Bank Credit to the Private Non-financial Sector
	I	2	3	4	5	6
	$I = 2 + 3$					
	$3 = 4 + 5$					
India	128.2 (3.4)	68.2 (1.9)	60 (1.4)	10.5 (1.2)	49.5 (0.3)	56.3 (1.7)
All economies	246.3 (-15.2)	82.6 (2.9)	156.7 (-11.1)	61.5 (-0.1)	95.2 (11.0)	91.4 (5.6)
Advanced economies	279.2 (5.5)	103.1 (4.0)	165 (-0.6)	76.1 (-1.4)	88.9 (0.9)	89.1 (-4.2)
Emerging markets	190 (42.3)	47.5 (6.1)	142.5 (36.2)	36.6 (6.9)	105.9 (29.4)	107.6 (22.5)

Source: Calculated from BIS (2017) http://www.bis.org/statistics/tables_f.pdf

Notes: 1. Core debt comprises debt securities, loans and currency and deposits in nominal values. 2. In USD at market exchange rates. 3. Figures in brackets give the change in the ratio from 2011 to 2015.

The results suggest demand was and remains the key constraint for credit. Demand variables affected corporate credit for a broad set of firms—sales and inventory were the only significant variables. Only for a subset of indebted firms in a difference-in-difference type analysis did lagged credit and assets reduce credit, even so sales remained a dominant variable. From the bank panel, gross NPAs did not have a negative effect on advances but the RBI-imposed asset quality review (AQR) did have a strongly negative effect.

The bank panel showed NPAs fell with growth, increased with repo rates and with past advances. Therefore, while high interest rates and low growth raised NPAs, so did past credit. Other control variables including types of banks were not significant, suggesting external shocks were the predominant NPA drivers.

Therefore the past credit boom did contribute to NPAs, but macroeconomic conditions more than the debt accumulation constrained credit and output growth that could have brought down NPAs. An inherently sectoral debt problem was allowed to fester. Absence of resolution in a high interest rate regime led to chronically stressed assets with interest cover of less than 1 reaching about 33.5 per cent of the aggregate loan portfolio in 2016 (Reserve Bank of India [RBI], 2016). High interest rates reduce demand as well as add to stress in assets. They raise corporate debt especially when revenue growth is low. Slowdown in bank credit growth is problematic since alternative sources of credit will take time to mature, especially for small firms.

The structure of the article is as follows: Section 2 presents some stylised facts; Section 3 gives a literature review; Section 4 discusses data and methodology; Section 5 has the analysis of estimation; and Section 6 concludes the article with some policy implications.

2. STYLISED FACTS

A rise in EM corporate dollar debt is regarded as a major post-global financial crisis (GFC) risk. This grew from US\$1.7 trillion in 2008 to US\$4.3 trillion in 2015 as quantitative easing pumped up global liquidity. China, Turkey and some Latin American countries saw the largest rise. This made EM corporates vulnerable to rising international interest rates and dollar appreciation as the US Fed exited from easing (IMF, 2015).

Talk of an Indian balance sheet problem tends to put Indian firms in the same basket. But rather than excessive credit growth in this period of excess global liquidity, India actually managed the opposite problem—too low a level and growth rate of credit. Calibrated restrictions on foreign borrowing also limited the relative size of large Indian corporate external debt. Indian private sector

external debt only rose to US\$105 billion in 2014 from US\$59 billion in 2008. In India the rise in debt may have been large in absolute terms but still low as a ratio to GDP. But was there a credit boom before the GFC that created India's corporate debt problem?

The Bank of International Settlements releases quarterly data on international core debt ratios to GDP. A comparison of Indian ratios, and change in these ratios, with different regions is startling. The ratio of Indian total credit to the non-financial private sector was and remains far below the average for all economies and for EMs (Table 1). Indian credit availability has never been excessive, despite double digit credit growth prior to the GFC.

The Indian government does borrow more, as a ratio to GDP, than other EMs, although much less than advanced economies (AEs). But overall Indian debt ratios are much lower than all other countries. Corporates and households borrow much less.

Moreover, the increase in Indian ratios of total debt, debt to government and to non-financial corporations over 2011–2015, a period of high global liquidity, was below the global increase. The government was reducing its fiscal deficit and firms were borrowing little. For Indian non-financial corporations, the ratio increased only by 0.3 compared to 29.4 for other EMs. Debt is concentrated in large infrastructure firms, but even so average debt–equity ratios remain at around unity since they are low for other firms. The pre-2008 credit boom, therefore, was concentrated only in a few firms.

While there was some deleveraging by AE households and banks, household bank credit and market borrowings grew substantially in EMs. Non-bank financial intermediation (Columns 3–6 for the term in brackets) increased by about 14 per cent of GDP since the crisis for EMs. In India, this was minuscule. Banks remain the dominant source of credit, so the slow growth of bank credit is doubly worrying.

The all-India commercial bank credit–deposit ratio fell to 70.6 per cent by end-December 2016 compared to 74.5 per cent a quarter earlier.⁵ As Table 2 shows, the asset quality problem affects only a part of the banking system and only a particular type of loan. NPAs that stopped producing income are concentrated in public sector bank loans to large corporates. The problem was therefore limited in size and funds required to restore health were not excessive.

Even so, high interest rates in this period added to stress and debt since little fresh equity was available. For over 3,000 non-financial firms in the Centre for Monitoring Indian Economy (CMIE) database, debt grew at 12.8 per cent

⁵ See https://www.rbi.org.in/Scripts/BS_PressReleaseDisplay.aspx?prid=39697

Table 2 Indian Banks' Bad Loans, Deposits and Credit Growth

Banks	March 2015			March 2016			September 2016		
	Gross NPA/gross Advances	Deposit Growth	Gross NPA/gross Advances	Deposit Growth	Stressed Advances	Gross NPA/gross Advances	Deposit Growth	Credit Growth	
									2.2
Private	3.2	15.0	4.2	13.2	4.4	4.1	18	4.8	
Foreign	5.4	8.9	9.8	4.6	15.8	11.8	5.5	3.1	
Public	4.6	10.7	7.8	7.6	12.3	9.1	9.2	7.8	
All banks									

Source: RBI (2016), second chapter.

Notes: NPA: Non-performing assets; stressed advances are ratios to total advances of gross NPAs plus restructured standard advances.

per annum over 2011–2015. Firms were less able to service their interest burden. Loans rolled over to cover interest payments grew even as asset values deteriorated. Interest coverage declined by over 25 per cent over 2011–2014 although it was still healthy by 3.5 times. It deteriorated more for smaller firms. The share of chronically stressed firms with interest coverage ratio less than unity reached 33.5 in 2016.

The RBI introduced many schemes to encourage banks to restructure advances, but they were not effective in the absence of a resolution regime. Recovery was taking too long, and loan and deposit growth in PSBs was the slowest (Table 2). Their larger share of stressed assets was denting confidence in PSBs, even though there was no run on banks due to government backing, and assets were largely maintained.

If asset sales or capital conservation are inadequate, infusion of new capital is required to clean balance sheets and revive lending. The government, however, as part of its Indradhanush restructuring plan for PSBs decided to provide only limited amounts conditional on improvements in governance.⁶ Even so, the RBI imposed AQR in 2015. As a result, NPAs jumped sharply in 2016 (Table 2). Between March and September 2016, the stressed advances ratio increased for more than 70 per cent of banks (RBI, 2016).⁷

The banking system as a whole continued to be stable, however. Asset quality was weak only in a part of the system, as Table 2 shows, and only a particular type of loan. NPAs were concentrated in PSB loans to large corporates, in specific sectors. Non-priority sector loans accounted for 65 per cent of NPAs in 2015, a switch from pre-GFC when priority sector loans were the majority. Diversity helped reduce overall risk, since private banks did better in this period. Their market capitalisation overtook that of listed public sector banks in 2011. They also attracted more foreign investment.

The PSBs had demonstrated the ability to compete effectively and earn profits in the past.⁸ Their post-GFC problems were partly due to government pressure

⁶ ₹700 billion was to be provided from the budget over 2015–2019 against a privately estimated requirement of ₹1,800 billion. Apart from NPAs funds are also required for expanded capital requirements due to international accounting standards and aspects of Basel III that are to apply in 2018.

⁷ As on 30 September 2016, the gross NPAs of public sector banks rose to ₹6,300 billion from about ₹3,000 billion in 2012. Including figures for restructured assets as well, the stressed assets in the banking system are estimated to be in the range of ₹10,000 billion. Of the estimated ₹4,000 billion of provisioning about ₹3,000 billion was done, but bankers believed more was required to revive assets.

⁸ Standardised versions of Basel-type prudential norms supplemented with broad pattern regulation were implemented during the 1990s banking reforms. Although chosen because of skill limitations in PSBs they turned out to have good stability-enhancing incentives. The new philosophy of regulation, together with high growth and legal reform that made debt recovery easier, led to NPA ratios falling to historic lows from 12.8 per cent in 1991 to 2.4 per cent in 2009–2010. The public sector did unexpectedly well,

but also due to errors of judgement and to external shocks. They were pushed to compensate for the winding up of development banks and for thin bond markets and did not foresee the governance and administrative problems that delayed projects expected to be viable under high growth. They came from a history of hand-holding large corporates in order to encourage development. Private sector banks that focused on retail credit remained in good shape. Disincentives from taxpayer support are not limited to PSBs since no large bank is allowed to fail for fear of systemic spillovers.

As the problem continued to fester, banks were not spared fresh blows, such as tougher regulatory requirements following international norms. The high-interest regime aggravated debt. Bank credit fell sharply over 2011–2016. For example, bank non-food credit growth rates fell from about 20 per cent to 8 per cent, and credit growth to industry actually was –1 per cent over May–July 2016.⁹ The PSBs also turned to retail lending. Alternative credit sources remained underdeveloped.

3. LITERATURE REVIEW

There is an exhaustive literature on non-performing loans, with causal factors ranging from macroeconomic to external shocks, past loans, credit standards and bank specific factors. Beck, Jakubik and Piloju (2013) find that macroeconomic factors, such as real GDP growth, exchange rate, share prices and lending rates are the main determinants of NPAs. Further, external sector shocks and capital market size also affect NPAs.

The literature emphasises that bank lending is excessive during boom periods compared to recessionary times (Caruana, 2002). During upturns, banks get overoptimistic about borrowers' investment projects and their ability to repay their loans, fees and interest rates and hence give more credit while lowering credit standards. Such lending practices increase NPAs during downturns. Rajan (1994) emphasises the 'herd behaviour' among banks as a primary reason for financing projects with negative NPVs during expansions. Banks face strong competition from peers to perform at par with them, which enhances lending during booms that later turns out to be non-performing. Adrian and Shin (2010) point out that asset price changes are reflected in net worth of financial

and even overtook private banks on some parameters. It also outperformed during and immediately after the GFC. Features such as high leverage, short-term market-based funding, risky endogenous expansion of balance sheets, and exposure to cross-border risks, which had led to massive bank failures in the West, were limited (Goyal, 2014).

⁹ These figures were calculated with data from the RBI website.

intermediaries, which they respond to by adjusting the size of their balance sheets. Banks tend to search for new borrowers during credit booms and end up providing sub-prime loans, which increase their NPAs during a recession.

Berger and Udell (2003) empirically test the ‘institutional memory hypothesis’ to explain the procyclicality of bank loans and non-performing loan losses. They show that banks tend to have a short memory of ‘credit busts’ during downturns. As time passes, they face similar incentives of risk-taking during booms and grant excess loans.

Collateral is also an important factor which drives credit cycles and risk-taking by banks. In general, credit cycles tend to be associated with asset price cycles. During an asset price boom, banks increase credit limits because the valuation of the underlying collateral goes up, setting in a feedback mechanism (Kiyotaki & Moore, 1997). In the process, banks provide excess loans, which later turn out to be bad loans during a downturn in asset prices. Davis and Zhu (2011) show that credit cycles are largely driven by dynamic linkages among commercial property prices, bank credit and the macro economy. Asea and Blomberg (1998) provide evidence that the probability of collateralisation decreases during expansions and increases during contractions in the United States of America.

Keeton (1999) shows that higher loan losses can be attributed to increases in loan growth, provided that faster loan growth is caused mainly by a shift in bank credit supply. Salas and Saurina (2002) show poor credit risk management is an important determinant of problem loans. Dell’Ariccia and Garibaldi (2005) provide a theoretical explanation that the stronger the credit expansion, the more likely is financial distress mainly due to lower credit standards. Jimenez, Salas and Saurina (2006) provide empirical support for a positive relationship between rapid growth and loan losses. They further show that banks exercise easier credit standards during boom times in terms of screening of borrowers and collateral requirements. The ownership structure of banks also influences their risk-taking behaviour. Stockholder-controlled banks tend to take higher risk in bank lending compared to banks with manager control (Saunders, Strock, & Travlos, 1990). De Bock and Demyanets (2012), using a sample of EMEs, showed that lower growth rates, exchange rate depreciation, weaker debt inflows and weaker terms of trade reduce private credit and deteriorate loan quality. They further show feedback from the financial sector to the wider economy.

On similar lines, Skarica (2014) emphasises the role of economic slowdown, unemployment and interest rates as important factors raising NPAs, using a panel of Eastern and Central European countries. Adverse macroeconomic factors generally accompany rising NPAs and they have a further feedback effect on the macroeconomic performance of AEs (Nkusu, 2011). Financial market openness tends to reduce NPAs (Tanasković & Jandrić, 2015). Berger

and DeYoung (1997) show that lower cost efficiency and a decrease in bank capital ratios increase NPAs, since low-capitalised banks take more risk and end up having higher NPAs. Louzis et al. (2012) found that higher non-interest income of banks relates to lower NPAs; however, the size of the bank does not affect the level of NPAs significantly. A higher level of NPAs is also associated with geographical concentration in a loan portfolio (Jimenez et al., 2006). They further show that collateralised loans to industry are more risky compared to households, and positively affect NPAs.

In the Indian context, efficiently managed banks are found to have better loan quality (Das & Ghosh, 2007; Swamy, 2012). Rajan and Dhal (2003) found that an expectation of higher cost of credit tends to increase NPAs while maturity of credit, a better credit culture and a better macroeconomic environment lower NPAs in the economy. Misra and Dhal (2010) show terms of credit, bank specific indicators, regulatory capital requirements and business cycle shocks mainly influence the level of NPAs in the Indian economy. Lokare (2014) emphasises that NPA growth is followed by credit growth with some lag. Growth slowdown, changes in the lending rates, high inflation, falling asset prices, external macroeconomic environment, non-priority sector lending and lax monitoring are some of the important factors which contributed to rising NPAs.

Reddy (2002) emphasises that the problem of NPAs is mainly caused by legal complications and the time-consuming nature of the asset disposal process. Aggarwal and Mittal (2012) further show that rising NPAs are mainly attributed to a weak credit appraisal system, loose credit management and monitoring, industrial slowdown, inefficient methods in selecting borrowers and the lack of proper follow-up. Large banks have better risk management procedures, which reduce their NPA levels compared to smaller banks (Swamy, 2012). Also private and foreign banks are more efficient in credit management and reducing NPAs. They have faster exit.

The Indian literature has largely addressed the question of what determines NPAs. But there is no rigorous study of the contribution of NPAs to the credit slowdown. The international literature surveyed earlier finds that a credit boom reduces future credit. But credit growth and ratios in India have both been low by international standards. Therefore it is worth exploring other determinants of credit in the Indian context.

Acharya, Mishra and Prabhala (2016), using a database of 3,000 firms, try to distinguish between a bank lending (credit supply) and a corporate distress (firm demand) channel by using outcome variation when the cycle turned in 2012. Since firms connected to weak banks do better in an up-cycle and worse in a down-cycle, they argue that the problem originates in the bank lending channel and supports the RBI's AQR. They do not control for factors such as

the fact that private banks did not lend to infrastructure firms, which were worst affected by external price shocks and permission delays. They also do not test the effect of aggregate demand on the bank lending channel.

4. DATA AND METHODOLOGY

A corporate database on indebtedness of 8,648 firms was sourced from Ace Equity, put together by Accord Fintech Pvt Ltd., and provided by CARE Ratings. It had components of the balance sheet and profit and loss account. Hence on the asset side, there was data on gross fixed assets, current assets and investments while on liabilities side there were borrowings, equity, reserves and current liabilities. The 5-year panel ended in 2015–2016 and therefore covered the period of maximum growth in corporate debt, bank NPAs and slowdown in credit growth. It is thus relevant for analysis of the question posed. Finance-based companies were excluded from the dataset. Firm-specific variables such as sales, assets and inventories, debt to capital employed, assets to sales, debt to asset ratio and turnover ratio were calculated. Credit as the dependent variable was defined as the first difference of debt in two successive periods (t and $t + 1$). We used 2014–2015 as the year dummy for the AQR conducted by RBI.

Bank statistical returns, available from the RBI website, were the source of annual panel data on 51 banks for 2005–2015. Apart from information on gross advances and NPAs, this provides bank-specific variables such as capital adequacy ratios (CARs) by type of banks. Macro demand variables, such as GDP growth and repo rates, were also obtained from the RBI database. The source for the other demand indicator variables used, such as foreign tourist arrival and air passengers, was from the IndiaStat database.

The dynamic panel generalized method of moments (GMM) estimation was used for the analysis of bank- and firm-level credit since it is robust to simultaneous equation errors. It controls for endogeneity of explanatory variables, commonly observed in econometric analysis. The dynamic panel used was:

$$Y_{it} = \Sigma \alpha_j Y_{i,t-j} + x_{it} \beta_1 + w_{it} \beta_2 + v_i + \epsilon_{it} \quad i = 1 \dots n; t = 1 \dots T_i \quad (1)$$

where x_{it} is a vector of strictly exogenous variables, w_{it} is a vector of lagged predetermined and endogenous variables and v_i are the panel-level effects. The firm panel uses exogenous macroeconomic demand variables, endogenous firm-level demand and balance sheet variables and lagged endogenous dependent variables. The aim is to test the significance of demand variables

compared to balance sheet variables as determinants of credit and debt. The bank panel similarly seeks to assess the relative significance of endogenous bank variables and exogenous demand variables for bank advances (credit) and NPAs. Lagged endogenous dependent variables are included. Bank types, year dummies for policy actions and other exogenous policy variables, such as CAR ratios, are controlled for.

Since dynamic panel GMM estimation is at first difference level, any fixed effect drops out during the estimation. So the fixed effects model was also estimated along with GMM for robustness. In the fixed effects regressions, it is also possible to include interactive dummy variables. Fixed or random effects were used in lieu of bank or firm variables. R software was used for data cleaning and Stata for fixed effect and GMM estimation. The `orthog` command was used to minimise data loss.

5. ESTIMATION

5.1 Credit

The first set of regressions have credit as the dependent variable regressed on lags, the economy-wide growth and repo rate as macroeconomic controls, as well as firm-specific demand variables such as sales or inventories, and firm-specific variables such as assets to capture the health of firms' balance sheets. The objective was to test if demand or balance sheet health had the greater effect on credit. Only sales, however, were found to be positive and weakly significant for credit (Table 3, Column 1).

This specification was the best of various other specifications tried using different but related variables. A few dependent variables tested were the debt to asset ratio, debt to capital employed and so on. These are not reported to save space but are available on request.

Since deriving the credit variable loses 1 year of the time-series data, regressions were also carried out using debt itself as the dependant variable. Apart from demand and indebtedness variables, interactive dummies could be used in the fixed effects regressions attempted. In the first regression, sales, inventories and assets significantly increase firm debt, while the repo rate weakly decreases it (Table 4, Column 1). A dummy for AQR (Year 2015) is insignificant. This implies that firms could raise debt when sales rose, or if they had assets, but a rise in repo rates forced them to economise on debt.

Since only demand variables were significant for all firms in the GMM regressions, they were repeated with only the subset of sectors where indebted firms are concentrated or the firms were isolated using interactive dummies

Table 3 Dynamic Panel for Firm Credit (GMM)

	<i>All Firms</i>		<i>Indebted Firms</i>	
	1	2	3	
L. Firm credit	0.10 (0.34)	-0.46* (-2.31)	-0.276 (-1.05)	
Growth rate	-22.28 (-1.19)		3.047 (0.07)	
L. Growth rate	-6.79 (-1.72)	3.80 (0.16)		
Sales	0.24* (2.50)	0.54** (2.58)	0.344 (1.08)	
L. Sales	-0.22 (-1.77)	0.16 (0.75)	0.275 (1.04)	
Assets	0.01 (0.84)	0.06 (0.78)	0.0174 (0.30)	
L. Assets	0.01 (0.81)	-0.21** (-3.09)	-0.220 (-1.74)	
Debt_Capemployed			-0.257 (-0.05)	
L. Debt_			-1.737** (-2.59)	
Capemployed				
Turnover ratio (sales/assets)			-16.74 (-0.15)	
L. Turnover ratio			31.73 (0.34)	
Repo rate			4.547 (0.73)	
L. Repo rate			9.296 (1.26)	
Inventories			0.451 (0.89)	
L. Inventories			-0.273 (-0.61)	
Observations	15,546	1,305		
Sargan_overid_p	1.16e-64	7.00e-09	7.66e-14	
Hansen_overid_p	0.816	0.858	0.952	
ABtest_AR1_p	0.0881	0.468	0.954	
ABtest_AR2_p	0.374	0.359	0.282	

Source: Authors' estimation.

Notes: *t*-statistics in parentheses; * $p < 0.05$ and ** $p < 0.01$.

in order to see if their high debt levels affected credit growth for these firms at least, and if there were other differences in the coefficients. While infrastructure, aviation, textiles, mining, iron and steel were the sectors that contributed most to NPAs in the period of analysis, some corporates were cash rich—there is a large diversity among corporates.

For a filtered corporate dataset of these indebted firms, only sales and inventories continue to raise credit in a fixed effect regression (Table 4, Column 2). Interacting the sales and inventory variables with a dummy variable for the indebted firms in a fixed effects regression for all firms shows a larger coefficient for sales, while inventories become negative (Table 4, Column 3). Thus sales were an even more important enabler for indebted firms to raise more credit. A pooled ordinary least squares (OLS) regression with a group dummy for the indebted firms shows indebtedness strongly raised debt for such firms pointing to the debt trap they are in (Table 4, Column 4).

Table 4 Firm Debt

	<i>Fixed Effect (All firms)</i>	<i>Fixed Effect (Indebted firms)</i>	<i>Fixed Effect (Interactive dummy)</i>	<i>Pooled OLS (Group dummy)</i>
	1	2	3	4
Growth rate	−2.116 (−0.30)	5.92 (0.45)	−0.549 (−0.08)	−1.429 (−0.07)
Repo rate	−9.250* (−1.97)	1.47 (0.17)	−9.090 (−1.94)	−12.65 (−0.88)
Inventories	1.252*** (56.86)	0.15*** (5.05)	1.299*** (54.12)	0.726*** (5.74)
Sales	0.0637*** (23.57)	0.05*** (4.74)	0.0587*** (21.42)	0.103*** (5.97)
Assets	0.00226*** (9.93)			
Year 2015	26.62 (1.42)	−36.29 (−1.06)	26.43 (1.41)	32.10 (0.51)
Indebt_sales			0.251*** (12.53)	
Indebt_invent			−0.426*** (−6.96)	
Indebt_indgrp				251.2*** (4.75)
Constant	217.0*** (6.82)	−55.23 (−0.90)	189.5*** (5.94)	258.6*** (3.31)
Observations	27,357	2,245	27,357	27,357

Source: Authors' estimation.

Notes: *t*-statistics in parentheses; * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$.

In a dynamic GMM panel regression for the subset of firms (Table 3, Column 2), sales continue to be significant, with the larger coefficient also indicating, as with an interactive dummy in Table 4 (Column 3), that sales have an even larger effect on raising credit for indebted firms. But lagged credit weakly reduces credit, as do lagged assets, since assets are likely to be low for such firms. Thus past borrowing is a constraint on credit only for indebted firms. In a regression including the ratio of debt to capital employed (Table 3, Column 3), its lagged value reduces credit while all other variables become insignificant. To summarise, past credit and debt-related variables are significant only for indebted firms, while demand variables help all firms increase credit. Coefficients are different for indebted firms, however. Improved demand and sales are even more critical to enable such firms to raise credit.

5.2 Bank Panel

We then turn to the bank panel to further assess the determinants of credit and of NPAs. Since bank advances measure bank credit, we first try to analyse the credit determinants using bank advances as the dependent variable (Table 5, Column 1). Bank-specific variables such as CAR, predetermined lagged gross advances, gross NPAs, exogenous macroeconomic control variables and policy dummies were assessed for their impact on advances. Column 2 has gross NPA regressed on similar variables.

Lagged advances actually increase advances as do gross NPAs, rather than appearing as a constraint on lending. This may reflect evergreening, as one way to get NPA ratios down is to increase credit. Perhaps that is why lagged growth, which decreases NPAs (Table 5, Column 2), also mildly decreases advances. A dummy for the 2015 AQR, which stopped such evergreening, is strongly negative. It decreased credit because of the higher provisioning requirements it implied. A better CAR reduced advances.

The bank panel can also be used to examine the determinants of NPAs. Since there is simultaneity between gross advances and gross NPAs, only GMM estimation, which corrects for such simultaneity, is used. Table 5 reported results for Gross NPAs as the dependent variable, while Table 6 has the ratio

Table 5 Dynamic Panel GMM Results

	<i>Gross Advances</i>	<i>Gross NPA</i>
	1	2
CAR	0.28* (2.03)	
Gross NPA	6.09* (2.61)	
L. Gross NPA		1.43*** (7.90)
L2. Gross NPA		-0.88** (-3.25)
Gross advances		0.02** (3.12)
L1. Gross advances	0.74*** (5.84)	-0.003 (-0.44)
Growth rate	-18.23** (-3.27)	359.1 (1.83)
L1. Growth rate		-340.1** (-2.95)
Repo rate	6.80 (1.47)	-412.1 (-1.27)
L1. Repo rate		1,574.9** (2.66)
Year_2015_dum (Ass~)	-66.74* (-2.08)	
N		497
Sargan_overid_p	5.35e-09	7.88e-11
Hansen_overid_p	1	0.997
ABtest_AR1_p	0.166	0.0239
ABtest_AR2_p	0.273	0.0755

Source: Authors' estimation.

Notes: *t*-statistics in parentheses; * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$.

Table 6 Dynamic Bank Panel (GMM) (NPA/advances as dependent variable)

	1	2	3	4
L. NPA/advances	1.12*** (12.11)	1.136*** (12.54)	0.91*** (6.84)	1.129*** (12.71)
L2. NPA/advances	-0.24** (-2.86)	-0.237** (-2.77)	-0.28** (-2.99)	-0.233* (-2.58)
Growth rate	0.05 (0.50)	-0.389 (-1.38)	0.14* (2.36)	-0.431 (-1.48)
L. Growth rate	-0.17*** (-4.09)	0.133 (0.96)	-0.11*** (-3.67)	0.121 (0.84)
Repo rate	0.15 (1.23)	0.790* (2.61)	-0.09 (-1.56)	0.758* (2.54)
L. Repo rate	0.01 (0.04)	-0.439 (-1.76)	0.23* (2.21)	-0.469 (-1.83)
CAR	-0.01*** (-3.70)	-0.0102** (-3.20)	-0.02*** (-6.34)	-0.0116*** (-4.14)
L. CAR	-0.03 (-1.13)	-0.0391 (-1.33)	0.02 (0.36)	-0.0477 (-1.62)
Air passengers growth		-4.800 (-1.90)		-4.218 (-1.74)
Core industry growth		-0.268 (-2.00)		-0.233 (-1.74)
Foreign tourist growth		-0.121** (-3.09)		-0.117** (-3.01)
Bank type (nationalised)	1.96 (1.56)	1.508 (1.01)		
Bank type (private)	0.40 (0.86)			
Bank type (SBI & assoc)	-0.52 (-0.45)	-0.945 (-0.90)		
Bank type (foreign)		-0.511 (-1.10)		
Constant	0.26 (0.13)	4.754 (1.59)		5.404 (1.73)
Observations	383		333	
Sargan_overid_p	3.63e-22	9.86e-22	1.06e-11	1.40e-22
Hansen_overid_p	1.000	1.000	0.999	1.000
ABtest_AR1_p	0.00147	0.00254	0.00324	0.00268
ABtest_AR2_p	0.759	0.372	0.526	0.383

Source: Authors' estimation.

Notes: *t*-statistics in parentheses; * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$.

of NPAs to advances. Independent variables include lagged NPA ratios, macro demand indicators such as GDP growth, other growth indicators, repo rate and bank-specific CARs and dummies for bank types. Table 5 shows that past NPAs, advances and the lagged repo rate increased NPAs while lagged growth reduced them (Column 2). Thus rising demand reduced NPAs.

Table 6, where the dependent variable is the ratio of NPAs to advances, has similar results. In addition, the CAR significantly reduces NPAs, pointing to the productivity of fund infusion. A bank ownership dummy has no effect, suggesting when other determinants are controlled for bank ownership does not affect NPA ratios.

6. CONCLUSION

In answer to our question on the critical constraint on credit growth for firms, the analysis in this article supports the aggregate demand over the bank lending (credit supply) channel. Estimations based on a firm-level panel and a bank-level panel point towards low demand rather than high NPAs as the cause of slowdown in credit growth. Balance sheet weakness reduced credit only for the narrow subset of indebted firms in a difference-in-difference type analysis. Macroeconomic demand variables were also found to affect bank advances and NPAs.

Aggregate demand has been squeezed ever since 2011 in a fight against inflation largely driven by supply shocks. This may have aggravated NPAs as well as reduced credit growth. There was also a tightening of macroprudential regulations for banks.

Bankruptcy reforms and bank recapitalisation progressed well in 2017. There were also signs of a growth revival driven by a rise in global growth also supporting the demand constraint view. As long as structural change is in the right direction, and supply-side changes keep inflation low, some monetary easing could contribute to reviving demand and credit growth.

The latest research (IMF-FSB-BIS, 2016) on the use of macroprudential regulations recommends relaxation, especially where macroprudential measures are binding on the provision of credit. This supports flexibility in restructuring schemes and some counter-cyclical regulatory easing for banks.

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