

Bankruptcy reforms and firms' access to credit

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Abstract

Access to credit is a major barrier to investment and economic growth in developing countries. Either limiting access or financial frictions hinder the efficient allocation of capital by increasing the cost of credit, thus aggravating the adverse selection problem. One way to deal with this problem is bankruptcy reforms that try to lower financial frictions by rebalancing debtors-creditors' rights for efficient recovery of claims in distressed firms in a timely manner. In 2016, India introduced the Indian Insolvency and Bankruptcy Code (IBC) 2016 as a unified bankruptcy law to increase the recovery rate of insolvent firms in a time-bound manner. This study evaluates the impact of IBC on the credit dynamics of Indian firms. The paper examines how IBC affects firms' access to credit, cost of credit, and borrowing choices using data on non-financial firms from 2012 through 2022. The findings from panel fixed effect models suggest that the IBC has reduced the cost of credit by 1.4% points while increasing total (especially long-term) credit access for non-financial firms by 2.4% points (2.2%). Moreover, the study establishes the role of asset, credit, and liquidity channels via which the IBC impacts the cost and supply of credit.

Keywords: IBC, cost of credit, credit supply, non-financial firms

JEL classification: G18, G23, G32, G33

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1 Introduction

The credit supply plays a pivotal role in catalyzing investment and fueling economic growth in market economies. Saving and investment are integral elements of this active mechanism. Savings are capital accumulation, which firms can leverage as credit to invest in innovation and expansion. This dynamic relationship between saving, investment, and credit supply drives the credit channels fueling firms into productive endeavors that spur economic growth (Garcia-Escribano and Han, 2015).

If the credit market lacks a well-functioning credit channel, it imposes financial constraints on its participants. Financial constraints such as information asymmetry and transaction costs create barriers for firms to access credit. Information asymmetry arises when firms or creditors withhold or obscure details related to financial dealings. This asymmetric information between credit participants creates two problems: (1) adverse selection and (2) moral hazard. If firms hide information about their credit quality while raising debt, creditors may end up with firms with poor credit quality or high credit risk. This is adverse selection problem for creditors, which timid their confidence leading reduction in lending credit to firms. Creditors also face moral hazard issues when firms (debtors) attract to risky investment or reflect adverse behavior after accessing credit. Another constraint firms face in the form of transaction costs, that restricts firms access to credit. These costs incur due to higher processing or compliance fee during raising funds, specially it discourages small firms with limited resources.

Due to these financial constraints, firms find challenges in accessing credit, which limits their growth. The growth of Chinese enterprises is hindered by formal financing limits, as seen by the average sales growth rate of these firms being approximately 5% lower than that of their peers (Wang et al., 2022). Addressing and minimizing these financial constraints is crucial for fostering a more accessible and efficient credit market, enabling firms to overcome financial constraints and support their growth aspirations.

Developing credit information entities that can furnish precise information would alleviate the financial constraints firms face. Streamlining regulatory processes and diverse sources of financing could result in credit market reform that lowers restrictions on firms using various credit channels. Various countries worldwide have implemented various legal regulations and reforms to address these financial constraints strategically. In order to facilitate substantial access to credit for firms at reasonable interest rates, Gray (1997) highlighted the importance of robust legal rights and bankruptcy reforms for creditors with market-oriented goals when dealing with the restructuring of financially distressed firms.

In this paper, we focus on one particular dimension of this problem related to bankruptcy laws. A bankruptcy law refers to rules and mechanisms that enable individuals or firms facing distress or insolvency to seek relief from their debts. When creditors find firms unable to repay their debt, they file a legal case against firms under the bankruptcy law. When law professionals accept an insolvency case, they start to resolve or liquidate the firm with the decision of creditors to recover the debt as per bankruptcy law. It reduces the problem of information asymmetry as participants are mandated to disclose comprehensive information to insolvency professionals. If distress or low credit quality firms raise funds and unable to repay, creditors are legally safeguarded, enhancing their ability to recover debts. It will reduce the problem of adverse selection and fearful of legal liquidation, financially distressed

firms are incentivized to avoid excessive fund-raising and associated adverse behaviors, thus mitigating moral hazard. As bankruptcy will protect creditors and strengthen their rights, this confidence is likely to result in increased lending with reduced transaction costs.

The underlying objective of bankruptcy laws is to facilitate the seamless operation of credit markets while safeguarding the rights of both creditors and debtors within contractual agreements. An efficient bankruptcy regime will play a crucial role in curtailing financial frictions and enhancing firms' access to credit (Rodano et al., 2016), (Bose et al., 2021).

While providing firms access to credit in the lack of such reforms, creditors face adverse selection issues (See Akerlof (1978)) and moral hazard (See Zhang et al. (2016)) that may result in uncertainty in the recovery and liquidation of debt. The difficulties in resolving these distressed debts lead to unease and panic among creditors and lending organizations. They hesitate to provide firms with wide access to credit for their growth, and it causes a limited supply of credit in the market. If firms face such financial constraints in financing their investment, they will raise funds at a higher cost of borrowings. Firms paying higher interest expenses over their debt will likely fall in distress. Such distressed firms will borrow more in a credit market with limited credit supply, which will induce an adverse selection problem for creditors. More debt holding by these distressed firms will suppress the credit supply, creating a vicious loop of bad credit channels in the credit market.

La Porta et al. (1997) conducted research involving 49 countries and found that those with less effective bankruptcy reforms tend to have less developed equity or debt markets. Ayotte and Skeel Jr (2013) - Bankruptcy laws are warranted in resolving the issues related to excessive debt burdens and adverse selection, which can lead to liquidity challenges.

India has undergone several changes in its insolvency and bankruptcy laws to achieve this goal. The initial step was the introduction of the Companies Act 1956, primarily aimed at addressing the debtors' incapacity to meet their financial obligations. In 1985, the government of India enacted the Sick Industrial Companies Act (SICA) to identify financially distressed firms and to facilitate the release of locked-up investments for creditors by either reviving or liquidating such unviable firms. The principal factors contributing to its inefficacy were the absence of a time-constrained resolution mechanism and the prolonged moratorium protection. Recognizing the shortcomings of the Companies Act and the SICA reforms¹, India established the Debt Recovery Tribunal (DRT) in 1993. The DRT, operating as a court-based system, sought to expedite debt recovery processes while safeguarding the interests of financial institutions. In 2002, India implemented the Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest Act (SARFAESI) based on the recommendations of the Narasimhan Committee - II². SARFAESI empowered banks and financial institutions with extensive rights for loan recovery and collateral seizure, while eliminating the need for judicial intervention. SARFAESI demonstrated high debt recovery rates during its initial years of implementation. However, these rates gradually declined, resulting in stagnant resolutions of non-performing assets (see Reports on Trend and Progress of Banking in

¹See for details: (Sengupta et al., 2016)

²The expert committee under the chairmanship of M. Narasimham was set up in 1998 for banking sector reform. The committee recommended Asset Reconstruction Companies to resolve the problem of increasing non-performing assets of banks that hampers their profitability and productivity. These recommendations led to implementation of the SARFAESI Act in 2002, which focused to increase the rights of banks and financial institutions to recover their loans.

India, RBI).

Prior to 2016, the majority of reforms in India predominantly focused on safeguarding the interests of specific creditor groups, notably secured lenders and financial institutions. However, in 2016, India introduced a comprehensive bankruptcy reform known as the Insolvency and Bankruptcy Code³. This unified legal framework consolidated all previously existing firm insolvency and bankruptcy laws related to non-financial firms. The IBC, which aims to protect all stakeholders' rights, is designed to ensure speedy insolvency resolutions within the stipulated time. The exclusion of financial institutions from the IBC serves as a strategic preventive measure against the repercussions associated with the failure of 'Systematically Critical' financial entities, termed as 'Too Big to Fail.' This exclusion also focuses on securing the interests of depositors and averting a potential domino effect arising from the financial crisis that could adversely impact the economy. The banks and insurance companies should be excluded from general insolvency laws due to their critical roles in the economy, requiring specialized regulations (IMF⁴). Financial institutions and banks continue to use the SARFAESI to reclaim secured credit because there was no proposal to repeal it after the IBC regime. However, there are restrictions on the applicability of SARFAESI once insolvency resolution or liquidation under IBC starts.

In this paper, we investigate the impact of the Insolvency and Bankruptcy Code (IBC) on non-financial firms' access to credit in India. Specifically, we examine both the demand side and the credit supply side, where credit supply is defined as the aggregate quantity of funds borrowed by Indian firms. Our first research question is: What is the impact of the IBC on the credit supply? Our study defines credit supply as the ratio of total borrowings to total assets. We also use short-term and long-term borrowings as a proportion of total assets to measure short and long-run credit supply.

Additionally, we assess changes in the cost of credit resulting from variations in credit supply. Thus, our second research question is: What is the impact of the IBC on the cost of debt? We define the cost of credit as the ratio of total interest expense to total debt within a given year. By addressing these questions, we aim to provide a comprehensive analysis of how the IBC has influenced credit dynamics for non-financial firms in India.

We use annual standalone balance sheet data for all non-financial firms available in the CMIE⁵ ProwessIQ database from 2012 to 2022. Employing fixed-effects panel regression model, we provide empirical estimates to answer these questions related to costs and supply of credit. Further, we look at additional dimension of credit related to maturity composition and collateralized lending. We also incorporate firm-specific and macroeconomic covariates as control variables to alleviate heterogeneity among firms and buffer against economic disturbances.

Our findings shows that IBC has statistically significant and negative impact on the cost of debt. Our estimates indicate that average annual interest expenses of non-financial firms has come down from 9.7% to 8.3%, resulting in an overall reduction of 14.43%. Our findings also suggest that post-IBC, the total borrowings of Indian non-financial firms has gone up by 6.35%. We did not find a significant effect of IBC on short-term borrowings, however we do find statistically significant positive effect of IBC on the long-term borrowings (gone up by

³For details: [The Insolvency and Bankruptcy Code 2016](#)

⁴IMF, 1999, Orderly & Effective Insolvency Procedures

⁵Center for Monitoring Indian Economy

9.05%). For secured vs unsecured borrowings, we find statistically significant and positive impact of IBC on both. Our estimates suggest that the secured and unsecured borrowings has increased by 6.49% and 2.81%, respectively post IBC. Our findings align with the study by [Funchal \(2008\)](#), who found a reduction in the cost of credit and increased aggregate and long-term credit supply as the result of bankruptcy reform. However, our findings differ from the study by [Jose et al. \(2020\)](#), which reported a decline in total borrowings. Our findings on secured borrowings contradict the results reported by [Vig \(2013\)](#), who found a decrease of approximately 3% in secured borrowings following the implementation of SARFAESI.

In this paper, we also explore another critical question: Which types of firms are most affected by the implementation of the IBC, particularly in terms of the cost and supply of credit? Given the substantial impact of the IBC, we aim to identify which firms are more prone to its effects and which exhibit greater variation in cost and supply of credit in response to its implementation. To answer this question, we extend our analysis to understand the channels via which IBC impacts the credit supply. An extensive review of literature suggests three possible channels: (1) asset channel: firms with high tangible asset; (2) credit channel: with the advent of IBC, firms with high credit risk will face a lower cost of debt

In the cross-sectional variations, we comprehensively analyze the implications of the IBC on the cost and supply of credit for firms with different levels of collateral, liquidity, and credit risk. This analysis of interactive variables helps us understand how our variables of interests, cost, and supply of credit are influenced by IBC implementation for firms with different characteristics, specifically in terms of collateral, liquidity, and credit risk. Our estimates suggest no influence of IBC on the cost of debt for firms with varying levels of collateral and credit risk except liquidity, which has a significant effect at 10%. We found that IBC affects long-term and total borrowings negatively in the case of firms with collateral and liquidity. However, the IBC shows a positive impact on these two credit for firms with different levels of credit risk. We expect this analysis to offer valuable insights for policymakers and regulators, aiding in their understanding of how IBC influences credit dynamics within these firms.

The rest of the paper is organized as follows. Section 2 points out the facets of Indian bankruptcy laws focusing on the IBC, 2016. Section 3 provides the understanding of previous research on bankruptcy reforms in literature. In section 4, we discussed data, methodology, and event study, followed by results and discussion in section 5. We added our cross-sectional variation analysis in section 6. Lastly, we reported our conclusion of the study in section 8.

2 Institutional setup: Bankruptcy reforms in India

Resolving firms' insolvency has been challenging task for legislators in India. India has undergone several changes in its insolvency and bankruptcy laws. The origin can be traced to the introduction of the Companies Act 1956. It was only legal setup for functioning of a corporation in all aspects. The company act explains the circumstances for winding up a firm in chapter II (see for details: [Chapter II: Winding up by the court](#)). A firm is wound up by the court, if they found that firm is not viable, unable to repay or terminates its functioning for a year. The winding up decision of firm should be in the interests of creditors and the contributors of firms. The court appoints the official liquidators for firms' resolution and recover debt from firms' assets. This remained the solitary reform effort addressing firm insolvency until

1985. However, the Company Act 1956 does not have the bankruptcy or insolvency terms but winding up.

The origin can be traced to the introduction of the Companies Act 1956 - Part VIA: Revival and rehabilitation of sick industrial companies. [Part VII: Winding up - Chapter II: Winding up by the court - 434](#). Key feature of this act: (1) How you decide that a firm is sick? (2) How government is going to resolve this? A special tribunal was setup to address debtors incapacity to pay its debt.

SICA, 1985: In 1985, the government of India enacted the Sick Industrial Companies Act (SICA) to identify financially distressed firms and to facilitate the release of locked-up investments for creditors by either reviving or liquidating such unviable firms⁶. It was a debtors' friendly regime, which intended to revive sick firms restructuring their assets. Due to judicial complexities and limited sources, average time under SICA to close a case is 5.8 years ([Sengupta et al., 2016](#)).

DRT, 1993: The Company Act has no specification of bankruptcy or insolvency, and debt liquidation was processed through tribunals, while SICA focused on restructuring sick firms. All debt recovery cases underwent a complex and sluggish process under the tribunal or civil court-based systems ([Visaria, 2009](#)) and ([Vig, 2013](#)). Recognizing the shortcomings of the Companies Act and the SICA reforms, India established the Debt Recovery Tribunal (DRT) in 1993 under the Recovery of Debt Due to Bank and Financial Institutions (RDDBFI) Act. The law still exists and enables secured and unsecured creditor constrained to financial institutions to recover their debt. The DRT, operating as a court-based system, sought to expedite debt recovery processes while safeguarding the interests of banks and financial institutions.

Due to the lengthy and court-based procedures of the previous reforms, many cases were pending. In 2002, India experienced a major reform, Securitization and Reconstruction of Financial Assets and Enforcement of Security Interest (SARFAESI), that protects secured creditors. SARFAESI allows banks and financial institutions to recover their debt by acquiring or selling the collateral without judicial intervention. The absence of judicial intervention in its enforcement made SARFAESI different from previous reforms based on court systems. The reports on the trend and progress of banking in India show the high debt recovery rates through SARFAESI in its early years of enactment, which have been decreasing.

Previous reforms were limited to banks and financial institutions to secure and recover their debt. However, [Table 1](#) shows that these reforms performed well in early years but facing low recovery rate over the years. These reforms could not achieve their targets as regulators planned during implementation. The reasons were protracted pending cases in judicial courts, weak institutions, and the problem of parallel proceedings in multiple forums ([Ravi, 2015](#)).

To address this hurdle and provide security for all participants in the credit market, the Ministry of Finance (GoI) introduced a unified bankruptcy law - the "Insolvency and Bankruptcy Code 2016" (IBC). In contrast to prior reforms, the IBC applies to all non-financial firms, including proprietorships, partnerships, and limited liability firms. The primary objective of this comprehensive bankruptcy reform is to safeguard creditors' interests by efficiently resolving

⁶The SICA reform was enacted based on the Tiwari committee recommendation, which was appointed in 1981 to address the problem of industrial sickness.

Table 1 Recovery rates of DRTs and SARFAESI

Reforms	2008	2011	2013	2016
DRTs	51.9%	27.89%	14.0%	9.18%
SARFAESI	61%	37.78%	27.17%	16.45%

source: Reserve Bank of India

firms' insolvency and bankruptcy issues within a designated time frame. Precisely, the IBC aims to facilitate the liquidation of assets of insolvent companies and ensure the prompt recovery of creditors' funds, with a target of achieving this within one year from the time a firm files for insolvency under this bankruptcy code ⁷. Various studies and reports published by the RBI and IBBI have assessed the recovery outcomes of the IBC and other legal reforms over the period. According to a Reserve Bank of India report⁸, in the fiscal year 2021-2022, the recovery rate for non-performing assets (NPAs) was 23.8% for the Insolvency and Bankruptcy Code (IBC) and 22.5% for the SARFAESI Act.

Since previous reforms were not repealed after the introduction of IBC, cases are still being processed in these reforms. The IBC, a unified and comprehensive law, was enacted with key features that boost the creditors' confidence to lend. The IBC aims to resolve a distressed firm in a time-bound manner. The rapid recovery of debt benefits creditors from decreasing the value of assets due to depreciation. In the case of liquidation, insolvency professionals aim to maximize the value of assets, which is a key feature of IBC. It is also called the "collective creditors' regime," as a single creditor can not file for resolution of a distressed firm if the firm has borrowed from multiple creditors.

These vital features of IBC show creditors' protection and ease the liquidation process in case of firms' resolution. The implementation of IBC will support creditors in providing wide access to credit to all non-financial firms. If creditors are confident to increase their credit to non-financial firms, increased credit supply will lower the cost of debt.

3 Evidence from literature

The level of investor protection and the quality of legal institutions in India are deemed inadequate (Allen et al., 2012), signaling potential challenges and areas for improvement within the regulatory framework.

When firms seek credit for investment growth from a financial market, they face financial constraints that create barriers to accessing credit. These constraints, such as information asymmetry, transaction costs, etc., lead to increased interest rates and reduced credit supply. Regulators suggest legal rules and reforms in economies to reduce these constraints. Numerous studies have investigated the implementation of legal rights and bankruptcy reforms in various countries. These reforms are designed to enhance the functionality of credit markets by safeguarding the rights of market participants, thereby potentially improving access to credit and enhancing credit allocation efficiency.

⁷Before the 2019 amendment, the corporate insolvency and resolution process in India had a target completion period of 180 days

⁸<https://rbi.org.in/Scripts/PublicationsView.aspx?id=21578>

Bae and Goyal (2009) examined how various legal protections affected the size, maturity, and spread of loans in 48 different nations. The results suggest a reduction of 41 basis points in the loan spread when a borrower relocates from a nation with poor creditors' rights to one with strong creditors' rights. Creditors rights have insignificant effect on the size and maturity of loans. The size and maturity of loans were found insignificant in case of difference in creditors rights. When addressing the role of creditors in corporate governance, Gray (1997) explained that many companies might receive credit for restructuring during financial trouble at competitive interest rates from strong, market-oriented creditors. In developing and transitional economies, creditors may need legal rights and bankruptcy laws to fulfill this function. Gutiérrez et al. (2012), using the system GMM method, analyzed the effect of bankruptcy law on the value of distressed and healthy firms across Germany, Spain, the United States, France, and the United Kingdom. They found that creditor-oriented bankruptcy reforms led to a decrease in the value of distressed firms and those who have filed for bankruptcy, but it has no significant effect on healthy firms.

The Brazilian bankruptcy reform came into effect in 2005, which was creditors' friendly regime. The law empowered creditors enabling them for filing case out of court and increased their priority in liquidation. Comparing the effect of the new Brazilian bankruptcy reforms on Brazilian firms and its neighborhood countries firms, Araujo et al. (2012) found a positive impact on the creditors' willingness to lend and firms' access to finance. They reported an 8% reduction in the cost of debt and an increase of 10% and 23% in total debt and long-term debt. German Insolvency Law was introduced in 2011, which shifted power from shareholders to creditors to appoint insolvency professionals. Examining the effect of this creditor protection law on 284 German firms, Closset and Urban (2019) found that larger firms have reduced their financial leverage and face higher costs of debt than small firms. Closset et al. (2023), using difference-in-difference estimation, examined the effect of corporate restructure-oriented eight insolvency reforms in 15 European countries. They reported that reforms led to an increase of 50 basis points in firms' cost of debt, which resulted in a decline in total debt by 2.5%. Countries with strong legal rules and better quality of enforcement lead to an increase in external finance. Analyzing the legal rules across 49 countries, La Porta et al. (1997) found that legal rules strongly affect the size and breadth of capital markets. In a bank loan study, the strong creditors' rights protection increased the concentration of loan ownership and long-term credit while reducing the interest rate (Qian and Strahan, 2007).

Funchal (2008) examined the effect of Brazilian bankruptcy reform on the cost of debt and firms' borrowings using a panel regression with a fixed effect. He found that reform in 2005 increased the creditors' protection, leading to a reduction of 22% in the cost of debt and increasing the aggregate and long-term credit by 39% and 79%. Rodano et al. (2016) examined the effects of reorganization (strengthening debtors' rights) and liquidation (strengthening creditors' rights) reforms under the Italian Bankruptcy Reform 2006 on the cost of bank finance and firms investment. Their result shows that reorganization reform led to an increase in the cost of bank financing by 3% points and decreased firms' investment rates by an average of 2.5% points, while the liquidation reform improved the firms' investment by 0.08% points and reduced the cost of bank financing by 2% points. Timely resolution of distressed firms may boost investor confidence. Ponticelli and Alencar (2016) used the congestion of civil courts as a measure of bankruptcy case duration and found an inverse relationship between court congestion and firms' access to credit and investment. Their findings indicate

that investment as a percentage of total assets was 0.46% higher for firms in courts with less than 23.8% congestion.

[Visaria \(2009\)](#) examined the effect of DRTs in India on borrowers' repayment behavior, along with the effect on size and interest rates charged on new loans. Results suggest improved loan repayment behavior. The author found a negative relationship between interest rates and new loan issuance, where a 10 million rupees increase in loan size results in a reduction of 1.36% point in interest rate. Analyzing Debt Recovery Tribunals (DRTs), which resulted in a decrease in enforcement cost of debt, [Gopalan et al. \(2016\)](#) found that DRTs led to an increase in long-term debt as a portion of total assets by 11.9% and a decrease in short term debt as a portion of the total asset by 11.3%. Firms will borrow more from multiple short-term creditors to avoid court action in case of default. The competition among lender will lead to incentivize borrowers with negotiation power resulting reduction in the transaction cost.

India also experienced different bankruptcy reforms to ease the financial constraints for participants in the Indian credit market. Employing a difference-in-difference approach to estimate the effect of SARFAESI on the debt structure of firms, [Vig \(2013\)](#) found that firms have reduced leverage by 4.6%, secured debt by 5.2% and faced 0.6% lower cost of debt for secure debt after the implementation of SARFAESI. [Jose et al. \(2020\)](#) analyzed the effect of IBC on firms' borrowings and found that demand for total borrowings declined by 6.3% and a reduction of 3.5% in cost of borrowings. [Bose et al. \(2021\)](#) examined the effect of IBC on distressed and non-distressed Indian firms for 2008-2019. They found that firms' cost of debt is reduced by 0.8% and long-term and short-term debt increased by 6.3% & 1.4%, respectively. [Singh et al. \(2021\)](#) investigated the effect of IBC on firms' financing choices using multivariate regression analysis. They reported a decrease in the debt ratio and average leverage of firms after the IBC reform. [Ramesh and Ramesh \(2022\)](#) examined the effect of IBC on borrowing and investment decisions of non-financial firms based on promoter holdings. They found that high promoter holding firms reduced their debt dependence, which shows strengthening creditor rights, and they have a positive and significant effect on the cost of debt.

Our reading of the extent literature suggests that creditor friendly bankruptcy reforms that lower the transactions cost and resolve distressed firms within a short time has the potential to increase the credit supply and lower the cost of debt. However, we also observe that firms lower their leverage and use of collateral while accessing credit. In this paper, we test whether the market oriented creditor friendly IBC derived the intended benefit. We also extend the analysis by figuring the channels via which IBC influences the credit demand/supply.

4 Data and methodology

4.1 Data and descriptive statistics

We sourced standalone balance sheet data for all non-financial companies from the Center for Monitoring Indian Economy (CMIE) via ProwessDX as of March 2023. We had 5,39,687 firm-year observations for 45,705 firms, which were reduced to 5,39,678 for 45,609 firms after removing firms with missing zero or negative total assets and total liabilities. We eliminate the duplicate information of firms in the same year, which can affect our results. We merge the identity information of firms with their balance sheet information, which results in 5,16,758

firm-year observations for 45,228 firms. Our study analyzes only non-financial firms; thus, we removed all the financial and non-banking financial firms. After this, our dataset comprises 452,823 firm-year observations for 40,661 non-financial firms in India, spanning 1989 to 2022. Since we are concerned only with the effect of IBC, passed in May 2016, we consider our analysis period from 2012 to 2022. We remove our firm-year observations, which lie out of the period 2012-2022. Our final dataset is an unbalanced panel comprising 260,686 observations with 32,725 unique non-financial firms. The dataset comprises annual financial data, with units measured in millions.

We compiled macro-level data, including real gross domestic product (GDP) and inflation figures, from the Reserve Bank of India from 2012 to 2022. To mitigate the potential influence of extreme outliers on our results, we have winsorized all the variables used in our study, removing values beyond the 2.5% threshold.

Variable description

To calculate the cost of debt for non-financial firms, we assessed their total interest expense as a proportion of their total debt (Vig (2013), Bose et al. (2021)). To evaluate credit availability among firms, we considered various measures, including total, long-term, and short-term borrowings, in relation to their total assets. We also examined secured and unsecured borrowings as percentages of firms' total assets. Incorporating control variables into our analysis, we consider collateral, defined as the ratio of net fixed assets to total assets (Rajan and Zingales (1995), Vig (2013)) and liquidity, characterized as the difference between current assets and current liabilities relative to total assets. Additionally, we account for firms' size measured as the natural logarithm of total assets and age measured as years since incorporation year. We also account for macroeconomic variables, specifically GDP growth and inflation. These variables are derived by assessing the annual fluctuations in real GDP and the Consumer Price Index, utilizing data from the RBI database.

Table 2 reports the summary statistics of all our variables. This table helps us understand the features of our variables in the sample period. All the borrowings are represented as the ratio to firms' total assets. The unit of GDP growth and inflation are in percentage.

In the dataset comprising 120,438 observations, non-financial firms exhibit an average borrowing cost of 0.097 (9.7%) from 2012 to 2022, with a modest standard deviation of 0.061, indicating moderate variability. The cost of debt ranges from a minimum of 0.2% to a maximum of 47.4%, portraying the spectrum of borrowing costs among these firms. The mean of total borrowings shows that firms borrowed 37.8% on average of their total assets. The high standard deviation (0.231) shows large heterogeneity in total borrowings by firms, where minimum ratio of total borrowings to total assets is 0.016 and maximum is 1.245. Firms use average long-term and short-term borrowings with 24.3% and 21.5%, respectively. Both borrowings show large deviation to their average borrowings. Firms use more SB/TA on average (26.2%) than average USB/TA (24.9%). USB/TA are highly dispersed indicating standard deviation 0.337, which is higher than standard deviation (0.198) of SB/TA.

The average net fixed assets to total assets ratio for all firms in our study is 26.3%, with a deviation of 0.23 indicating spread of firms' collateral around its mean. The maximum collateral (0.915) for 1,97,252 observations shows the firms' reliance on net fixed assets in their total assets in borrowings. Average liquidity of firms is 14.9% with high spread of 0.315.

Table 2 Summary statistics

Note: The table presents the summary statistics of all the variables. The variables represent annual financial data for the period from 2012 to 2022, measured in millions. Cost of debt is measured as the ratio of total interest expense to total debt. TB/TA refers to the ratio of total borrowings to total assets. LTB/TA refers to the ratio of long-term borrowings to total assets. STB/TA refers to the ratio of short-term borrowings to total assets. SB/TA refers to the ratio of secured borrowings to total assets and USB/TA shows the ratio of unsecured borrowings to total assets. Collateral are measured as the ratio of net fixed assets to total assets. LQ/TA are measured as the difference between current assets and current liabilities over total assets. Size is measured as the natural log of total asset of firms. Age number is measured as difference between current year and incorporation year. Annual GDP growth shows the change in real GDP which is adjusted with inflation and inflation refers to change in Consumer Price Index over the period.

Variables	Description	Mean	SD	Min	Max	Observation	Unit
Cost of debt	Ratio of total expense to total debt	0.097	0.061	0.002	0.474	120438	in %
TB/TA	Ratio of total borrowings to total assets	0.378	0.231	0.016	1.245	120234	Ratio
LTB/TA	Ratio of long-term borrowings to total assets	0.243	0.271	0.000	1.581	152468	Ratio
STB/TA	Ratio of short-term borrowings to total assets	0.215	0.212	0.001	1.145	146630	Ratio
SB/TA	Ratio of secured borrowings to total assets	0.262	0.198	0.002	0.920	148569	Ratio
USB/TA	Ratio of unsecured borrowings to total assets	0.249	0.337	0.001	2.378	135216	Ratio
Collateral	Ratio of net fixed assets to total assets	0.263	0.230	0.000	0.915	197252	Ratio
LQ/TA	Difference between current asset and current liabilities over total assets	0.149	0.315	0.000	0.826	217794	Ratio
Size	Natural log of total assets	5.965	2.208	-0.511	10.645	64326	-
Age	Number of years since incorporation	20.02	12.85	2.000	69.00	68	Year
GDP growth	Real GDP growth rate (Annually)	5.508	3.896	-5.831	9.050	11	in %
Inflation	Change in Consumer Price Index (Annually)	6.061	2.145	2.491	10.908	11	in %

The maximum LQ/TA (0.826) shows cash-rich firms in the datasets. The average size of firms is 5.965, which has standard deviation of 2.208. The largest size of firms is 10.645 and the lowest is -0.511. The average age of firms is 20 years and the youngest firm is 2 year old while oldest one is 69 years old. The spread around firms' average age is 12.85 years. Average real GDP growth in this study is 5.508% with an high dispersion of 3.896 while average inflation is 6.061 with an SD of 2.145. The maximum inflation in this sample period is 10.908 and minimum 2.491.

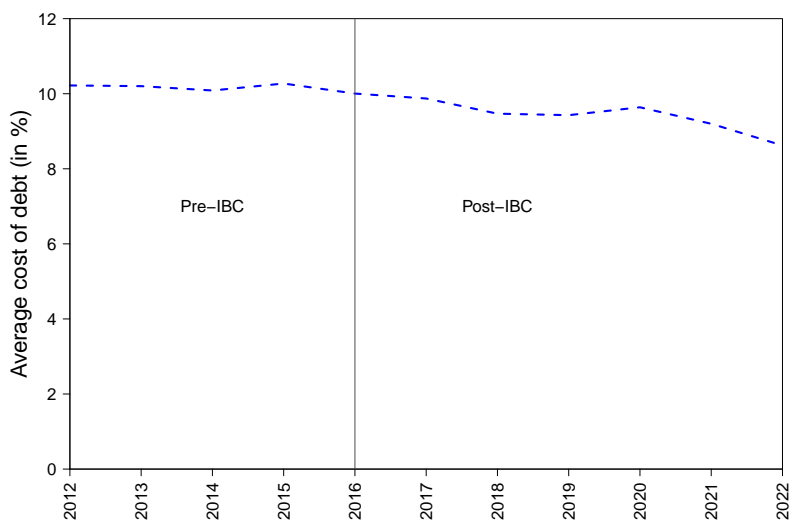
4.2 Event study

Figure 1 provides a visual account of how IBC affects the cost of debt and credit supply for non-financial firms. We employ an event study framework to understand the impact of the IBC on the cost of debt and credit supply in pre- and post-IBC periods. The event, IBC 2016, is denoted by the vertical line on the x-axis (years). Both figures 1 (a) and 1 (b) exhibit the pattern of cost of debt and credit supply for non-financial firms in the presence and absence of IBC. Figure 1 (a) illustrates the shift in the cost of debt pattern, showing a decline following the implementation of IBC 2016. This trend continues in the subsequent period. Figure 1 (b) provides a visual representation of changes in total, short-term, and long-term borrowings following the event (IBC, 2016). It displays a gradual decrease in all types of borrowings. However, we do not observe much variation in short-term borrowings over the period.

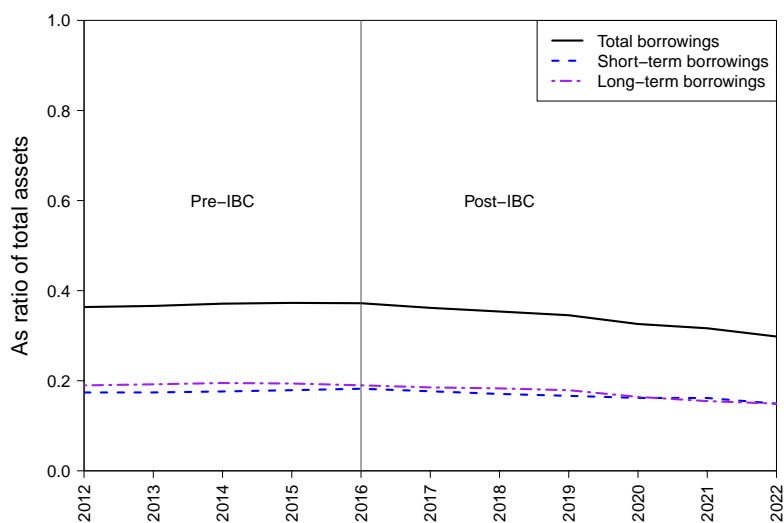
To determine whether there are significant differences in our variable means between the pre-IBC and post-IBC groups, we apply a statistical t-test. The statistical results of the t-test

Figure 1 Evolution of cost of debt and credit supply: 2012 to 2022

Note: Figure 1(a) depicts the cost of debt (%), computed as the ratio of total interest expenses to total debt, for all non-financial firms spanning from 2012 to 2022. Concurrently, Figure 1(b) exhibits the ratios of total, long-term, and short-term borrowings to total assets for non-financial firms over the same period. The vertical line denotes the implementation of IBC in 2016.



(a) Average cost of debt



(b) Credit supply (as ratio of total assets)

for our variables of interest are presented in Table 3. Column (IBC = 0) shows the mean value of variables for the pre-IBC period (2012-2016), while column (IBC = 1) reports the mean value of variables for the post-IBC period (2017-2022). The change and change in percentage (%) reveal the fall or rise in the variables of interest after the implementation of IBC. The Table 3 reports p-value in the last column to analyze the significance of mean difference of all variables for non-financial firms. There are 1,13,516 firm-year observations in the pre-IBC period and 1,47,170 observations in post-IBC period.

The findings indicate a significant difference in the means of our variables between both pre and post IBC period except the USB/TA. Table 3 reports a significant reduction of 6.93% in the average cost of debt for non-financial firms in post-IBC period. The average credit supply in terms of TB/TA also decreased by 8.31% post-IBC regime. On an average, results shows that firms have reduced their total borrowings after the introduction of creditors' regime. Average value of LTB/TA and STB/TA shows that non-financial firms experienced the reduction of 7.48% and 9.65% in the ratio of long-term and short-term borrowings to total assets, respectively, in post-IBC period. The average SB/TA decreased by 11.43% post-IBC regime, while mean difference for USB/TA was found insignificant.

Thus, the statistical output in Table 3 suggests that firms reduced their interest burden, indicating a reduction in the cost of debt post-IBC reform. The event study table also highlights the average disparities in all borrowing-related variables, where firms have reduced all their borrowings (TB/TA, LTB/TA, STB/TA, and SB/TA except USB/TA) after the IBC regime.

Table 3 Event study

Note: The table shows the t test results for our variables of interests. The cost of debt is measured as the ratio of total interest expenses to total debt of firms. TB/TA are represented as the ratio of total borrowings to total assets. LTB/TA are represented as the ratio of long term borrowings to total assets. STB/TA are represented as the ratio of short term borrowings to total assets. SB/TA refers to the ratio of secured borrowings to total assets and USB/TA shows the ratio of unsecured borrowings to total assets. The p value <0.01 shows significant difference in both sample (i.e. IBC = 0 and IBC = 1).

Variables	IBC = 0	IBC = 1	Change	Change in %	p-value
Cost of debt	0.101 (0.06)	0.094 (0.06)	-0.007	6.93	0.000
TB/TA	0.397 (0.22)	0.364 (0.24)	-0.033	8.31	0.000
LTB/TA	0.254 (0.27)	0.235 (0.27)	-0.019	7.48	0.000
STB/TA	0.228 (0.21)	0.206 (0.21)	-0.022	9.65	0.000
SB/TA	0.280 (0.20)	0.248 (0.20)	-0.032	11.43	0.000
USB/TA	0.249 (0.33)	0.250 (0.34)	0.001	0.40	0.343
Observation	1,13,516	1,47,170			(0,1)

4.3 Methodology: Regression specification

We employ a fixed effect regression model with our panel dataset to assess how the IBC reform has influenced the cost and availability of credit for non-financial firms. The fixed effect model provides a mechanism for mitigating the influence of time-invariant unobservable individual characteristics that may exhibit correlations with the observed independent variables. To assess the impact of IBC, we define a binary dummy variable, IBC , which takes value 0 in the pre-IBC period (2012-2016) and 1 in the post-IBC period (2017-2022). Following Funchal (2008), we estimate the baseline model as:

$$Y_{it} = \alpha_i + \delta_i + \beta_1(IBC_t) + \beta_2 IBC_t * Assets_{it} + \gamma_1 X_{it} + \epsilon_{it} \quad (1)$$

Where i and t represent firm and time, respectively, the dependent variables, denoted as Y_{it} , encompass dependent variables such as the cost of debt, long-term and short-term borrowings, total borrowings, and secured & unsecured borrowings as a ratio to total assets. Our primary independent variable, IBC_t , is a time dummy that takes value 1 for years 2017-2022

and 0 otherwise. We introduce the α_i and δ_i to account for unobservable firm-specific and industry-specific characteristics, respectively, that are time-invariant.

Additionally, we incorporate an interaction variable, $IBC_t * Assets_{it}$, which considers the interplay between IBC and firm size, as firm size can potentially influence our dependent variables differently across various-sized firms. Our model, denoted by X_{it} , encompasses all firm-specific and macroeconomic variables that are pertinent to our analysis.

To analyze the cross-sectional variations after the implementation of IBC, we added an interactive variable in the equation 1. For asset channel, we added an interaction term of IBC and collateral to examine the variations in non-financial firms with varying level of collateral after the implementation of IBC. Equation 2 follows as:

$$Y_{it} = \alpha_i + \delta_i + \beta_1(IBC_t) + \beta_2IBC_t * Assets_{it} + \gamma_1X_{it} + \beta_3IBC_t * Collatrtal + \epsilon_{it} \quad (2)$$

The equation 3 is presented for the second channel i.e. the liquidity channel:

$$Y_{it} = \alpha_i + \delta_i + \beta_1(IBC_t) + \beta_2IBC_t * Assets_{it} + \gamma_1X_{it} + \beta_3IBC_t * Liquidity + \epsilon_{it} \quad (3)$$

Finally, the equation 4 is presented for the third channel i.e. the credit risk channel:

$$Y_{it} = \alpha_i + \delta_i + \beta_1(IBC_t) + \beta_2IBC_t * Assets_{it} + \gamma_1X_{it} + \beta_3IBC_t * Z_score + \epsilon_{it} \quad (4)$$

We incorporate firm-specific variables such as collateral, liquidity, size, and age (Bose et al. (2021)) alongside macroeconomic variables, including real GDP growth and inflation. As the bankruptcy reform has significant effects on firms with high tangible assets, we utilize collateral as a proxy for the tangible assets of the firms to account for the heterogeneity with tangible assets (Vig (2013)). Including liquidity in our analysis addresses potential distortions arising from high volatility in firms' liquidity. Firms with high liquidity are less likely to default, while those with low liquidity are at higher risk. Additionally, we introduce size and age as control variables to account for the influence of firm heterogeneity, specifically concerning larger and more established firms, on our research outcomes. The study includes the real GDP growth rate, which can indirectly reflect the overall economic adjustments and changes in consumer behavior resulting from Goods and Services Tax implementation⁹. We use inflation to assess the impact of demonetization in India because it can be influenced by the demand and supply shocks caused by demonetization¹⁰. However, the aggregate statistics

⁹The Kelkar task force recommended the idea of GST, a unified tax system, in 2000 to replace the existing intricate and fragmented tax structure. The Indian parliament enacted Goods and Services Tax (GST) on July 1, 2017, replacing multiple indirect taxes levied by the Central and State Governments. Goods and services are classified into various GST tax slabs, including 5%, 12%, 18%, and 28%. A dual structure underpins the GST, with the Central government imposing the Central GST (CGST) and the State governments imposing the State GST (SGST) simultaneously. The central government also collects integrated GST (IGST) levied on interstate supplies and imports.

¹⁰Demonetization refers to the withdrawal of currencies in a nation by its central bank to be used as legal tender. On November 8, 2016, the Indian government declared the demonetization of all Rs. 500 and Rs. 1,000

show the minimum effect of demonetization, and the cost of demonetization was temporary, which lasted two quarters (Lahiri, 2020). To address the diversity of industries in our findings, we introduce an industry dummy variable as a control in our analysis. Table 4 summarizes our independent variables and their expected association with cost and supply of credit.

Table 4 Variables' description

Note: The table displays the description of all variables and their sources. It also suggests the expected direction of variation of mentioned variables with cost and supply of credit. Bankruptcy law represents IBC 2016, our binary independent variable, which takes 1 for post-IBC period and 0 otherwise. Collateral are measured as the ratio of net fixed assets to total assets. LQ/TA are measured as the difference between current assets and current liabilities over total assets. Size is measured as the natural log of total asset of firms. Age number is measured as difference between current year and incorporation year. Annual GDP growth shows the change in real GDP which is adjusted with inflation and inflation refers to change in consumer price index over the period.

Variables	Description	Source	Expected variation with cost of debt	Expected variation with total borrowings	Expected variation with secured borrowings	Reference
IBC	Time dummy (IBC = 1 for years 2017-2022, 0 otherwise)		(-)	(+)	(+)	Jose et al. (2020), Funchal (2008)
Collateral	Ratio of net fixed assets to total assets	CMIE	(-)	(+)	(+)	Bose et al. (2021), Singh et al. (2023)
LQ/TA	Difference between current assets and current liabilities over total assets	CMIE	(-)	(+)	(+)	Jose et al. (2020), Bose et al. (2021), Singh et al. (2023)
Size	Natural log of total assets	CMIE	(U)	(U)	(+)	Jose et al. (2020), Bose et al. (2021), Singh et al. (2023)
Age	The number of years since incorporation	CMIE	(U)	(-)	(U)	Bose et al. (2021), Singh et al. (2023)
GDP growth	Change in real GDP over period	RBI	(U)	(+)	(U)	Jose et al. (2020)
Inflation	Change in consumer price index	RBI	(U)	(U)	(U)	

Note: "U" refers to ambiguous sign. Source: Author's work

5 Results

This section presents the results obtained through a fixed-effect model, focusing on the impact of the implementation of the IBC on the cost and accessibility of credit for non-financial firms. To ensure the robustness of our analysis, we incorporate both firm-specific and macroeconomic control variables, addressing potential unobservable factors that might influence our dependent variables¹¹.

banknotes from the Mahatma Gandhi Series to cut down the shadow economy and promote cashless transactions. It resulted in 86% of the Indian currencies in circulation being demonetized. The RBI declared a successful return of more than 99% of the demonetized currency through commercial banks. See for more details: Lahiri (2020)

¹¹All variables have been adjusted by trimming 2.5% of the extreme values from both the upper and lower ends to mitigate outlier-related issues.

5.1 The cost of debt

Table 5 shows that the coefficient¹² for bankruptcy law is negative and statistically significant at the 1% level. The average annual interest expenses of non-financial firms has come down from 9.7% to 8.3%, resulting in an overall reduction of 14.43% after the implementation. This reduction in interest expenses relative to total debt suggests improved credit accessibility for firms, which can be attributed to the positive impact of the IBC reform.

Table 5 Panel fixed effect model: Impact of IBC on the cost of debt

Note: The table shows results from the panel fixed effect model with firm, year, and industry fixed effects. The dependent variable, the cost of debt, is the ratio of total interest expenses to total debt. Our independent variable, IBC, is a binary dummy that takes 1 for post-IBC (2017-2022) observations and 0 otherwise. Our control variable, collateral, is the ratio of net fixed assets to total assets, while liquidity is the difference of current assets minus current liabilities over total assets. We calculate firm-specific variables size and age as a natural log of total assets and the years since incorporation. GDP growth is measured as the annual percentage change in real GDP, while inflation shows the annual percentage change in the consumer price index.

	<i>Dependent variable: Cost of debt</i>		
	(1)	(2)	(3)
IBC	-0.006*** (0.0003)	-0.014*** (0.001)	-0.014*** (0.001)
IBC*Size		0.002*** (0.0001)	0.002*** (0.0001)
Collateral		0.025*** (0.002)	0.025*** (0.002)
Liquidity		0.018*** (0.001)	0.019*** (0.001)
Size		-0.008*** (0.0004)	-0.008*** (0.0004)
Age		-0.001*** (0.0001)	-0.001*** (0.0001)
GDP growth (real)			-0.0001** (0.00004)
Inflation			-0.001*** (0.0001)
Firm FE		Yes	Yes
Industry FE		Yes	Yes
Observations	146,020	146,020	146,020
R ²	0.004	0.013	0.014
Adjusted R ²	-0.180	-0.170	-0.169

Note: *p<0.1; **p<0.05; ***p<0.01

These findings are consistent with prior research by [Jose et al. \(2020\)](#) and [Bose et al. \(2021\)](#). Furthermore, firm size also has a negative impact on the average cost of debt, decreasing it by 0.8%, with statistical significance at the 1% level. However, the interaction term 'bankruptcy law and size of firms' has a positive and statistically significant coefficient of 0.20% at the 1% significance level. It implies that larger firms compared to small firms experienced increased cost of debt post-IBC. The positive and significant coefficients for collateral (2.5%) and liquidity (1.9%) indicate that the cost of debt rises for firms with higher tangible assets and liquidity, respectively. Conversely, the negative coefficient for age suggests that larger firms

¹²Standard errors are shown in parenthesis.

experienced a decrease in their cost of debt. GDP growth and inflation are significant, with a negative and low impact on the cost of debt.

5.2 Credit supply: Long-term, short-term, and total borrowings

We report the impact of IBC on firms' borrowings, which reflects the aggregate credit supply for non-financial firms in Table 6. The coefficient of the bankruptcy law, which is statistically significant at the 1% level, indicates a positive influence on total and long-term borrowings to total assets, resulting in a rise of 6.35% and 9.05%, respectively. Post-IBC, this suggests increased creditors' confidence in providing credit access to firms while strengthening creditors' rights. The increased total and long-term borrowings to total assets imply reduced financial constraints and improved credit channels for non-financial firms to access credit for investment growth. This finding contradicts the research by [Jose et al. \(2020\)](#), which reported a decrease in long-term borrowings but aligns with the findings of [Funchal \(2008\)](#) who found an increase in aggregate credit supply for firms after the implementation of Brazilian bankruptcy reforms in 2005. Our findings highlight that IBC does not demonstrate any significant impact on short-term borrowings to total assets. Firms prefer to utilize long-term borrowings rather than short-term borrowings post-IBC.

Collateral has a statistically significant and positive impact, leading to an increase of, on average, 20.8% long-term borrowings and 6.2% in total borrowings to total assets. IBC aims to recover the debt liquidating the collateral of a distressed firms to protect creditors. Creditors may use collateral minimizing their risk and may ease their lending to non-financial firms after IBC regime. Our long-term borrowings to total assets results align with [Bose et al. \(2021\)](#). It suggests that firms with more tangible assets can access more credit. The negative but significant coefficient for liquidity indicates a reduction of 15% in total borrowings to total assets; on the other hand, it has a significant and positive impact of 15.9% on long-term borrowings to total assets. In other words, firms with higher liquidity, often called "cash-rich" firms, have increased their access to long-term borrowings but reduced access to total borrowings. Collateral and liquidity have significant but negative impacts of, on average, 15.4% and 30.6%, respectively, on the short-term borrowings to total assets.

Our firm-specific variables' size and age are statistically significant at 1%, having a negative impact on credit supply. It shows that larger and older non-financial firms reduced their access to credit. The maturity stage of these firms can be a possible reason for reducing borrowings. Our interaction variables IBC and Size are statistically significant at 1% for long-term and total borrowings to total assets but at 10% for short-term borrowings to total assets. After implementing the IBC, the overall credit supply for larger and older firms has experienced a decrease of 0.4% in long-term and short-term borrowings to total assets and 0.5% in total borrowings to total assets. However, when considering macroeconomic control variables, we found that inflation has a negative impact of 0.1% on all credit supply measures, which is statistically significant at 1%. The real GDP growth has minimal adverse impact (0.03%) on long-term borrowings to total assets while minimal positive impact (0.04%) on short-term borrowings to total assets. It does not show any significant effect on total borrowings to total assets.

Table 6: Panel fixed effect model: Impact of IBC on credit supply

Note: The table shows results from the panel fixed effect model with firm, year, and industry fixed effects. The dependent variables, Long-term, short-term, and total borrowings, are denoted as proportion of total assets. Our independent variable, IBC, is a binary dummy that takes 1 for post-IBC (2017-2022) observations and 0 otherwise. Our control variable, collateral, is the ratio of net fixed assets to total assets, while liquidity is the difference of current assets minus current liabilities over total assets. We calculate firm-specific variables size and age as a natural log of total assets and the years since incorporation. GDP growth is measured as the annual percentage change in real GDP, while inflation shows the annual percentage change in the consumer price index.

	<i>Dependent variables: Credit supply</i>								
	Long-term borrowings			Short-term borrowings			Total borrowings		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IBC	-0.017*** (0.001)	0.022*** (0.002)	0.022*** (0.002)	-0.017*** (0.001)	0.002 (0.002)	0.001 (0.002)	-0.033*** (0.001)	0.026*** (0.003)	0.024*** (0.003)
IBC*Size		-0.004*** (0.0003)	-0.004*** (0.0003)		-0.004* (0.0002)	-0.0004* (0.0002)		-0.005*** (0.0004)	-0.005*** (0.0004)
Collateral		0.209*** (0.003)	0.208*** (0.003)		-0.155*** (0.003)	-0.154*** (0.003)		0.063*** (0.004)	0.062*** (0.004)
Liquidity		0.159*** (0.002)	0.159*** (0.002)		-0.306*** (0.002)	-0.306*** (0.002)		-0.150*** (0.003)	-0.150*** (0.003)
Size		-0.009*** (0.001)	-0.009*** (0.001)		-0.009*** (0.001)	-0.009*** (0.001)		-0.005*** (0.001)	-0.004*** (0.001)
Age		-0.002*** (0.0002)	-0.002*** (0.0002)		-0.001*** (0.0002)	-0.001*** (0.0002)		-0.004*** (0.0002)	-0.004*** (0.0002)
GDP growth (real)			-0.0003*** (0.0001)		0.0004*** (0.0001)	0.0004*** (0.0001)		0.00002 (0.0001)	0.00002 (0.0001)
Inflation			-0.001*** (0.0002)		-0.001*** (0.0001)	-0.001*** (0.0001)		-0.001*** (0.0002)	-0.001*** (0.0002)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	140,423	140,423	140,423	134,856	134,856	134,856	111,846	111,846	111,846
R ²	0.006	0.068	0.069	0.009	0.222	0.222	0.021	0.067	0.067
Adjusted R ²	-0.182	-0.108	-0.108	-0.184	0.070	0.070	-0.181	-0.126	-0.125

Note: * p<0.1; ** p<0.05; *** p<0.01

5.3 Credit supply: Secured and unsecured borrowings

In Table 7, we present the impact of the IBC on secured versus unsecured borrowings to total assets. The results reveal a positive and statistically significant coefficient for the IBC, leading to a significant, on average, 1.7% and 0.7% increase in secured and unsecured borrowings to total assets, respectively. Thus, average secured borrowings to total assets increased by 6.49%, while average unsecured borrowings to total assets increased by 2.81%. The earlier reform, SARFAESI, decreased secured debt according to Vig (2013), whereas our study indicates a positive effect of the IBC reform on secured borrowings.

Table 7 Panel fixed effect model: Impact of IBC on secured vs unsecured borrowings

Note: The table shows results from the panel fixed effect model with firm, year, and industry fixed effects. The dependent variables, secured and unsecured borrowings, are denoted as the proportion of total assets. Our independent variable, IBC, is a binary dummy that takes 1 for post-IBC (2017-2022) observations and 0 otherwise. Our control variable, collateral, is the ratio of net fixed assets to total assets, while liquidity is the difference of current assets minus current liabilities over total assets. We calculate firm-specific variables size and age as a natural log of total assets and the years since incorporation. GDP growth is measured as the annual percentage change in real GDP, while inflation shows the annual percentage change in the consumer price index.

	<i>Dependent variable: Credit supply</i>					
	Secured borrowings			Unsecured borrowings		
	(1)	(2)	(3)	(4)	(5)	(6)
IBC	-0.031*** (0.001)	0.018*** (0.002)	0.017*** (0.002)	0.0004 (0.001)	0.007*** (0.003)	0.007*** (0.003)
IBC*Size		-0.004*** (0.0003)	-0.004*** (0.0003)		-0.001*** (0.0003)	-0.001*** (0.0003)
Collateral		0.077*** (0.003)	0.077*** (0.003)		0.012*** (0.004)	0.012*** (0.004)
Liquidity		-0.122*** (0.002)	-0.122*** (0.002)		-0.071*** (0.002)	-0.071*** (0.002)
Size		0.027*** (0.001)	0.027*** (0.001)		-0.047*** (0.001)	-0.046*** (0.001)
Age		-0.005*** (0.0002)	-0.006*** (0.0002)		0.004*** (0.0002)	0.004*** (0.0002)
GDP growth (real)			0.00001 (0.0001)			-0.0002** (0.0001)
Inflation			-0.001*** (0.0001)			-0.0003* (0.0002)
Firm FE		Yes	Yes		Yes	Yes
Industry FE		Yes	Yes		Yes	Yes
Observations	140,380	140,380	140,380	121,070	121,070	121,070
R ²	0.022	0.071	0.071	0.00000	0.038	0.038
Adjusted R ²	-0.159	-0.101	-0.101	-0.218	-0.172	-0.172
<i>Note:</i>					*p<0.1; **p<0.05; ***p<0.01	

Larger firms benefit from a 2.1% increase in secured borrowings, as indicated by the significant size coefficient, and younger firms also enjoy enhanced access to secured borrowings. The IBC positively influences secured borrowings to total assets but has a reduced impact on larger firms. In contrast, smaller firms may experience more pronounced benefits from the IBC regarding secured borrowings. Collateral positively influences secured and unsecured borrowings to total assets, contributing to a rise of 7.7% and 1.2%, respectively, while liquidity has a negative impact, leading to a 12.2% decrease in secured and 7.1% in unsecured

borrowings. Results show that firms with higher tangible assets have improved their access to secured and unsecured credit, whereas those with higher liquidity face restrictions. Results suggest that one unit change in firms' size leads to a 2.7% increase in secured borrowings while a 4.6% decrease in unsecured borrowings. We found a reduction of 0.5% in secured borrowings for older firms, while younger firms enjoyed a 0.4% increase in unsecured borrowings o total assets. The negative but significant coefficient for the interaction variable (IBC and Size) suggests that the IBC can provide more significant benefits to smaller firms regarding these credits than larger ones. The GDP exhibits no noteworthy influence on secured borrowings to total assets but minimal impact on unsecured borrowings to total assets at a 5% significance level. Inflation also has a minimal but negative relation with secured and unsecured borrowings to total assets.

Thus, the analysis has focused on evaluating how the IBC (2016) has affected the cost of debt and credit supply (Long-term, short-term, and total borrowings) along with secured and unsecured borrowings. For a comprehensive analysis, we have included several control variables to account for firm-specific variations and the impact of macroeconomic fluctuations. The findings reveal that the implementation of the IBC has lowered the cost of debt and boosted credit supply for all non-financial firms, with the exception being short-term credit.

6 IBC impact: Cross-sectional variations

Financing pattern in a market varies across the firm heterogeneity. Firms with different level of tangible assets, risk and liquidity will raise funds disproportionately as creditors observe these features as financial health or borrowings capacity of firms before providing credit access. A firm with high tangible assets can borrow more using these assets as collateral. High credit risk firms may struggle to raise funds compared to low credit risk. Therefore, we expect differential impact of IBC on firms given the differences in tangible assets, liquidity needs, credit risk.

Interaction terms enable the model to account for firms' heterogeneity in the dataset. Firms heterogeneity in tangible assets, credit risk, and liquidity may exhibit varying relationships between the variables, and interaction terms help differentiate these effects. We introduced interactions between these variables and the IBC for a comprehensive and policy-oriented analysis. This approach allowed us to uncover how the IBC affects firms with varying collateral, liquidity, and credit risk levels. Our regression specification to analyze these interaction terms effect is following:

$$Y_{it} = \alpha_i + \delta_i + \beta_1(IBC_t) + \beta_2 IBC_t * Assets_{it} + \gamma_1 X_{it} + \beta_3 IBC_t * Z_{it} + \epsilon_{it}$$

We added the interaction variables in our regression equation 1, which exhibit the effect of IBC on cost and supply of credit with Z_{it} . Here, Z_{it} shows the varying level of tangible assets, liquidity, and credit risk.

We expect IBC has differential impact on firms' heterogeneity. By delving into these dynamics, we aimed to understand how bankruptcy laws impact firms in diverse financial conditions and under various circumstances, thus providing valuable insights for policymakers and stakeholders.

6.1 The asset channel

The assets channel shows how firms with tangible assets are raising funds. Firms with high tangible assets have more borrowing capacity because these tangible assets are used as collateral. Collateral minimizes creditors' risk as they can liquidate these collateral if firms are unable to repay their debt. IBC has increased creditors rights easing access to collateral in case of default. On the other hand, firms can negotiate to decrease interest burden, lowering down the fear of liquidation. Collateral boosts firms' borrowings while creditors may increase lending with collateral as secured by IBC regime. However, firms with high collateral may avoid borrowings in fear of loosing their collateral in case of distress and can move to unsecured borrowings. Hence, we introduce an additional inquiry to explore whether the influence of IBC is contingent on varying levels of collateral, alongside the targeted dependent variables in our study.

The IBC has eased the creditors' access to collateral in case of firms' default. It targets to recover the debt rapidly, which will increase the value of collateral. We expect that creditors will lend more to firms with high collateral. Increased credit supply may lower down the cost of debt. We also expect that high collateral firms may reduce their secured borrowings due to fear of liquidation, and move to other source of financing like unsecured borrowings. As unsecured creditors can also file in IBC, it will increase unsecured credit supply, which will lower down the cost of debt.

We observe assets channel using collateral as a ratio of firms' net fixed assets to total assets. We create an interaction term with the interplay of collateral and IBC to examine how IBC affects cost and supply of credit for firms with varying level of collateral. We include this interaction variable in our baseline equation and create a new equation (see in section 6). We regress the interaction of IBC and collateral on the cost and supply of credit for non-financial firms. We interpret the joint effect of our interaction variable how IBC affects the cost of debt and credit supply of firms with different level of collateral.

Collateral plays a vital role for creditors while lending firms. Debt backed by collateral is secured debt. If firms cannot repay or fall distressed, creditors will move to collateral and liquidate it to secure their debt. Bankruptcy reforms like IBC target to resolve the firms in distress or default and protect creditors recovering the debt by liquidating the collateral and other assets of firms. Analyzing the SARFAESI reform, [Vig \(2013\)](#) found a reduction of 3.2% in secured debt as a fraction of total debt for high tangible assets firms.¹³ [Van Doornik et al. \(2015\)](#) reported the positive effect of Brazilian bankruptcy law 2005 on highly liquid collateral and an increase of 13% in secured debt. The IBC has a positive impact on the secured debt for credit-constrained firms ([Singh et al., 2023](#)).

The impact of IBC on firms with varying levels of collateral is detailed in [Table 8](#). The interaction of IBC and collateral is insignificant, which shows no effect on the cost of debt for non-financial firms. It implies that IBC does not influence firms' borrowing costs with differing collateral levels. Post IBC, we find that creditors have no response to change in interest rate for firms with collateral. However, IBC, standalone, has a statistically significant negative impact on the cost of debt with average amount of 14.43%, while collateral independently has a significant positive impact, leading to an average 28.6% increase in the cost of debt.¹⁴

¹³Tangible assets are used as collateral for secured loans.

¹⁴We calculate the change percentage from change in average amount of variable.

Table 8 Panel fixed effect model: The asset channel and IBC

Note: The table shows results from the panel fixed effect model with firm, year, and industry fixed effects. The dependent variable, the cost of debt, is the ratio of total interest expenses to total debt. LTB/TA, STB/TA, and TB/TA show the long-term, short-term, and total borrowings as a proportion of total assets. SB/TA and USB/TA refer to the ratio of secured and unsecured borrowings to total assets. Our independent variable, IBC, is a binary dummy that takes 1 for post-IBC (2017-2022) observations and 0 otherwise. Our control variable, collateral, is the ratio of net fixed assets to total assets, while liquidity is the difference of current assets minus current liabilities over total assets. We calculate firm-specific variable size as a natural log of total assets, and age is measured as the number of years since incorporation year. GDP growth is measured as the annual percentage change in real GDP, while inflation shows the annual percentage change in the consumer price index.

	<i>Dependent variables</i>					
	Cost of debt (1)	LTB/TA (1)	STB/TA (2)	TB/TA (3)	SB/TA (1)	USB/TA (2)
IBC	-0.014*** (0.001)	0.036*** (0.002)	-0.004* (0.002)	0.033*** (0.003)	0.029*** (0.002)	0.004 (0.003)
IBC*Size	0.002*** (0.0001)	-0.003*** (0.0003)	-0.001** (0.0002)	-0.004*** (0.0004)	-0.003*** (0.0003)	-0.001*** (0.0003)
IBC*Collateral	-0.002 (0.001)	-0.059*** (0.003)	0.020*** (0.002)	-0.041*** (0.004)	-0.058*** (0.003)	0.012*** (0.003)
Collateral	0.026*** (0.002)	0.237*** (0.003)	-0.164*** (0.003)	0.083*** (0.004)	0.105*** (0.003)	0.006 (0.004)
Liquidity	0.019*** (0.001)	0.159*** (0.002)	-0.306*** (0.002)	-0.150*** (0.003)	-0.122*** (0.002)	-0.071*** (0.002)
Size	-0.008*** (0.0004)	-0.010*** (0.001)	-0.009*** (0.001)	-0.005*** (0.001)	0.025*** (0.001)	-0.046*** (0.001)
Age	-0.001*** (0.0001)	-0.002*** (0.0002)	-0.001*** (0.0002)	-0.004*** (0.0002)	-0.006*** (0.0002)	0.004*** (0.0002)
GDP growth	-0.0001** (0.00004)	-0.0003*** (0.0001)	0.0004*** (0.0001)	0.00002 (0.0001)	0.00001 (0.0001)	-0.0002** (0.0001)
Inflation	-0.001*** (0.0001)	-0.001*** (0.0002)	-0.001*** (0.0001)	-0.001*** (0.0002)	-0.001*** (0.0001)	-0.0003* (0.0002)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	146,020	140,423	134,856	111,846	140,380	121,070
R ²	0.014	0.072	0.223	0.068	0.075	0.038
Adjusted R ²	-0.169	-0.104	0.071	-0.124	-0.097	-0.172

Note:

*p<0.1; **p<0.05; ***p<0.01

Thus, IBC has reduced the cost of debt but the joint effect with collateral shows insignificant effect. Other control variable like liquidity shows that cash rich firms face higher cost of debt (1.9% points) post IBC. Our firm-specific and macroeconomic control variables are significant at 1% but negatively impact the cost of debt. The interaction between IBC and size is significant, which shows that larger firms face higher cost of debt (0.2% points).

In Table 8, we also present the impact of IBC on credit supply across firms varying in collateral. Post IBC reform, we observed that one unit change in firms' collateral led to a decrease of 24.28% and 10.85% in the long-term and total borrowings, relative to the average cost of debt, while an increase of 9.30% in short-term borrowings. The coefficients estimates show that firms with high tangible assets have reduced their access to long-term and aggregate credit supply after implementing IBC, but in contrast, they have increased their access to

short-term credit supply. However, the standalone IBC and collateral have positive impact on long-term and total borrowings, while negative on short-term borrowings. The interaction of IBC and size shows little distraction of larger firms towards borrowings after IBC regime. The statistically significant liquidity coefficient shows positive impact on long term and negative impact on short-term and total borrowings of non-financial firms. Moreover, size and age have negative but significant effect on total, long-term and short-term borrowings.

We report how IBC influences the secured and unsecured borrowings of firms with different levels of collateral with last two column in Table 8. The significant coefficient reveal on average 22.14% reduction in secured borrowings while a 4.82% increase in unsecured borrowings post-IBC reform. One unit change in collateral, individually, increases the secured borrowings by 40.08% on average and IBC, individually caused an increase of 11.07% in average secured borrowings. Both do not have significant effect on unsecured borrowings. Our control variable, liquidity has negative relationship with secured and unsecured borrowings. Larger firms have positive relationship with secured but negative with unsecured borrowings, while older firms have negative relationship secured and positive with unsecured borrowings. Real GDP growth is insignificant for unsecured while significant at 5% for secured borrowings. Inflation has a minimal negative impact on secured and unsecured borrowings.

Thus, in asset channel, we used interaction of IBC and collateral variables and found no role of asset channel in affecting the cost of debt of firms post IBC reform. However, this channel plays significant role in credit supply. IBC has reduced the total, long-term and secured borrowings for firms with higher collateral, while estimates show increased short-term and unsecured borrowings. It shows that creditors' protection regime affects debtors negatively in term of asset channel for their long-term credit supply.

6.2 The liquidity channel

We considered liquidity as a factor to assess whether the IBC's influence on the cost and supply of credit varied for firms with differing levels of cash reserves post-2016.

Firms grapple with the problem of illiquidity when they are encumbered by substantial debt. A high debt load can lead to financial distress, ultimately resulting in bankruptcy. Bankruptcy legislation can provide firms with a mechanism to address the illiquidity challenges, which often stem from substantial debt burdens and adverse selection (Ayotte and Skeel Jr, 2013). Creditors can perceived risk assessing the liquidity level of firms before lending. However, creditors may increase their lending to firms facing liquidity constraints, as IBC protects creditors easing recovery of collateral of low liquidity firms as well.

We expect creditors will increase lending credit to liquidity constraints firms as creditors can easily access to collateral and recover it under IBC. We expect that increased credit supply will lower down the cost of debt. On the other hand, IBC may not have any effect on cash-rich firms, as they have low tendency to borrow and they may repay their debt to avoid creditors' control post IBC.

This section delves into an analysis of the influence of the IBC on credit dynamics, explicitly examining the cost and availability of credit for firms with varying level of liquidity. We construct an interaction variable incorporating IBC and firms' liquidity levels. We add this variable into our baseline equation to create same equation as in our asset channel.

Table 9 Panel fixed effect model: The liquidity channel and IBC

Note: The table shows results from the panel fixed effect model with firm, year, and industry fixed effects. The dependent variable, the cost of debt, is the ratio of total interest expenses to total debt. LTB/TA, STB/TA, and TB/TA show the long-term, short-term, and total borrowings as a proportion of total assets. SB/TA and USB/TA refer to the ratio of secured and unsecured borrowings to total assets. Our independent variable, IBC, is a binary dummy that takes 1 for post-IBC (2017-2022) observations and 0 otherwise. Our control variable, collateral, is the ratio of net fixed assets to total assets, while liquidity is the difference of current assets minus current liabilities over total assets. We calculate firm-specific variable size as a natural log of total assets, and age is measured as the number of years since incorporation year. GDP growth is measured as the annual percentage change in real GDP, while inflation shows the annual percentage change in the consumer price index.

	<i>Dependent variables</i>					
	Cost of debt	LTB/TA	STB/TA	TB/TA	SB/TA	USB/TA
	(1)	(1)	(2)	(3)	(1)	(2)
IBC	-0.015*** (0.001)	0.023*** (0.002)	0.004** (0.002)	0.029*** (0.003)	0.012*** (0.002)	0.014*** (0.003)
IBC*Size	0.002*** (0.0001)	-0.004*** (0.0003)	-0.001** (0.0002)	-0.005*** (0.0004)	-0.004*** (0.0003)	-0.002*** (0.0003)
IBC*Liquidity	0.002* (0.001)	-0.006** (0.003)	-0.016*** (0.002)	-0.020*** (0.003)	0.020*** (0.003)	-0.034*** (0.003)
Collateral	0.025*** (0.002)	0.208*** (0.003)	-0.154*** (0.003)	0.063*** (0.004)	0.077*** (0.003)	0.012*** (0.004)
Liquidity	0.017*** (0.001)	0.163*** (0.003)	-0.296*** (0.002)	-0.137*** (0.004)	-0.134*** (0.003)	-0.050*** (0.003)
Size	-0.008*** (0.0004)	-0.009*** (0.001)	-0.009*** (0.001)	-0.004*** (0.001)	0.026*** (0.001)	-0.045*** (0.001)
Age	-0.001*** (0.0001)	-0.002*** (0.0002)	-0.001*** (0.0002)	-0.004*** (0.0002)	-0.006*** (0.0002)	0.004*** (0.0002)
GDP growth	-0.0001** (0.00004)	-0.0003*** (0.0001)	0.0004*** (0.0001)	0.00001 (0.0001)	0.00002 (0.0001)	-0.0002** (0.0001)
Inflation	-0.001*** (0.0001)	-0.001*** (0.0002)	-0.001*** (0.0001)	-0.001*** (0.0002)	-0.001*** (0.0001)	-0.0003 (0.0002)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	146,020	140,423	134,856	111,846	140,380	121,070
R ²	0.014	0.069	0.222	0.067	0.072	0.039
Adjusted R ²	-0.169	-0.108	0.071	-0.125	-0.101	-0.170

Note:

*p<0.1; **p<0.05; ***p<0.01

Since IBC allows creditors to liquidate distressed firms' assets, liquidity constraints firms will reduce their secured borrowings to secure their collateral. But these firms may experienced increased access to credit as creditors are confident under IBC regime for recovery of their debt in a stipulated time.

In Table 9, our findings indicate that liquidity has a positive effect on the cost of debt post IBC regime, which is significant at 10% level. IBC, standalone, show an reduction of on average 15.46% in the cost of debt. However, both liquidity and collateral exhibit positive effect on the cost of debt. The size of firms initially shows a negative relationship with the cost of debt but demonstrates a positive relationship post-IBC, 2016. Age and our macroeconomic control variables real GDP growth and inflation also exhibit negative impact on the cost of debt.

We also report liquidity's effect on firms' credit access after implementation of IBC in Table 9.

Estimates show that liquidity has a negative but significant effect on firms' access to credit. After the introduction of IBC, one unit increase in liquidity has decreased total, long-term and short-term borrowings by, on average, 5.29%, 2.47%, and 7.44% in long-term, short-term, and total borrowings, respectively. Here, coefficients are significant at 1% for short-term and total borrowings but at 5% for long-term borrowings. Firms with high liquidity have reduced their borrowings, which can be result of debt repayment post IBC regime. It will reduce the creditors' control on them as IBC empowers creditors. Post IBC, one unit change in liquidity shows an increase of 7.63% in average secured borrowings while a reduction of 13.65% in average unsecured borrowings. Creditors perceived firms with high liquidity less risky and increase their secured lending as they are protected under IBC. High liquidity firms will lower down their unsecured borrowings as they have high cash reserves.

The coefficient of IBC suggests improved credit supply for firms. Estimates from IBC and size interaction show that larger and older firms have negative effect on credit supply. Our control variables, collateral has positive impact on all type of borrowings except short-term borrowings, which shows negative relationship. Liquidity, standalone, has negative impact on all types of borrowings except long-term borrowings.

Thus, the liquidity channel shows that firms reduced their borrowings except secured borrowings after the IBC regime. It suggests that IBC affects high liquidity firms negatively to access credit. However, we found an positive impact on the secured borrowings. The interaction between IBC and liquidity has positive but mild effect on the cost of debt.

6.3 The credit channel

Firms with higher credit risk struggle to access credit for investments and bear the high cost of credit. Creditors monitor firms' credit risk to avoid lending to distressed firms. Bankruptcy law provides the structural framework for asset restructuring and ensures the fair treatment of creditors. They may feel secure lending to distressed firms with IBC in place, as it targets resolving distressed firms and liquidating rapidly in case of default. The IBC plays a critical role in increasing distressed firms' access to long-term credit by 6.3% and to short-term credit by 1.4% (Bose et al., 2021). The IBC helps distressed firms survive and improve credit supply (Singh et al., 2022).

Creditors may avoid lending to high credit risk firms since they have high probability of default. However, creditors may provide lending to risky firms if they are protected to recover their debt in case of default of the risky firms. We expect increased borrowings for high credit risk firms as IBC aims to resolve risky firms rapidly and recover the creditors' debt in a time bound manner.

We consider the credit risk level of firms as a factor of creditors' lending. To understand how firms with different levels of credit risk experience the cost and supply of credit after IBC implementation, we use an interaction variable between IBC and credit risk to estimate the effect of IBC on credit risk firms after implementing this reform in 2016. We use the Altman z-score model to calculate the credit risk level for all non-financial firms. We discussed the Altman z-score model in appendix C.

We report the effect of IBC on the cost of debt in Table 10 for firms with different levels of credit risk. The interaction variable (IBC and credit risk) shows no significant impact on

Table 10 Panel fixed effect model: The credit channel and IBC

Note: The table shows results from the panel fixed effect model with firm, year, and industry fixed effects. The dependent variable, the cost of debt, is the ratio of total interest expenses to total debt. LTB/TA, STB/TA, and TB/TA show the long-term, short-term, and total borrowings as a proportion of total assets. SB/TA and USB/TA refer to the ratio of secured and unsecured borrowings to total assets. Our independent variable, IBC, is a binary dummy that takes 1 for post-IBC (2017-2022) observations and 0 otherwise. Credit risk shows the firms' financial health, estimated using the Altman Z score. Our control variable, collateral, is the ratio of net fixed assets to total assets, while liquidity is the difference of current assets minus current liabilities over total assets. We calculate firm-specific variable size as a natural log of total assets, and age is measured as the number of years since incorporation year. GDP growth is measured as the annual percentage change in real GDP, while inflation shows the annual percentage change in the consumer price index.

	<i>Dependent variables</i>					
	Cost of debt (1)	LTB/TA (1)	STB/TA (2)	TB/TA (3)	SB/TA (1)	USB/TA (2)
IBC	-0.012*** (0.001)	0.009*** (0.002)	0.002 (0.002)	0.019*** (0.003)	0.012*** (0.002)	0.006** (0.002)
IBC*Size	0.002*** (0.0001)	-0.003*** (0.0003)	-0.0005* (0.0003)	-0.004*** (0.0004)	-0.004*** (0.0003)	-0.0005 (0.0003)
IBC*credit risk	-0.0001 (0.0001)	0.002*** (0.0002)	-0.0005*** (0.0001)	0.001*** (0.0002)	0.001*** (0.0002)	-0.001*** (0.0002)
Credit risk	0.003*** (0.0001)	-0.018*** (0.0002)	-0.004*** (0.0001)	-0.024*** (0.0002)	-0.014*** (0.0002)	-0.010*** (0.0002)
Collateral	0.023*** (0.002)	0.256*** (0.003)	-0.159*** (0.003)	0.091*** (0.004)	0.098*** (0.003)	0.026*** (0.004)
Liquidity	-0.0005 (0.001)	0.271*** (0.002)	-0.264*** (0.002)	-0.009*** (0.003)	-0.042*** (0.002)	0.024*** (0.002)
Size	-0.007*** (0.0004)	-0.002*** (0.001)	-0.011*** (0.001)	-0.006*** (0.001)	0.022*** (0.001)	-0.040*** (0.001)
Age	-0.001*** (0.0001)	-0.001*** (0.0002)	-0.001*** (0.0002)	-0.003*** (0.0002)	-0.004*** (0.0002)	0.003*** (0.0002)
GDP growth	-0.0001*** (0.00003)	-0.0002** (0.0001)	0.0004*** (0.0001)	0.0001 (0.0001)	0.00005 (0.0001)	-0.00003 (0.0001)
Inflation	-0.001*** (0.0001)	-0.0005*** (0.0001)	-0.0004*** (0.0001)	-0.001*** (0.0002)	-0.0005*** (0.0001)	-0.0003* (0.0002)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	133,326	127,674	119,385	104,647	126,631	105,084
R ²	0.032	0.227	0.222	0.214	0.152	0.073
Adjusted R ²	-0.154	0.075	0.063	0.047	-0.013	-0.140

Note:

*p<0.1; **p<0.05; ***p<0.01

the cost of debt. However, standalone IBC has a negative, and standalone credit risk has a positive relationship with the cost of debt. The results show that the average cost of debt for non-financial firms has been reduced by 12.37%. The collateral estimate positively impacts the cost of debt, while liquidity is insignificant. We found a reduction in the average cost of debt by 7.22% and 1.03%, respectively, due to one one-unit increase in larger and older firms, which are significant at the 1% level. Our interaction variable IBC and size shows an increase of 1% in firms' size, leading to an increase of 2.06% in the cost of debt. Real GDP growth and inflation are negatively related to the cost of debt.

Table 10 also displays the change in credit supply for firms with varying credit risk after

IBC. Our interaction variable of IBC and credit risk is significant at 1% and shows a positive effect on total and long-term borrowings but a negative on short-term borrowings. We found increased firms' access to long-term and aggregate credit while reduced short-term credit for lower credit risk firms (higher Z-score) post-IBC regime. Based on standalone credit risk estimates, we found that one unit decrease in firms' credit risk (referring to distressed firms) led to an increase of 6.35%, 7.41%, and 1.86% in the average long-term, short-term, and total borrowings. Results show enhanced credit supply for distressed firms after implementing IBC.

The collateral shows a positive and significant relationship with total and long-term borrowings while negative with short-term borrowings. Liquidity has a positive impact on long-term borrowings but a negative impact on total and short-term borrowings. The interaction of IBC and size suggests a reduction in all borrowings (total, long-term, and short-term) after the IBC regime. We found a negative relationship with all borrowings for larger and older firms.

We discussed the change in secured and unsecured borrowings for different credit risk firms after the IBC regime in the last two columns in Table 10. As the coefficients of the interaction variable (IBC and credit risk) are significant, it suggests reduced secured by 0.38% and increased unsecured borrowings by 0.40% for distressed firms (decrease in Z-score) in the IBC period. Lower credit risk firms are attracted to secured borrowings but show a negative relationship with unsecured borrowings after implementing the IBC regime. The significant and positive coefficients of individual IBC suggest increased secured and unsecured borrowings. In contrast, the coefficients of individual credit risk show decreased secured and unsecured borrowings for all non-financial firms in the sample.

Collateral, our control variable, suggests a positive relationship between secured and unsecured borrowings. Liquidity shows a negative impact on secured but a positive on unsecured borrowings. We found a negative effect on secured and unsecured borrowings for the interplay between IBC and firms' size. We also found a positive effect on secured borrowings but a negative effect on unsecured borrowings for larger firms. The effect is negative on secured borrowings but positive on unsecured borrowings for older firms. Inflation negatively affects both borrowings, while the real GDP growth lacks significance.

Summary and discussion

Firms have different ways of financing based on their financial health. A firm with high collateral or less liquidity can borrow more than its counterparts with less collateral and high liquidity. Similarly, creditors will prefer low-risk firms to lend compared to high-risk firms. IBC aims to resolve distressed firms and secure creditors' interests. We use interaction variables using the interplay of IBC with collateral, liquidity, and credit to check how these firms' cost and supply of credit with different collateral, liquidity, and credit levels have been changed post-IBC.

We do not find any significant relationship between IBC and the cost of debt in the asset and credit channel. In contrast, the liquidity channel indicates a positive relationship at a 10% significance level. Total and long-term borrowings to total assets increased for low collateral and liquidity firms but decreased for high credit-risk firms. However, short-term borrowings to total assets decreased for low collateral, low credit risk, and high liquidity firms post-IBC. Thus, we found evidence supporting the liquidity channel and limited support for the credit channel.

7 Robustness check

Many events occurred around the year of IBC implementation. We consider IBC a time dummy variable that takes 1 for the post-IBC period (2017-2022) and 0 otherwise. Around 2016, we adopted inflation targeting in May 2016, and the government also announced demonetization on Nov 8, 2016. The Goods and Services Tax (GST) Act was enacted in July 2017, and we observed public sector banks (PSBs) recapitalization with roughly 2.2 lakh crore over three consecutive financial years from 2016-17 to 2018-19.

Since we use a time dummy to measure the effect of IBC, we need to control the effect of these interventions in our study to check the robust effect of IBC on the cost and supply of credit. We have used the real GDP growth rate to account for the effect of the GST Act and the inflation rate to adjust the effect of demonetization. However, demonetization temporarily shocked the economy, which was recovered in two quarters (Lahiri, 2020).

For monetary policy effect, we control for the short-term interest rates using repo and the yield curve's slope using term spread, which is measured as the difference between the 10-year Government of India yield and repo rate. We include the repo rate and term spread variable in our baseline equation to check the robustness of our study. We found robust results for the cost of debt and credit supply for all non-financial firms. Results estimates are mentioned in appendix D.

We reduced our sample period from 2012-2022 to 2014-2019 for another robustness check. We studied three years, pre- and post-IBC, to examine the effect of IBC on the cost and supply of credit. Using this process, we account for controlling the effect of PSBs recapitalization effects. We found a robust relationship between IBC and the cost of debt and credit supply. Secured and unsecured borrowings to total assets were insignificant in this robustness check. Results estimates are mentioned in appendix E.

8 Conclusion

Our motivation is rooted in the valuable lessons derived from prior reforms in India, which have sparked our interest in evaluating the performance of the Insolvency and Bankruptcy Code (IBC). Over a seven-year study period, we aspire to furnish policymakers with a comprehensive analysis of the shifts in credit levels and the cost of debt attributable to the IBC. Despite the diverse outcomes in existing literature regarding the IBC's impact on firms' borrowing decisions, our empirical study is committed to providing policymakers with clear, consistent, and valuable insights.

In this paper, we examine how the implementation of the IBC in 2016 has influenced credit availability and the cost of borrowing for all non-financial firms in India. We test a hypothesis based on the goal of IBC, 2016, that this creditors' protection will enhance credit supply in the market for non-financial firms, which may reduce the cost of borrowings. We employ the panel fixed-effect model to examine this hypothesis using the balance sheet information of non-financial firms from CMIE.

Our analysis suggests that the IBC has reduced firms' total interests expenses relative to their total debt. This decrease in the cost of debt could be attributed to the facilitation of restructuring provided to firms under the IBC reform. Theoretically, we can observe this reduction

in the cost of credit due to the increased availability of credit in the market for firms. Our findings are in line with [Jose et al. \(2020\)](#) and [Bose et al. \(2021\)](#).

Our findings reveal that implementing the IBC has improved firms' access to credit with an increase of 2.2% and 2.4% in long-term and total borrowings to total assets. However, it does not significantly impact short-term credit supply. Our firm-specific and macroeconomic control variables also significantly affect credit supply. Our results align with the findings of [Funchal \(2008\)](#) and [Bose et al. \(2021\)](#).

We found that one unit increase in collateral led to an increase of 20.8% and 6.2% in long-term and total borrowings. Additionally, we examine the effect of IBC on borrowings with collateral and non-collateral and found that the reform has increased the secured and unsecured borrowings by 1.7% and 0.7%, respectively. This outcome regarding secured borrowings contradicts the study's findings by [Vig \(2013\)](#), which reported a reduction in secured borrowings following the SARFAESI reform.

We provide new insights examining the cross-sectional variations among non-financial firms after the introduction of IBC. We use three channels to estimate these differential impact of IBC on the cost and supply of credit for firms with different levels of collateral, liquidity, and credit risk. Results show no significant effect of IBC on the cost of debt for these interaction variables except IBC*liquidity, which is significant at the 10% level. The IBC negatively affects long-term and total borrowings for firms with varying collateral and liquidity while exhibiting a positive relationship for firms with varying credit risk.

Overall, implementing IBC with supply-side reform reduced the cost of credit and enabled an enhanced credit supply in the market for all non-financial firms. We expect this reform to be more efficient for all the credit market participants, providing comprehensive credit channels. Our study aims to provide insights that can assist regulators in shaping future policy developments for more efficient credit market functioning.

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Appendices

A Correlation matrix

We constructed a correlation matrix to investigate the presence of multicollinearity among our predictor variables and to gain insights into the relationships and patterns among them. The outcomes of this correlation matrix are presented in Table A.1. We observed a weak negative association, which was found the highest in matrix, between collateral and liquidity. Conversely, the lowest correlation was identified for size and age with inflation, indicating a minimal correlation coefficient of 0.002. Our analysis suggests that there is generally a very weak or negligible association among our independent variables.

Table A.1 Correlation matrix

	Collateral	Liquidity	Age	Size	Inflation	GDP growth
Collateral	1	-0.413	-0.029	0.031	0.020	0.009
Liquidity	-0.413	1	0.052	-0.038	-0.028	-0.042
Age	-0.029	0.052	1	0.062	-0.013	-0.058
Size	0.031	-0.038	0.062	1	-0.001	-0.005
Inflation	0.020	-0.028	-0.013	-0.001	1	-0.009
GDP growth	0.009	-0.042	-0.058	-0.005	-0.009	1

B Unit root test: Phillips-Perron test

We employ the Phillips-Perron test to examine the unit root characteristics of firm-specific time series data, aiming to mitigate the risk of spurious results. The Phillips-Perron test is particularly advantageous as it considers serially correlated errors and exhibits robust performance in the context of large sample data. Our analysis leads to the rejection of the null hypothesis¹⁵ for all variables, as indicated by p-values below the 0.05 significance threshold. Thus, we conclude that all the variables in our study are stationary.

Table B.1 Unit root test: Phillips-Perron test

Variables	Z-tau statistics	p-value
Cost of debt	-181.4782	0.000
Total assets	-97.1059	0.000
Collateral	-146.9307	0.000
Liquidity	-181.4782	0.000
Inflation	-282.458	0.000
GDP growth (Real)	-500.2424	0.000
Long-term borrowings	-99.1595	0.000
Short-term borrowings	-114.0484	0.000
Secured borrowings	-90.2472	0.000
Unsecured borrowings	-95.3467	0.000

¹⁵ H_0 : The variable contains a unit root.

C Altman Z-score model

Edward Altman developed an effective approach of predicting firms' credit risk level to assess their financial health. It is a numerical measurement to predict firms' default risk in coming two years. The model predicting firms' bankruptcy was created based on weighting system using five key accounting ratio of firms. Using information from these accounting ratios, Altman calculated the *Z-score*. It is also called Z-score model, which is the traditional measure of default risk. We use the following formula to calculate the Z-score for all non-financial firms.

$$Z = 0.717(X_1) + 0.847(X_2) + 3.107(X_3) + 0.420(X_4) + 0.998(X_5)$$

where, the Altman Z-score model includes the following fundamental accounting ratios:

1. X_1 : Working capital/Total assets;
2. X_2 : Retained earnings/Total assets;
3. X_3 : Book value of equity/Book value of total liabilities;
4. X_4 : Sales/Total assets; and
5. X_5 : Earnings before interest and taxes/Total assets.

There is inverse relationship between Z-score and firms' credit risk. A lower Z-score indicates higher credit risk and vice versa. We consider a firm scored less Z-score indicates the sign of distress. We suggest to visit the [Altman Z score](#) paper for detailed analysis and different variation of the same model.

D Robustness check: Monetary Policy Committee (MPC)

Table D.1 displays the results for the change in the cost of debt after accounting for the implementation of inflation targeting in 2016. After incorporating the repo rate and term spread into the regression model, the results show a statistically significant reduction in the cost of debt by 1.5% on average, at the 1% significance level, following the implementation of the IBC. The coefficients for repo rate and term spread are positive and statistically significant at 1% level. The estimated coefficient (0.005) indicates that an increase in the repo rate will raise the interest burden for firms.

Table D.1 Cost of debt: Robustness check with repo rate and term spread

	Cost of debt		
	(1)	(2)	(3)
IBC	-0.006*** (0.0003)	-0.014*** (0.001)	-0.015*** (0.001)
IBC*Size		0.002*** (0.0001)	0.002*** (0.0001)
Collateral		0.025*** (0.002)	0.025*** (0.002)
Liquidity		0.018*** (0.001)	0.019*** (0.001)
Size		-0.008*** (0.0004)	-0.008*** (0.0004)
Age		-0.001*** (0.0001)	0.0005* (0.0002)
GDP growth (real)			-0.0004*** (0.00004)
Repo rate			0.005*** (0.0004)
Term spread			0.003*** (0.001)
Inflation			-0.001*** (0.0001)
Firm FE		Y	Y
Industry FE		Y	Y
Observations	146,020	146,020	146,020
R ²	0.004	0.013	0.015
Adjusted R ²	-0.180	-0.170	-0.167
Note:	*p<0.1; **p<0.05; ***p<0.01		

Table D.2 presents the results for variations in credit supply after incorporating the repo rate and term spread variables into our model. The estimates, after accounting for the implementation of MPC, indicate that our findings are robust for long-term borrowings, short-term borrowings, and total borrowings. We observed positive and statistically significant coefficients for both long-term and total borrowings. However, the coefficient for short-term borrowings was insignificant in both analyses. On average, long-term borrowings increased by 2.1%, and total borrowings rose by 2.4% in the post-IBC period.

Our estimates indicate a positive and statistically significant impact of the repo rate on long-term, short-term, and total borrowings. The significance level is 5% for long-term borrowings

Table D.2 Credit supply: Robustness check with repo rate and term spread

	Dependent variables								
	Long-term borrowings			Short-term borrowings			Total borrowings		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IBC	-0.017*** (0.001)	0.022*** (0.002)	0.021*** (0.002)	-0.017*** (0.001)	0.002 (0.002)	0.001 (0.002)	-0.033*** (0.001)	0.026*** (0.003)	0.024*** (0.003)
IBC*Size		-0.004*** (0.0003)	-0.004*** (0.0003)		-0.0004* (0.0002)	-0.0004 (0.0002)		-0.005*** (0.0004)	-0.005*** (0.0004)
Collateral		0.209*** (0.003)	0.208*** (0.003)		-0.155*** (0.003)	-0.154*** (0.003)		0.063*** (0.004)	0.062*** (0.004)
Liquidity		0.159*** (0.002)	0.159*** (0.002)		-0.306*** (0.002)	-0.305*** (0.002)		-0.150*** (0.003)	-0.149*** (0.003)
Size		-0.009*** (0.001)	-0.009*** (0.001)		-0.009*** (0.001)	-0.009*** (0.001)		-0.005*** (0.001)	-0.005*** (0.001)
Age		-0.002*** (0.0002)	-0.002*** (0.001)		-0.001*** (0.0002)	0.001 (0.0004)		-0.004*** (0.0002)	-0.002*** (0.001)
GDP growth (real)			-0.0004*** (0.0001)			0.0001 (0.0001)			-0.0002** (0.0001)
Repo rate			0.002** (0.001)			0.004*** (0.001)			0.004*** (0.001)
Term spread			0.002 (0.002)			-0.001 (0.002)			-0.002 (0.003)
Inflation			-0.001*** (0.0002)			-0.001*** (0.0001)			-0.001*** (0.0002)
Firm FE		Y	Y		Y	Y		Y	Y
Industry FE		Y	Y		Y	Y		Y	Y
Observations	140,423	140,423	140,423	134,856	134,856	134,856	111,846	111,846	111,846
R ²	0.006	0.068	0.069	0.009	0.222	0.222	0.021	0.067	0.067
Adjusted R ²	-0.182	-0.108	-0.108	-0.184	0.070	0.071	-0.181	-0.126	-0.125

Note: *p<0.1; **p<0.05; ***p<0.01

and 1% for both short-term and total borrowings. However, the term spread shows no significant effect on credit supply.

In Table D.3, we examine the robustness of the findings for secured and unsecured borrowings after including the repo rate and term spread in the model. Our results remain robust as there is no significant change in the coefficients for secured and unsecured borrowings. After accounting for the inflation targeting variables, we found that, on average, secured borrowings increased by 1.7% and unsecured borrowings increased by 0.7% following the implementation of IBC.

Table D.3 Secured and unsecured borrowings: Robustness check with repo rate and term spread

	<i>Dependent variables</i>					
	Secured borrowings			Unsecured borrowings		
	(1)	(2)	(3)	(4)	(5)	(6)
IBC	-0.031*** (0.001)	0.018*** (0.002)	0.017*** (0.002)	0.0004 (0.001)	0.007*** (0.003)	0.007*** (0.003)
IBC*Size		-0.004*** (0.0003)	-0.004*** (0.0003)		-0.001*** (0.0003)	-0.001*** (0.0003)
Collateral		0.077*** (0.003)	0.077*** (0.003)		0.012*** (0.004)	0.012*** (0.004)
Liquidity		-0.122*** (0.002)	-0.121*** (0.002)		-0.071*** (0.002)	-0.071*** (0.002)
Size		0.027*** (0.001)	0.027*** (0.001)		-0.047*** (0.001)	-0.046*** (0.001)
Age		-0.005*** (0.0002)	-0.004*** (0.0005)		0.004*** (0.0002)	0.004*** (0.001)
GDP growth (real)			-0.0001 (0.0001)			-0.0003*** (0.0001)
Repo rate			0.002** (0.001)			0.002* (0.001)
Term spread			-0.006*** (0.002)			0.004* (0.002)
Inflation			-0.001*** (0.0002)			-0.0005** (0.0002)
Firm FE		Y	Y		Y	Y
Industry FE		Y	Y		Y	Y
Observations	140,380	140,380	140,380	121,070	121,070	121,070
R ²	0.022	0.071	0.072	0.00000	0.038	0.038
Adjusted R ²	-0.159	-0.101	-0.101	-0.218	-0.172	-0.172

Note: *p<0.1; **p<0.05; ***p<0.01

E Robustness check: Public Sector Banks recapitalization

The Government of India recapitalized public sector banks to strengthen their conditions in 2019 (see for details: [PIB](#)). To ensure the robustness of our findings in light of this phenomenon, we reduced our sample period from 2012-2022 to 2014-2019 and re-evaluated the results.

We reported the results from our revised sample period estimation for cost of debt in [Table E.1](#). The findings reveal a negative and statistically significant coefficient for IBC, indicating a decline in the average cost of debt post-IBC implementation. This analysis confirms the robustness of our findings, as the reduction in the cost of debt persists even in the reduced sample period. The reduction in the cost of debt is less pronounced (0.4%) when considering the shortened sample period of 2014 to 2019.

Table E.1 Cost of debt: Robustness check with PSBs recapitalization

	Cost of debt		
	(1)	(2)	(3)
IBC	-0.004*** (0.0003)	-0.010*** (0.001)	-0.004*** (0.002)
IBC*Size		0.001*** (0.0002)	0.001*** (0.0002)
Collateral		0.027*** (0.002)	0.027*** (0.002)
Liquidity		0.021*** (0.001)	0.021*** (0.001)
Size		-0.012*** (0.001)	-0.011*** (0.001)
Age		0.0001 (0.0002)	-0.001*** (0.0003)
GDP growth (real)			0.004*** (0.001)
Inflation			0.002*** (0.0003)
Firm FE		Y	Y
Industry FE		Y	Y
Observations	87,203	87,203	87,203
R ²	0.002	0.011	0.012
Adjusted R ²	-0.305	-0.292	-0.291
Note:	*p<0.1; **p<0.05; ***p<0.01		

In Table E.2, we analyze the robustness of our credit supply findings using the reduced sample period, taking into account bank recapitalization. The results confirm the robustness of our findings, as the coefficients for IBC are positive and statistically significant at the 1% level for both long-term and total borrowings. Findings for the revised sample period show that long-term borrowings increased by 1% and total borrowings by 0.9% in the post-IBC period. The coefficient for short-term borrowings remains insignificant.

Table E.3 shows the result for secured and unsecured borrowings with a reduced sample period. We have not found any significant change in secured and unsecured borrowings since the implementation of IBC. Thus, our findings for secured and unsecured borrowings are not robust when we reduce the sample period to account for the PSBs recapitalization.

Table E.2 Credit supply: Robustness check with PSBs recapitalization

	<i>Dependent variables</i>								
	Long-term borrowings			Short-term borrowings			Total borrowings		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IBC	-0.014*** (0.001)	0.012*** (0.003)	0.010*** (0.004)	-0.007*** (0.001)	-0.004** (0.002)	-0.003 (0.003)	-0.021*** (0.001)	0.009*** (0.003)	0.009** (0.004)
IBC*Size		-0.003*** (0.0003)	-0.003*** (0.0003)		0.0003 (0.0003)	0.0003 (0.0003)		-0.002*** (0.0004)	-0.002*** (0.0004)
Collateral		0.190*** (0.004)	0.190*** (0.004)		-0.143*** (0.004)	-0.143*** (0.004)		0.064*** (0.005)	0.063*** (0.005)
Liquidity		0.205*** (0.003)	0.205*** (0.003)		-0.308*** (0.003)	-0.308*** (0.003)		-0.097*** (0.004)	-0.097*** (0.004)
Size		-0.014*** (0.001)	-0.014*** (0.001)		-0.017*** (0.001)	-0.017*** (0.001)		-0.018*** (0.002)	-0.018*** (0.002)
Age		-0.002*** (0.0004)	-0.001 (0.001)		-0.0002 (0.0003)	-0.0004 (0.001)		-0.003*** (0.0005)	-0.002*** (0.001)
GDP growth (real)			0.0002 (0.001)			0.001 (0.001)			0.002 (0.001)
Inflation			-0.001 (0.001)			0.0003 (0.001)			0.00003 (0.001)
Firm FE		Y	Y		Y	Y		Y	Y
Industry FE		Y	Y		Y	Y		Y	Y
Observations	81,853	81,853	81,853	78,986	78,986	78,986	64,453	64,453	64,453
R ²	0.006	0.089	0.089	0.002	0.210	0.210	0.013	0.038	0.038
Adjusted R ²	-0.303	-0.194	-0.194	-0.318	-0.044	-0.044	-0.318	-0.285	-0.285

Note: *p<0.1; **p<0.05; ***p<0.01

Table E.3 Secured and unsecured borrowings: Robustness check with PSBs recapitalization

	<i>Dependent variables</i>					
	Secured borrowings			Unsecured borrowings		
	(1)	(2)	(3)	(4)	(5)	(6)
IBC	-0.021*** (0.001)	0.006** (0.003)	0.005 (0.003)	-0.0004 (0.001)	0.004 (0.003)	0.006 (0.004)
IBC*Size		-0.002*** (0.0003)	-0.002*** (0.0003)		-0.001 (0.0004)	-0.001 (0.0004)
Collateral		0.075*** (0.004)	0.074*** (0.004)		0.016*** (0.005)	0.016*** (0.005)
Liquidity		-0.102*** (0.003)	-0.102*** (0.003)		-0.054*** (0.003)	-0.054*** (0.003)
Size		0.019*** (0.001)	0.020*** (0.001)		-0.050*** (0.001)	-0.050*** (0.001)
Age		-0.006*** (0.0004)	-0.006*** (0.001)		0.004*** (0.0005)	0.003*** (0.001)
GDP growth (real)			0.001 (0.001)			0.001 (0.001)
Inflation			-0.0001 (0.001)			0.001 (0.001)
Firm FE		Y	Y		Y	Y
Industry FE		Y	Y		Y	Y
Observations	82,376	82,376	82,376	72,474	72,474	72,474
R ²	0.015	0.046	0.046	0.00000	0.031	0.031
Adjusted R ²	-0.287	-0.247	-0.247	-0.354	-0.313	-0.313

Note: *p<0.1; **p<0.05; ***p<0.01