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An agency cost channel from creditor rights reforms to leverage

By

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Abstract

The paper investigates the influence of creditor rights reforms on leverage. Based on a partial equilibrium agency cost model, we propose a novel channel running from the owner/manager's private bankruptcy costs to leverage. Such costs mitigate the firms' agency problem toward creditors, thereby increasing credit limits and leverage. The proposition is tested with data from India 2011–2020, a period that saw the strengthening of creditor rights. We find that the reform caused leverage to fall, which is indicative of a decrease in owner/manager's bankruptcy costs. We also find evidence of a decline in credit limits as predicted by the proposed theory.

1. Introduction

We examine the impact of creditor rights reforms (CRRs) on the leverage of non-financial firms. Many strands of theory predict that leverage responds to the expected payments creditors receive in the event of firm failure (Harris and Raviv, 1991). Empirical evidence supports this view. Liquidation value – a key determinant of such payments – has been shown to enhance credit availability (Benmelech et al., 2005; Benmelech, 2024). This "liquidation value channel" provides a positive link between creditor rights and leverage. However, it cannot be the sole mechanism at work. Several studies (Vig, 2013; Schoenherr and Starmans, 2022) report a countermovement of creditor rights and leverage, which is inconsistent with the liquidation value channel alone.

What accounts for this countermovement? Vig (2013) and Schoenherr and Starmans (2022) (or S&S 2022 hereafter) formalize the prevailing explanation that it arises from changes in the promoter's private, non-contractible bankruptcy costs. Under this "credit demand channel," stronger creditor rights raise these private costs, thereby reducing the willingness of the promoter to take on debt. According to this view, countermovement emerges when the credit demand channel outweighs the liquidation value effect.

This paper contributes to the current debate by proposing an unrecognized theoretical channel and presenting supporting empirical evidence. Notably, the mainstream framework focuses on borrowing behavior and abstracts from leverage. We extend the analysis to explicitly incorporate leverage within a similar partial equilibrium agency-cost framework. This generalization reveals a new mechanism linking the promoter's private bankruptcy costs to both borrowing and leverage. Specifically, higher private bankruptcy costs reduce the agency problems associated with lending, thereby expanding credit availability and increasing leverage.

This mechanism, which we designate as the agency cost channel, offers a novel explanation for the observed countermovement between creditor rights and leverage. Under our proposed theory, countermovement arises when creditor rights and the promoter's private bankruptcy costs move in opposite directions such as when a reform enhances creditor protections while simultaneously reducing the costs of bankruptcy for the promoter. Such a "win-win" outcome might occur, for instance, through increased and more transparent public sector involvement in the insolvency process, a common feature of many creditor rights reforms. Thus, the agency cost channel provides an alternative theoretical foundation for interpreting empirical findings that challenge the conventional liquidation value or credit demand explanations.

To empirically evaluate the proposed theory, we examine the impact on firm leverage from a major creditor rights reform in India, the Insolvency and Bankruptcy Code (IBC) in 2016. Owing to India's incremental approach to creditor rights reform (see Annex), the IBC had an uneven effect across creditor types. It particularly strengthened the rights of unsecured, non-bank creditors, who had been only weakly protected under the prior regime. This institutional shift creates a quasi-natural experiment to assess the regulatory impact on corporate leverage.

Using the difference-in-differences (DiD) approach, we find robust evidence that the strengthening of creditor rights under the IBC led to a decline in leverage among non-financial firms. In agreement with the proposed theory, the observed countermovement could be indicative of agency cost channel, whereby the reform to enhance creditor protections simultaneously reduced the promoter's private bankruptcy costs. The resulting reduction in borrower discipline raised the agency costs of lending, causing a tightening of credit constraints and reduction in leverage.

This interpretation stands in contrast to the mainstream credit demand channel, which attributes the decline in leverage to an increase in the promoter's private bankruptcy costs, thereby reducing the firm's willingness to borrow. The two theories cannot be differentiated directly based on bankruptcy costs, which are not observed. To differentiate between the two theories, we examine the behavior of credit limits following the IBC's implementation. Our theory predicts that a fall in leverage reflects a binding decline in credit limits. In contrast, the mainstream theory assumes that firms are not credit constrained, thus remaining agnostic about the direction of credit limits.

To test these competing predictions, we apply the stochastic frontier approach developed by Herrala (2009) to estimate firm-level credit limits. The results show evidence of a significant contraction in credit limits following the IBC, providing empirical support for our theory.

In the following chapters, we discuss the relevant literature and present our novel theory. A discussion of the data, the estimation period, and the estimation results, follows. A summary and some further discussion conclude. Throughout the text, we refer to the Annex, which provides a timeline of development of India's bankruptcy regulation since 1985.

2. The literature

2.1. The mainstream view of impact channels

Many strands of theory predict that liquidation value influences leverage (Harris and Raviv, 1991). Empirical studies (Benmelech, 2024; Benmelech et al., 2005) validate the existence of a "liquidation value channel," a positive effect of the liquidation value of a firm's assets on leverage. Since assets are liquidated during the insolvency process to the benefit of creditors, this channel generates co-movement between creditor rights and leverage. For example, a creditor-friendly CRR that improves liquidation value increases credit availability, borrowing, and leverage.

However, empirical studies have revealed significant evidence of countermovement between creditor rights and leverage, suggesting other channels in addition to the liquidation value channel may be active during creditor rights reforms. For example, Vig (2013) finds a negative effect of creditor rights strengthening on borrowing and leverage in India, while S&S (2022) show a positive effect of creditor rights weakening in South Korea. Furthermore, empirical studies that build on cross-country data suggest that countermovement could be common. Cho et al. (2014) and Acharya et al. (2011) report that leverage tends to be lower in countries where creditor rights are stronger.

Vig (2013) and S&S (2022), who each offer their own countermovement theories, study the problem from first principles in partial equilibrium using the agency cost approach that embeds the CRR in an imperfect contracting environment. Both studies view the CRR as competitive between the creditor and the promoter. An increase in liquidation speed increases the private bankruptcy costs of the promoter, thereby decreasing credit demand. This "credit demand channel" generates countermovement between creditor rights and leverage.

The primary contribution of the present paper is our proposed theory about the impact of CRR on leverage. It includes the liquidation value channel and provides a novel explanation for generation of countermovement. Notably, the mainstream theories of Vig (2013) and S&S (2022) focus on borrowing and only infer leverage. Leverage is well defined in our proposed a model. The theoretical extension reveals the "agency cost channel" from the CRR to borrowing and leverage, which we then validate with a case study.

2.2. Identifying regulatory impact

The empirical literature on creditor rights divides broadly into two approaches: cross-country studies (Cho et al. 2014; Acharya et al. 2011), and case studies of CRRs (S&S, 2022; Vig, 2013). While cross-country studies promise greater generality of findings, identification of the regulatory effect is a challenge in the absence of a natural experiment. CRRs often influence firms asymmetrically, which may be exploited to qualitatively estimate the regulatory effect with the DiD approach. CRRs, which are common across the developed and developing world, have fueled a lively debate about their economic impact (Adelegan and Herrala, 2026; Kumar 2024; Hotchkiss et al., 2023; Ponticelli and Alencar, 2016).

The experience from empirical work demonstrates that the identification of the regulatory effect is uncertain even in the context of a natural experiment. For example, Vig (2013) and Thapa et al. (2020) study the Securitisation and

Reconstruction of Financial Assets and Enforcement of Security Interest Act of 2003 (SAFRAESI Act), which strengthened the rights of secured creditors in India (Annex). Both apply the DiD approach on the same data source, but their different identification assumptions lead to opposite conclusions about the overall effect. Vig (2013) proposes that the SAFRAESI Act had a negative, while Thapa et al. (2020) claim it had a positive impact on firm borrowing and leverage.

2.3. The case of India

India's stepwise approach to creditor rights reform (Annex) and data-availability has made it a fruitful target of case studies. While Vig (2013) and Thapa et al. (2020) study the SAFRAESI Act, the more recent IBC gets scrutiny from other authors. Kulkarni et al. (2025) find that the IBC contributed to a reallocation of lending away from "zombie" firms to healthy borrowers. Kumar (2024) finds that distressed firms adjusted leverage faster after the IBC toward the new equilibrium. Banerjee and Herrala (2024) find that the increase in liquidation speed associated with reform contributed to a decline in the average leverage of firms through liquidation of insolvent, highly leveraged, firms.

Our study adds to this work the finding that the overall effect of the IBC on leverage was negative. We also validate of the agency cost channel in India. India is a suitable test case for our theory from the point of view of data quality and availability of identification options. Moreover, review of our work is straightforward as the Indian case is well known.

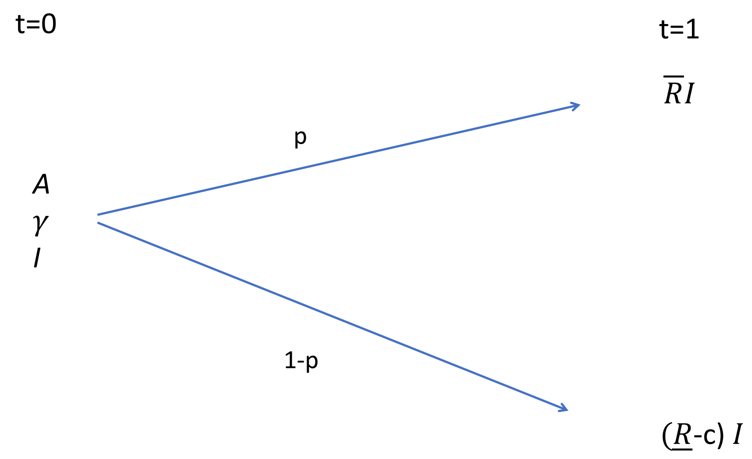
3. Theory

3.1. The model

Our proposed theory complements the incumbent theories of Vig (2013) and S&S (2022) on countermovement during CRRs. For comparability, our theory builds on a broadly similar partial equilibrium agency cost approach as the incumbent theories. The above-mentioned studies build on the core agency problem introduced by Holmström and Tirole (1997). Our model incorporates private bankruptcy costs of the promoter, a subject of key interest in CRR discussions.

We expand on the incumbent theories, which focus on borrowing, by including analysis of both borrowing and leverage. We also back up our a novel theoretical explanation for countermovement with an empirical example.

Figure 1. The model's timeline.



The model has two types of agents: *promoters* (who run firms), and *creditors* (who lend to firms). As we see in Fig. 1, there are also two dates t: the *investment date* (0), and the *payoff date* (1). Specifically:

- **t=0** All firms start with own funds $A > 0$. They have an investment possibility $I > 0$ with variable scale. Own funds may be invested without cost. Beyond that, a firm must borrow $I - A$ from creditors, who require an expected unit return $\gamma > 1$. The promoters privately choose between a good investment type, which succeeds with probability p_H, and a bad investment type which succeeds with probability p_L, where $\Delta p \equiv p_H - p_L > 0$. The bad investment type yields a private benefit $b > 0$ per unit of investment to the promoter.
- **t=1** Investment returns $\overline{R}$ if it succeeds and $\underline{R}$ if it fails per unit of investment, $\overline{R} > \gamma > \underline{R} > 0$. The unit "liquidation value" $\underline{R}$ is therefore so low that creditors cannot be fully repaid if the investment project fails. In the event of failure, the promoter of the firm suffers a "private bankruptcy cost" $c > 0$.

In line with the previous literature, we assume that an investment project is economically viable only if the promoter chooses the good investment type:

$$p_H\overline{R} + (1 - p_H)(\underline{R} - c) > \gamma > p_L\overline{R} + (1 - p_L)(\underline{R} - c) + b \qquad (1)$$

$\overline{R}_f$ and $\underline{R}_f$ denote the unit returns for the firm under success and failure, respectively. At $t=0$, the promoter prefers the good investment type if its expected unit return $p_H\overline{R}_f + (1 - p_H)(\underline{R}_f - c)$ exceeds that of the bad investment type $p_L\overline{R}_f + (1 - p_L)(\underline{R}_f - c) + b$. Setting the former greater than the latter and simplifying gives an incentive compatibility constraint under which the good investment type gets selected:

$$\frac{b}{\Delta p} - \overline{R}_f + \underline{R}_f - c \leq 0 \qquad (2)$$

Given (2), creditors are expected to get $\left(p_H(\overline{R} - \overline{R}_f) + (1 - p_H)(\underline{R} - \underline{R}_f)\right)I$. Since they require at least $(I - A)\,\gamma$, the investment is feasible if:

$$(I - A)\,\gamma - \left(p_H(\overline{R} - \overline{R}_f) + (1 - p_H)(\underline{R} - \underline{R}_f)\right)I \leq 0 \qquad (3)$$

We make two further assumptions about the parameter space:

$$\begin{array}{ll} (a)\ 0 < p_H\left(\overline{R} - \frac{b}{\Delta p} + c\right) + (1 - p_H)\underline{R} < \gamma \\ (b) \qquad\qquad\qquad\qquad c - p_H\frac{b}{\Delta p} < 0 \end{array}; \qquad (4)$$

Condition (4a) ensures that the pledgeable unit return from investment to the creditor is smaller than the return requirement of outside investors. This assumption rules out infinite investment. Condition (4b) ensures that the private bankruptcy cost is small enough to make it worthwhile for the promoter to invest.

To elaborate, the model and the notation closely follow Holmström and Tirole (1997). We abstract from financial intermediation and add liquidation value and private bankruptcy costs to support our research focus. These changes to the model influence the constraints (2)–(4) and the target function without altering their bi-linear structure.

3.2. The optimal contract

The optimal contract between a firm and creditors maximizes the firm's expected returns subject to (2)–(4) in the restricted domain:

$$\begin{gathered}\underset{I,\overline{R}_f,\underline{R}_f}{Max} \quad \left(p_H\overline{R}_f + (1-p_H)\left(\underline{R}_f - c\right)\right)I \\ s.t. \\ (2);(3); A - I \leq 0; 0 \leq \overline{R}_f \leq \overline{R}; 0 \leq \underline{R}_f \leq \underline{R}\end{gathered} \tag{5}$$

Under the bi-linear objective function, the maximum is always found at the constraints. The unique maximum (denoted by the asterisk) is characterized by:

$$\begin{aligned} &(a) \qquad \overline{R}_f^{\,*} = \frac{b}{\Delta p} - c \\ &(b) \qquad \underline{R}_f^{\,*} = 0 \\ &(c) \qquad I^* = \frac{\gamma A}{\gamma - p_H\left(\overline{R} - \frac{b}{\Delta p} + c\right) - (1-p_H)\underline{R}} \end{aligned} \tag{6}$$

The payoff to the firm under success (6a) binds constraint (2), the minimum to make the good investment type preferable for the promoter. The payoff of the firm under failure (6b) binds the non-negativity constraint. The firm is not paid if the project fails to minimize the agency cost of investment. Investment (6c) binds the investment feasibility constraint (3) at a level that is positive and finite under assumptions (4).

Proposition

Leverage is characterized in equilibrium by

$$\frac{I^* - A}{I^*} = \frac{p_H\left(\overline{R} - \frac{b}{\Delta p} + c\right) + (1-p_H)\underline{R}}{\gamma} \tag{7}$$

Proof (7) follows from (6c).

We note from (7) that equilibrium leverage is positive under (2) and below unity under (4). The main analytical focus is on how the parameters that are influenced by the CRR, namely the private bankruptcy cost c and the liquidation value $\underline{R}$, impact leverage. We observe from (7) that leverage increases in both variables as they increase the pledgeable unit value of investment given by the numerator on the right-hand side of (7). Liquidation value $\underline{R}$ increases pledgeable value because it is distributed in full to the creditors in equilibrium. The bankruptcy cost c

increases pledgeable value because it reduces the incentive compatible payoff to the promoter. We refer to the former as the liquidation value channel, and the latter as the agency cost channel.

3.3. Using theory to guide identification

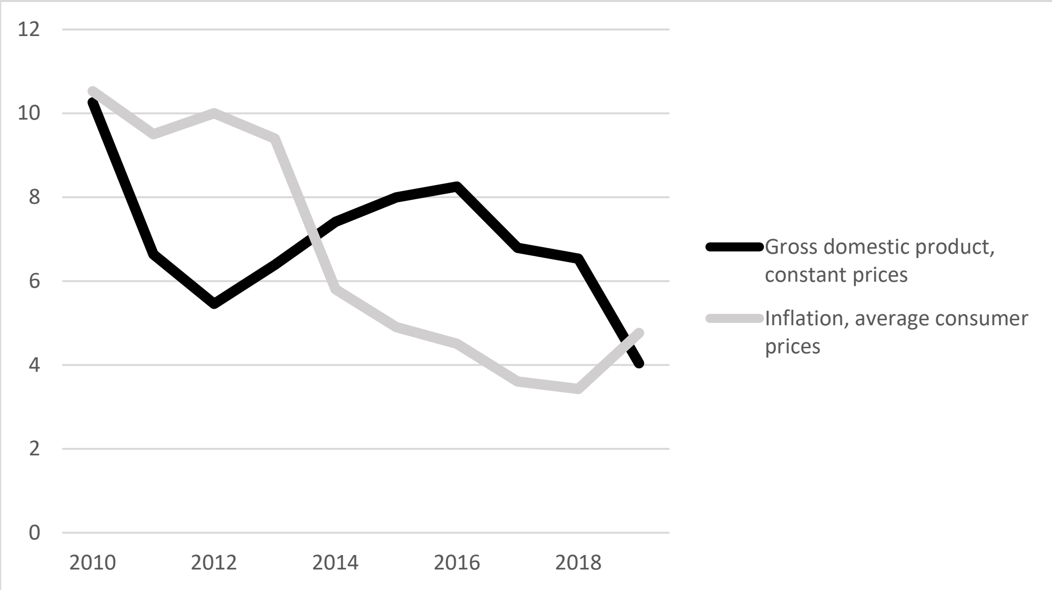
A key identification challenge is that $\underline{R}$ and c are unobservable or only partially observable in practice. While an important aim of the IBC in India was to maximize the value of assets of stressed firms, it is difficult to quantify the extent to which it benefited creditors. However, the finding that insolvency proceedings have greatly increased in number since the IBC (Abhirami and Rahul, 2022) suggests that the new regulation adds value for creditors. We therefore operate under the assumption that the IBC increased $\underline{R}$. Under this assumption, the finding of a negative overall effect on IBC on leverage implies under (7) a decrease in c.

4. The estimation period and the data

We test the theory with Indian data over the period from April 2010 to March 2020. The period is divided into ten fiscal years. Indian fiscal years run from April to March, and financial reporting of firms in India is regulated according to the fiscal year. For ease of presentation, we refer to each fiscal year by the year of its final quarter. Thus, the fiscal year from April 2015 to March 2016 is referred to as "2016" in the text, charts, and tables, unless otherwise stated.

At the start of the estimation period the turbulence caused by the global financial crisis had largely subsided and the Indian economy had recovered its dynamism. During the estimation period, India experienced rapid economic growth in the range of 5–10 % a year (Fig. 2). The moderation in inflation reflected, in part, India's transition to the inflation targeting monetary policy regime in 2016. At the end of the estimation period in 2020, the global Covid pandemic was just getting underway and India's government was intensifying its response.

Figure 2. Macroeconomic trends in India, 2010–2019, year-on-year % change.



Notes: The years in the horizontal axis refer to calendar years.
Data Source: IMF WEO database, October 2021.

Over the past three decades, India has improved creditor rights in a stepwise manner (Annex). The reforms of the 1990s and early 2000s strengthened the rights of financial institutions and creditors holding secured debt. Our sample period included the enactment of two major legislative reforms intended to promote equitable treatment across all creditors and a more timely and efficient insolvency process. The Companies Act of 2013 established national company law tribunals (NCLTs) to adjudicate insolvency cases. A more level playing field across creditors was achieved in 2016 through enactment of the Bankruptcy Code (IBC).

India's legacy of asymmetric reform implies that the IBC also impacted creditors asymmetrically. Since the pre-IBC legislation strongly favored banks and secured creditors, the marked leveling of the playing field by the IBC disproportionally impacted unsecured non-bank creditors. Under the IBC, for example, it became possible for any creditor to apply for initiation of an insolvency process. Previously, initiating an insolvency proceeding was limited mainly to financial creditors and secured creditors (Vig, 2013).

For identification, we exploit variation across firms in their reliance on unsecured non-intermediary creditors. Our treatment group are firms which in 2011-2016 show high reliance on un-secured non-intermediated credit. The control group are firms that displayed low reliance on such credit in 2011–2016.

For the estimations, we use the CMIE Prowess database, which covers 1–2 % of India's registered firms. Large firms are over-represented in Prowess. For example, the average level of equity capital in our data is typically two to three times larger than in the official aggregates by the Ministry of Corporate Affairs. We think that this sampling issue may bias our findings towards weaker impact based on the prior that the IBC disproportionately influenced the smaller firms, which were less impacted than many larger firms by previous creditor rights reforms.

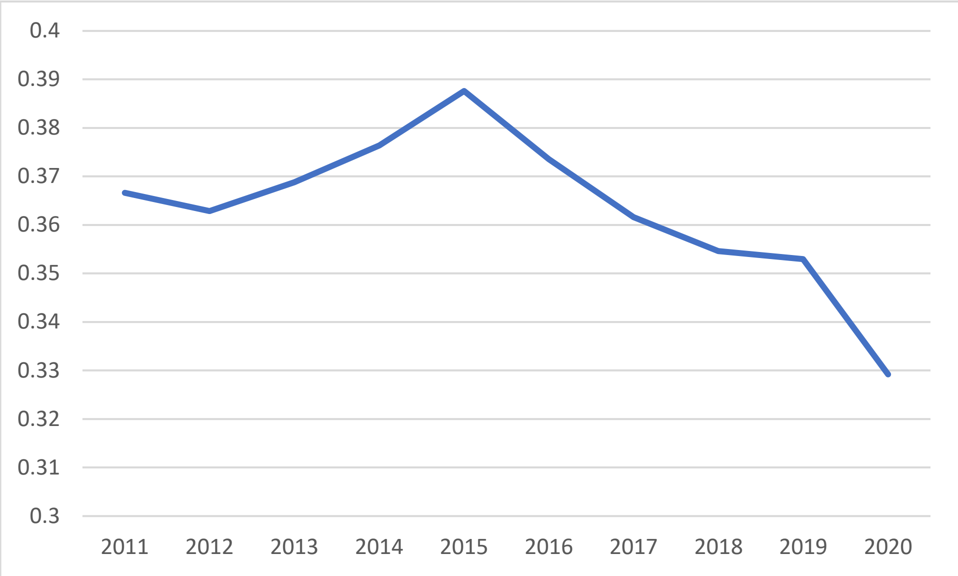
After experimenting with two widely used definitions of leverage (debt-to-total assets ratio and debt-to-equity capital ratio), we settled on debt-to-total assets ratio as our leverage measure to promote model stability. When the debt-to-equity ratio was used, the estimations are highly sensitive to the few observations with very low levels of equity capital. On average, leverage is at 0.36 in the sample of about 170,000 observations (Table 1). It shows significant dynamics (Figure 3), peaking around 2015, about one year before enactment of the IBC.

Table 1. Data description

Variable	Obs.	Mean	Std. Dev	Min.	Max.
Leverage	172,655	0.36	0.26	0.00	1.00
Debt	172,655	44.4	411.5	0.0	44151.8
Total Assets	172,655	122.5	1118.9	0.0	130747.8
Debt from financial institutions	126,058	26.0	202.2	0.0	18670.2
Unsecured debt	119,669	21.2	298.6	0.0	30248.3

Notes: Leverage: total debt divided by total assets. Total Assets and debt are measured in INR. Obs: number of observations; Std. Dev: standard deviation.
Data source: CMIE Prowess; Data frequency: annual; Data period from April 2010-March 2020 (10 fiscal years).

Figure 3. Average leverage by year.



Notes: The figure shows the average leverage of firms by fiscal year.
Data sources: CMIE Prowess database, authors' calculations.

5. Empirical analysis

5.1. Setting up the DiD model

Following the CRR literature, we use the DiD approach to estimate the overall effect of IBC on leverage. To construct the treatment and control groups, we first calculate a proxy for firm dependence on unsecured non-intermediated debt (*USNI*). The proxy builds on data about the share of unsecured debt to total debt (*US*) and the share of debt from financial institutions to total debt (*FI*).

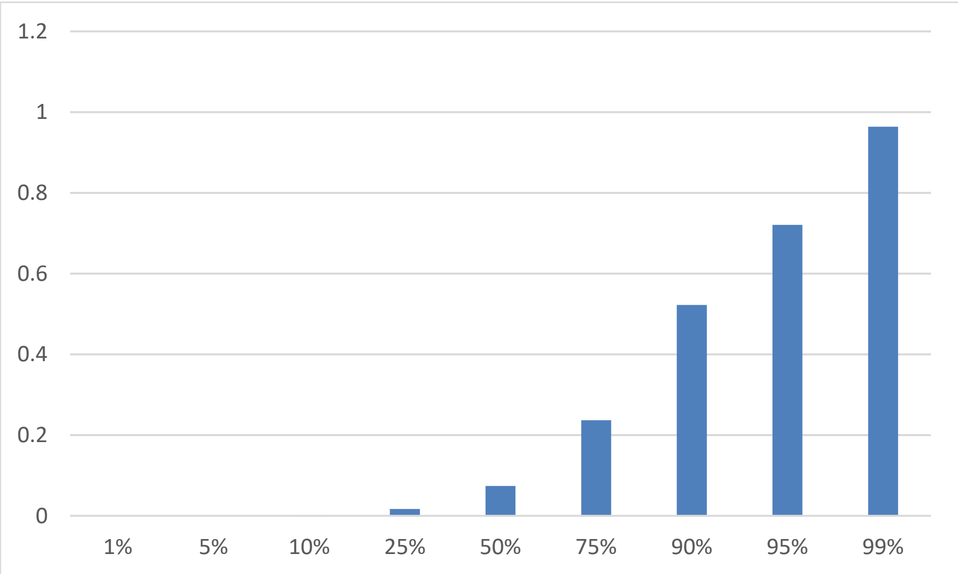
Under the assumption that *US* and *FI* are independent, the expected value of *USNI* is:

$$USNI = US * (1 - FI) \quad , \qquad (9)$$

where the expression $(1 - FI)$ indicates the share of non-intermediated debt. We use (9), averaged over the period 2011–2016 to ensure exogeneity relative to the IBC, as our baseline indicator of the dependence of firms on unsecured non-intermediated debt. For nearly a quarter of firms, *USNI* is negligible, and for half of them, it is below 10 % (Fig. 4). For about 10 % of firms, *USNI* exceeds 50 %.

Following Vig (2013), we use the extreme quantiles of the identification variable as the estimation data. In the benchmark model, we use firms in the highest and lowest decile of *USNI* as our treatment and control groups, respectively. This decile-based identification approach is visually attractive as it highlights the stark difference in *USNI* between the two extreme deciles. A decile-based approach also leads to especially strong performance in the parallel trend tests. For robustness, we also investigate models where extreme quartiles serve as the estimation data.

Figure 4. The mean of *USNI* by quantile.



Notes: The figure shows the average value of *USNI*, calculated over the period 2011–2016, in selected quantiles.
Data sources: CMIE Prowess database, authors' calculations.

We also explore alternative formulations of *USNI* to investigate the robustness of the analysis to possible correlation between *US* and *FI*. The *USNI* variants are constructed by weighting the extreme points (Frèchet bounds) in the domain of *USNI*, which are $max(0, US - FI)$ if *US* and *FI* are perfectly positively correlated, and $min(US, 1 - FI)$ if they are perfectly negatively correlated.

Building on the definition of *USNI*, and the approach for selecting treatment and control groups, the regulatory effect is estimated with the DiD model:

$$Leverage = \alpha 1 + \alpha 2 * Treatment\ group + \alpha 3 * Treatment\ period + \\ + \alpha 4 * Treatment\ group * Treatment\ period) + \alpha 5 * Other + \epsilon \qquad (10)$$

The focus of interest is the parameter $\alpha 4$, which indicates the difference between treatment and control after IBC was enacted. For the estimations, we mainly use the panel fixed-effects regression approach to enhance the control of unobserved time-invariant confounders at the state and firm level. Indian states vary considerably in terms of their economic structure and speed of development. Such factors, if not accounted for, could interfere with the estimations.

5.2. Internal validation of the agency cost channel

Before estimating the DiD models presented in Table 5, we test the parallel trends assumption in the estimation samples using a model specification that includes a full set of time fixed effects and pre-treatment interaction terms (not shown to save space). Wald tests yield p-values above 90 % in Models 1–3 and 5, and above 50 % in Model 4, consistently supporting the null hypothesis that the pre-treatment interactions are jointly insignificant. This indicates that, prior to treatment, leverage trends were similar between the treated and the control groups.

The estimated treatment effects are negative, small in magnitude (approximately –0.02), and statistically significant across all model specifications (Table 5). Our benchmark specification is Model 1, which employs a panel fixed effects estimator with standard errors clustered at the state level. The clustering choice reflects the substantial heterogeneity in economic structure across Indian states. Model 2 clusters residuals at the firm level.

Model 3 implements a placebo test by including a lead treatment variable; the coefficient is statistically insignificant, lending further credibility to the identification strategy. Model 4 confirms the robustness of the results when treatment and control groups are defined using quartile thresholds. Model 5 addresses the possibility of negative correlation between unsecured (*US*) and financial institution-intermediated (*FI*) debt. In this specification, the *USNI* index is computed using the formula *USNI=0.1*max(0, US-FI)+0.9*min(US, 1-FI)*, which is close to the case of extreme negative correlation. Further experimenting with the alternative weights (not shown), we find that our results are not qualitatively sensitive to the weighting of the Frèchet bounds, indicating robustness to positive or negative correlation between *US* and *FI*.

Table 2. Estimation result for the overall impact of IBC on leverage

Variables	Model 1 Leverage	Model 2 Leverage	Model 3 Leverage	Model 4 Leverage	Model 5 Leverage
Treatment* TreatmentPeriod	-0.0275***	-0.0276***	-0.0160**	-0.0174***	-0.0290***
1 lead Treatment*TreatmentPeriod			0.000276		
Firm fixed effects	X	X	X	X	X
State clustered residuals	X		X	X	X
Firm clustered residuals		X			
N	24,069	24,084	18,134	61,593	24,086
R2	0.009	0.009	0.007	0.010	0.009
Treatment at highest	Decile	Decile	Decile	Quartile	Quartile
USNI	Baseline	Baseline	Baseline	Baseline	Alternative

Notes: The table shows a subset of parameter estimates based on Eq. (10). The estimation period is 2011-2020. The estimation sample are firms at the lowest and highest quantiles of USNI. The dependent variable is Leverage defined as the total debt to total assets ratio; */**/***: significance at the 10-, 5-, and 1-% level based on the standard t -test; Obs.: the number of observations; R2: coefficient of determination.
Data source: CMIE Prowess database.

5.3. External validation based on the impact of IBC on credit limits

In the context of the novel theory, the evidence of countermovement presented in Table 2 validates the agency cost channel. This interpretation of countermovement is in contrast with the prevailing theory by Vig (2013) and S&S (2022), where countermovement is indicative of a fall in credit demand driven by an increase in the private bankruptcy costs of the promoter.

To assess the empirical relevance of the novel theory relative to the incumbent models, we examine the effect of the IBC on credit limits. Notably, incumbent theories assume that firms are not credit constrained, and therefore do not derive testable predictions about borrowing capacity. In contrast, our proposed theory explicitly links liquidation value channels and agency cost channels to credit limits. It predicts that the decrease in leverage following the IBC is the result of a lowering of credit limits via the agency cost channel.

To validate our theory against the incumbent theories, we provide evidence that its central prediction that credit limits declined after the IBC is supported by the data. This external validation lends credibility to our theory against the incumbent theories as it delivers empirically relevant predictions not addressed by the incumbent models.

As a preliminary to the analysis, we compare the leverage distributions ex ante (before 2017) and ex post (after 2016). If, as we suspect, the IBC caused a reduction in the credit limits, then we would expect that average leverage falls ex post at the top decile of the leverage distribution (where firms are at or close to their limit). Furthermore, we would expect that the decline is greater in the treatment group, where the impact of the IBC was stronger than in the control group.

Table 3. Average leverage in the highest leverage decile

Period	Full sample	Treatment group	Control group
2011–2016	0.75	0.83	0.66
2017–2020	0.72	0.77	0.65

Notes: The table shows average leverage in the highest decile of the estimation sample of Model 1 in Table 2.
Data source: CMIE Prowess database.

This is, indeed, what we find (Table 3). In the uppermost decile of the leverage distribution, average leverage drops from 75 % to 72 % after the IBC. Furthermore, the drop is more pronounced in the treatment group (from 83 % to below77 %) than in the control group (from 66 % to below 65 %). We therefore conclude that the leverage distribution shows right-tail changes that are consistent with a reduction in credit limits caused by the IBC.

Further evidence of a fall in credit limits is provided by the approach first presented in Herrala (2009) and pioneered by Adelegan and Herrala (2026) to estimate the impact of CRR on credit limits. Under that approach, credit limits are estimated by stochastic frontier analysis from the debt or leverage distribution of firms. Among the different approaches used in the literature to estimate credit limits (Anenberg et al., 2019), this approach has the particular advantage of a transparent link to the empirical framework used in our study.

Under the chosen approach, the impact of IBC on credit limits is estimated by maximum likelihood from the stochastic frontier model:

$$\ln(Leverage) = \alpha 1 + \alpha 2 * NonBankDependent + \alpha 3 * TreatmentPeriod + \\ + \alpha 4 * NonBankDependent * TreatmentPeriod + \epsilon - v, \qquad (11)$$

where ln indicates the natural logarithm, ϵ is independent random noise, and v is a one-sided independent random variable from the positive reals. The model

(11) decomposes leverage into three main (log)additive components: the first four rows give the systematic component of the credit limit; ϵ is the random component; and the one-sided random variable v is the distance of firms from the limit. The first four rows further decompose the systematic component of the limit into sub-components in line with the standard DiD approach. The parameter of interest is $\alpha 4$, which is the impact estimate of IBC on credit limits.

A comparison of (11) and (10) demonstrates the link of this empirical approach to our previous analysis. We observe that the DiD model given in (10) is replicated (up to a monotonic transformation) at the first five rows of (11): if the distribution of v is singular, then (11) reduces to (10). We already know from Table 2 that under the assumption that the distribution of v is singular, we find a decline in credit limits. With the stochastic frontier model (11) we may test the development of credit limits under the assumption that v is continuous. Estimation of (11) therefore extends our analysis from the theoretical case where all firms flock at the limit to the case where they are continuously distributed between zero and the limit.

Table 4. Estimations based on non-bank dependency

	(1)	(2)	(3)	(4)
Treatment group*Treatment period	-0.133***	-0.0538***	-0.0377***	-0.0361***
state and sector dummies		X	X	
time varying v distribution				X
time varying ϵ distribution				X
Treatment at highest	Decile	Decile	Quartile	Quartile
Panel estimator	X			
Distributional assumptions	NT	NE	NE	NHN
Obs.	24,079	24,064	60,199	60,214

Notes: The table shows a subset of the parameters estimated using Eq (11). The estimation period is 2011-2020 The estimation sample are firms at the lowest and highest decile of bank dependency. The dependent variable is the natural logarithm of Leverage. The models are estimated by maximum likelihood. NT: Normal-Truncated Normal; NE: Normal-exponential; NHN: Normal-Half-Normal distribution. */**/***: significance at the 10-, 5-, and 1 % level based on the z -test.
Data source: CMIE Prowess database.

A limitation of the empirical approach is that the parameter estimates rely on the joint distribution of the error terms ϵ and v, which is not observed. In our experiments with specification (11), we found that in some cases the model failed to converge or that convergence eventually ended with a model that was statistically insignificant based on the Wald test. We interpret these outcomes as signs that the chosen distributional assumptions were weak. However, in many other instances, the model converged quickly and yielded statistically significant results (see Table 4). In these cases, the estimated interaction term is negative, suggesting that the IBC led to a reduction in credit limits. Notwithstanding the issues related to model convergence and significance, the estimations establish that the finding of a decline in credit limits is robust across a range of distributional assumptions within the stochastic frontier framework.

6. Discussion and conclusions

This paper contributes to work on the impact of creditor rights reforms (CRRs) on leverage by expanding current theory and providing empirical evidence. Building on a partial equilibrium agency cost approach, our proposed theory predicts that the liquidation value and the promoter's private bankruptcy costs increase leverage. We show the existence of an "agency cost channel," which has not been previously discussed in the CRR literature, whereby an increase in the promoter's private bankruptcy costs decreases the agency costs of lending, thereby increasing credit limits, borrowing, and leverage.

We test the theory with data from the past decade that bracket India's recent creditor rights reforms. The empirical findings suggest that overall, the strengthening of creditor rights in India led to a decrease in leverage. Under our proposed theory, the finding of countermovement between creditor rights and leverage validates the existence of an agency cost channel. The theory is validated against incumbent theory by evidence of a decline in credit limits, which is predicted by our model but not the incumbent theories.

We look forward to future testing of this novel theory in other contexts. Looking ahead, we also see value in integrating the agency cost and credit demand channels within a unified theoretical framework. Such integration would deepen our understanding of how creditor rights influence leverage through both supply-side and demand-side mechanisms. A promising direction for future research is to extend the proposed model to incorporate heterogeneity in firms' distance from their credit limits, allowing for more realistic predictions across diverse firm types.

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Appendix

A timeline of India's recent bankruptcy regulation

1985 The Sick Industrial Companies act

1993 Recovery of Debts and Bankruptcy act

2003 SAFRAESI

2013 The Companies act of 2013

2016 The Insolvency and Bankruptcy Code

Under the Sick Industrial Companies Act of 1985, only the company in question, certain public entities and banks could initiate the insolvency process. Once started, the insolvency process was administered by the Board of Industrial and Financial Reconstruction (BIFR), a development finance institution owned by the Ministry of Finance. The recovery process laid down in the Sick Industrial Companies Act was widely regarded as inefficient, characterized by a lengthy process and low recovery rates (Kulkarni et al., 2025).

In 1993, debt recovery tribunals were established to speed up recovery of the non-performing loans of financial institutions. The Securitisation and Reconstruction of Financial Assets and Enforcement of Security Interest Act of 2003 (SAFRAESI Act) was intended to promote rapid rapid recovery from secured debt.

With the passage of the SAFRAESI Act, only recovery from unsecured debt and debt from the non-financial sector remained solely under the Sick Companies

Act. A series of further reforms during the past decade also apply to unsecured debt. The reforms were launched with the Companies Act (enacted in August 2013), which replaced BIFR with national company law tribunals (NCLTs). These tribunals are made up of judicial and technical experts appointed by the Ministry of Corporate Affairs. In 2016, the Sick Industrial Companies Act was repealed and in its place the Insolvency and Bankruptcy Code (IBC) was enacted in May 2016. Under the IBC, any creditor may initiate the insolvency process, which must then be resolved in under 180 days by an NCLT.

The IBC was followed by official communication by the Reserve Bank of India (RBI) encouraging banks to resolve their non-performing loans via the IBC. An RBI ruling of February 2018 required prompt reporting by banks of delinquent borrowers, and limited forbearance in the handling of such borrowers. Following a legal challenge by banks against the RBI's ruling, the RBI issued revised guidelines in April 2019 that imposed a 30-day limit for reporting about delinquent borrowers and ceded to banks the power use their own discretion in deciding whether to initiate bankruptcy proceedings against delinquent borrowers.

The implementation of the IBC was suspended from May 2020 to March 2021 due to the Covid pandemic.