Bankruptcy Resolution and Credit Cycles[*]

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Abstract

We study how the macroeconomic dynamics following credit cycles vary with business bankruptcy institutions. Using data on bankruptcy efficiency and business credit across countries, we document that business credit booms are followed by severe declines in output, investment, and consumption in environments with poorly functioning business bankruptcy. On the contrary, in settings with well functioning business bankruptcy, the aftermath of credit booms is characterized by moderate changes in economic activities. We use a simple model to lay out how and when efficient bankruptcy systems can mitigate the negative consequences of credit booms.

1 Introduction

Credit cycles have been a leading topic in discussions about macroeconomic stability and macro-prudential policies over the past decade. Following a growing body of evidence that credit booms often lead to economic turmoil (Schularick and Taylor, 2012; Jordà, Schularick, and Taylor, 2013; Mian, Sufi, and Verner, 2017; Greenwood et al., 2022; Ivashina et al., 2024), researchers and policymakers have considered using macroprudential policies to restrain credit expansions and prevent crises. However, macroprudential policies also have costs (e.g., they can introduce regulatory burdens or lead to misallocations). Therefore, a critical task for guiding these policies is to identify the settings where credit booms are more or less likely to create real damage. In the aftermath of credit booms, real damage often arises from firms suffering through inefficient resolution of distress and default, which can disrupt economic activities and aggravate output losses. Accordingly, institutions for the resolution of distress and default can be an important ingredient in the design of macroprudential policies.

In this paper, we study how institutions for business bankruptcy relate to the macroeconomic dynamics following of credit cycles. Using data on bankruptcy efficiency and business credit across 39 countries, we document that business credit booms are followed by severe economic contractions in environments with poorly functioning business bankruptcy. On the contrary, in settings with well functioning business bankruptcy, the aftermath of credit booms is characterized by moderate changes in output, investment, and unemployment. We use a simple model to lay out how bankruptcy resolution affects macro outcomes, and why more efficient bankruptcy systems can mitigate the negative consequences of credit booms.

At a high level, institutions for business bankruptcy resolve firms' distress and default through two main approaches. A traditional approach is to terminate firms' operations, liquidate their assets, and pay out the proceeds. This option is available in most countries. Another relatively more modern approach is to restructure viable firms where the continuation value from operations (i.e., "going-concern value") is greater than the liquidation value. For instance, in U.S. Chapter 11 restructuring, viable firms continue to operate, and creditors' payoffs are given by the going-concern value as verified and approved in court. Well functioning restructuring systems can reduce inefficiencies from liquidation, such as the loss of valuable organizational capital and the costs of redeploying specialized assets (Corbae and D'Erasmo,

2021; Bernstein, Colonnelli, and Iverson, 2019; Crouzet, Eberly, Eisfeldt, and Papanikolaou, 2022; Kermani and Ma, 2023), but these systems are challenging to build and relatively rare. Bankruptcy systems typically have higher efficiency if viable firms can continue to operate, and the procedure does not take too long or incur too much costs.

To measure the quality of a country's bankruptcy system, we follow the work by Djankov et al. (2008) and World Bank (2020). This measure assesses the amount of value that can be preserved for a viable company in financial distress. The data suggest that bankruptcy efficiency varies substantially around the world. For a standardized case where the company has continuation value 100 and liquidation value 70, the value that can be preserved after bankruptcy is 39 on average, with a standard deviation of 25. Indeed, some countries can only manage to liquidate the firm, and yet the process is expected to take years and incur high administrative expenses; meanwhile, other countries can restructure the firm successfully with a reasonable amount of expenses. We also obtain data on business credit from the Bank of International Settlements (BIS). This dataset contains both business credit issued by banks and credit extended by nonbanks (e.g., corporate bonds).

Our empirical analysis proceeds by estimating state-dependent local projections, which trace out how economic activities evolve following changes in business credit to GDP, in countries with high and low efficiency of business bankruptcy. We find that countries with better bankruptcy systems are less vulnerable to credit cycles. For instance, following a 10 percentage point increase in business credit to GDP over the past 5 years, output in the next 5 years declines by around 3 percentage points if bankruptcy efficiency is at the bottom quartile. In contrast, the decline is negligible when bankruptcy efficiency is at the top quartile. We also observe declines of investment and consumption, as well as increases of unemployment in countries with low bankruptcy efficiency, but to a lesser extent in countries with high bankruptcy efficiency. We verify that the differences in macroeconomic outcomes are not due to bankruptcy efficiency being correlated with development status, exchange rate pegging, or general rule of law, which might be some other factors that can affect the shape of credit cycles. The results are similar when we instrument bankruptcy efficiency with legal origins following Davydenko and Franks (2008). The results also hold when controlling for the size of the credit market (the level of business credit to GDP). Our exposition uses credit booms for simplicity, i.e., positive changes in business credit to GDP, but the results are symmetric for negative changes in business credit to GDP.

To interpret our empirical findings, we develop a simple model that links credit cycles and bankruptcy efficiency. In the model, firms finance investments with defaultable debt. Following default, firms either liquidate or reorganize. Weaker bankruptcy institutions increase the likelihood of inefficient liquidation, which generates greater output losses. We consider both "fundamental" credit booms, driven by rational expectations of increases in firms' productivity, and "nonfundamental" credit booms, driven by increases in credit supply or credit demand due to changes in discount rates or biased beliefs. As in the empirical analyses, our exposition here uses credit booms (i.e., increases in business credit) for simplicity, but the model predictions are symmetric for decreases in business credit too.

Our model analysis shows two main results. First, nonfundamental credit booms are be followed by lower output and more defaults, consistent with our findings and with previous empirical studies of credit cycles (Schularick and Taylor, 2012; Mian, Sufi, and Verner, 2017). In this case, more efficient bankruptcy systems mitigate the negative consequences of these credit booms, by decreasing the likelihood of inefficient liquidation in default; this is also consistent with our empirical evidence. Second, in our model, fundamental credit booms are be followed by higher output and fewer defaults, which is inconsistent with the patterns we document in data. In this case, a more efficient bankruptcy system dampens the positive impact of a credit boom, since a more efficient bankruptcy system leaves less room for increases in firms' productivity to decrease the amount of defaults and inefficient liquidations; this is again inconsistent with our empirical evidence. Overall, our findings suggest the importance of nonfundamental driven credit booms, in line with the literature. In this setting, bankruptcy efficiency ameliorates the negative consequences of credit booms.

The importance of bankruptcy institutions for credit cycles is illustrated vividly by the experience of Japan in the last two decades of the 20th century. Bankruptcy institutions in Japan were relatively under-developed until the late 1990s, with a tedious process and a focus on liquidation (Tan, 2004; Anderson, 2006). Business lending in Japan traditionally relied heavily on real estate, and a sharp business credit boom occurred when real estate prices surged in the late 1980s. The boom ended with the collapse of real estate prices, and Japan suffered substantially from negative macroeconomic consequences (Gan, 2007; Caballero, Hoshi, and Kashyap, 2008). With an inefficient bankruptcy system, bad debt problems were challenging to resolve. Correspondingly, firms were strained by debt overhang, while banks were burdened by nonperforming loans and often opted to evergreen such loans as default resolution was cumbersome. These issues exacerbated credit contractions, resource misallocations,

and economic downturns. As bad debt problems proliferated, Japanese policymakers recognized the importance of bankruptcy institutions and embarked on a major bankruptcy reform that lasted from 1996 to 2005.

In the U.S., where business bankruptcy institutions are among the most developed in the world, business debt has not been a primary source of macroeconomic instability. Instead, households and financial institutions, where default resolution has been much more challenging, have played a central role in credit cycles that ended in economic turmoil (Gertler and Gilchrist, 2018). However, business bankruptcy institutions perform poorly in many countries Djankov et al. (2008), and corporate credit booms appear to have been an important contributor to macroeconomic instability around the world in the 20th century (Ivashina et al., 2024).

Literature review   Our paper relates to several strands of literature. First, we extend the work on financial frictions and economic fluctuations. An influential line of research highlights that frictions in debt enforcement can exacerbate economic fluctuations (Kiyotaki and Moore, 1997; Bernanke, Gertler, and Gilchrist, 1999). A growing body of empirical work documents the negative consequences of credit booms in general (Schularick and Taylor, 2012; Jordà, Schularick, and Taylor, 2013; Greenwood et al., 2022) and corporate credit booms in particular (Müller and Verner, 2023; Ivashina et al., 2024). The most closely related research is Jordà, Kornejew, Schularick, and Taylor (2022), who focus on recessions and show that greater frictions in corporate debt resolution are associated with slower recoveries. We do not restrict to recessions, and we study a variety of macroeconomic outcomes following changes in business credit to GDP in general (e.g., what happens after credit booms or contractions). Indeed, we observe that, in countries with lower bankruptcy efficiency, credit booms are followed by a higher likelihood of recessions in the first place. We also provide a model to delineate how bankruptcy efficiency matters for the macroeconomic impact of credit cycles.

Second, we connect law and macroeconomics. An important literature has examined how financial markets and firm outcomes are affected by legal systems in general (La Porta et al., 1998), as well as bankruptcy institutions in particular (Acharya and Subramanian, 2009; Gilson, 2012; Vig, 2013; Ponticelli and Alencar, 2016; Becker and Josephson, 2016; Iverson, 2018; Becker and Ivashina, 2022). We focus on the macro consequences of credit cycles, which represent one of the most important challenges for economic stability. It is natural that the legal systems affect financial frictions, which in turn affect

macroeconomic outcomes.

Third, we provide a new perspective on macroprudential policies. The traditional approach relies on regulatory tools to prevent credit booms, in order to avoid costly recessions in the aftermath of these booms (Hanson, Kashyap, and Stein, 2011; Bianchi and Lorenzoni, 2022). Our evidence suggests that the macroeconomic dynamics following credit booms depend on institutions for default resolution. Improving these institutions is another approach for enhancing macroeconomic stability. To the extent that existing macroprudential tools could be blunt or costly (Ottonello, Perez, and Varraso, 2022; Andreasen et al., 2023), they may be less necessary in environments with high bankruptcy efficiency.

The rest of the paper is organized as follows. Section 2 outlines the economic functions of insitutions for business bankruptcy. Section 3 describes the data. Section 4 provides the empirical results on how bankruptcy efficiency relates to the macroeconomic consequences of credit booms. Section 5 uses a simple model to illustrate the mechanisms. Section 6 concludes.

2 The Economics of Business Bankruptcy

Why are legal institutions for business bankruptcy important? We proceed in two steps in this section. In Section 2.1, we discuss the relevance of default resolution for firm and macroeconomic outcomes. In Section 2.2, we then discuss the relevance of legal institutions on business bankruptcy for default resolution. In Section 2.3, we illustrate the importance of bankruptcy institutions for macroeconomic outcomes with the case of Japan.

2.1 Default Resolution and Economic Implications

Human civilizations have used debt contracts to support business activities for thousands of years. Since the earliest days, it has been well recognized that lenders are only willing to supply funding if they can expect to be paid back. There are several approaches of debt enforcement if borrowers default.

One approach is to impose severe punishment, such as debtors' prison (in ancient times) or autarky analyzed in many studies of sovereign default (Eaton and Gersovitz, 1981; Bulow and Rogoff, 1989). This approach is perhaps rare for commercial credit in today's world. It can be rather inefficient,

especially for "honest but unfortunate debtors," such as a viable company hit by adverse liquidity shocks (or firms during Covid).

Another approach is that firms pledge physical assets in order to borrow, which creditors can seize in the case of default. This approach exists in most countries, and has influenced many macroeconomic models (Kiyotaki and Moore, 1997; Bernanke, Gertler, and Gilchrist, 1999). It is natural if property rights over assets can be enforced, but cash flows are not verifiable. However, it can be inefficient too in the case of viable companies in financial distress (Diamond, 2023).

A third approach is to implement financial restructuring, and remunerate lenders with the continuation value of the company. This approach can be beneficial for viable companies in financial distress (Gilson, 2010). It tends to rely more on cash flow verifiability. For instance, in Chapter 11 restructuring in the U.S., viable firms continue to operate (instead of being liquidated), and creditors' payoffs are given by the "going-concern value" (i.e., the value of cash flows from ongoing operations) of the company post reorganization as verified and approved in court.

Default resolution affects "ex post" economic outcomes during distress, with a direct impact on resource allocation. Ideally, viable companies in financial distress should be kept alive, and nonviable companies in economic distress should be liquidated. However, inefficient default resolution may liquidate viable companies, or keep around nonviable firms whose assets have better use elsewhere. Inefficient default resolution can also distort banks' allocation of credit, by creating stronger incentives for ailing banks to evergreen nonperforming loans instead of resolving them (Becker and Ivashina, 2022). For these reasons, inefficient default resolution can exacerbate recessions.

Default resolution also affects "ex ante" credit availability and the determinants of firms' debt capacity. For example, with well-functioning restructuring system, creditors' payoffs in default are tied to the going-concern value of the company, which facilitates borrowing against earnings (Lian and Ma, 2021). Conversely, when liquidation dominates, pledging physical assets is especially important for borrowing, and companies' debt capacity can be more sensitive to real estate value.

What shapes the feasibility of each approach of default resolution? As mentioned above, the liquidation approach relies on property rights over assets, and the restructuring approach often relies on cash flow verifiability. In addition to these basic components, additional support from the legal system can be necessary, especially for restructuring which tends to be a more complex process. We discuss the

role of the legal institutions for business bankruptcy in the following.

2.2 The Role of Bankruptcy Institutions for Default Resolution

Bankruptcy is a legal process aimed to facilitate the resolution of financial and economic distress.[1] In the absence of legal institutions for business bankruptcy, private parties may encounter information frictions regarding the value of the debtors' assets and liabilities, as well as coordination frictions among different claimholders. Both types of frictions can shrink the total size of the pie ex post, and affect debt availability ex ante (Morris and Shin, 2004; Smith and Strömberg, 2005; Dou et al., 2021; Guntin, 2023). Legal institutions, with a combination of statues and court implementation, can improve the provision and verification of information and aid coordination.

In the case of liquidation, the key objective is to organize an orderly wind-down process. In this process, it is useful to verify the debtor's total assets and liabilities, as well as the priority structure among different claimholders. It may also be useful to coordinate the liquidation process to maximize the receipts from asset sales (e.g., when assets pledged to different parties have complementarity).

In the case of restructuring, addressing information frictions and coordination frictions is even more important. In this process, it is crucial to verify the debtor's assets, liabilities, and cash flows. In addition, a significant amount of coordination among claimholders may be required to reach a restructuring plan. Unilateral actions taken by creditors to seize their collateral (out of concerns regarding the value of their assets, the priority they have with respect to other creditors, or actions taken by other creditors) can disrupt continuing operations and destroy viable businesses.

Finally, adjudicating whether a company is viable requires reliable information and considerable coordination. Coordination frictions are typically more severe for large companies with complex operations and liability structures. Information frictions can apply to both large and small companies.

The legal process for business bankruptcy addresses information frictions and coordination frictions in several ways. First, the court can provide a centralized forum for information gathering and disclosure. In the U.S., debtors submit a variety of information to the court at the time of filing, including financial

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[1]Although the term "bankrupt" is often associated with business failure in popular culture, business bankruptcy is not the same as business failure. First, many businesses exit without bankruptcy proceedings. Formally, bankruptcy needs a petition to start, but business failures do not. Second, business bankruptcies in advanced economies may focus on restructuring financial obligations and streamline operations, and the company continues to operate instead of winding down.

information, organizational structure, lists of claimholders, among others. The court may also appoint trustees to collect additional information. In restructuring, the court approves the assessed value of the company, which is the basis of payments to claimholders. Second, the court may prohibit unilateral actions by claimholders that jeopardize orderly resolution or disrupt continuing operations of viable firms. In the U.S., business bankruptcy features the automatic stay, which forbids asset seizure and debt collection upon bankruptcy filing.[2] Third, the court can design voting rules to help different claimholders reach an agreement. In the U.S., claimholders with similar priority are grouped into one class, and each class needs to approve a restructuring plan with two thirds in value and one half in number. This voting rule aims to alleviate holdout problems and prevent powerful senior creditors from imposing their desires upon junior creditors (or vice versa).

The court may also help support the financing of firms' operations during restructuring. In the U.S., the court can approve "debtor-in-possession" financing with super priority over pre-petition claims (typically paid off when restructuring is completed), to provide liquidity and overcome debt overhang. In addition, the court can allow critical vendors to get paid for the goods and services they supply during the restructuring process (whereas other claimholders are not paid until restructuring is completed), to minimize production disruptions. Finally, bankruptcy laws often include provisions that allow the court to claw back payments made by the debtor during a certain time interval before the bankruptcy filing. Such provisions aim to prevent fraudulent behavior or unequal treatment of claimholders (e.g., the company tunneling funds towards certain parties in anticipation of the bankruptcy filing), and to correct such actions if they do occur.

Achieving these functions is a complicated endeavor, which requires a combination of sophisticated statues and competent judges (Aghion, Hart, and Moore, 1992; Smith and Strömberg, 2005; Ponticelli and Alencar, 2016; Antill, 2022; Iverson et al., 2023). Often times, bankruptcy laws are historically developed to liquidate failed businesses, and are slow to serve the need of resolving financial distress for viable companies, as restructuring is a complex process that involves more information gathering, financial analyses, operational expertise, and coordination. Court implementation can be plagued by bureaucracy, or hampered by the lack of financial expertise. Therefore, despite the importance of their tasks, legal institutions for business bankruptcy function poorly in many countries. In Section 3, we

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[2]Meanwhile, to ensure that creditors' rights are protected, payments will not be less than the liquidation value of their collateral.

turn to the measurement of the performance of these institutions around the world.

2.3 Business Bankruptcy and Macroeconomic Outcomes: The Case of Japan

Japan provides a vivid illustration of the relevance of bankruptcy institutions for macroeconomic outcomes. Until the 1990s, Japanese bankruptcy institutions were relatively under-developed. Traditionally, the bankruptcy framework focused on liquidation rather than restructuring, and the legal process was complex and tedious. Accordingly, formal bankruptcy was barely used and private enforcement was common (Tan, 2004; Anderson, 2006). In that environment, business lending relied heavily on pledging real estate. The real estate price boom in the late 1980s led to a sharp increase in business credit, and the subsequent collapse of real estate prices resulted had substantial negative consequences (Gan, 2007; Caballero, Hoshi, and Kashyap, 2008). Credit supply and business investment experienced sharp and persistent declines.

In the 1990s, as bad debt problems proliferated, policymakers thought that the slow recovery was partly due to the difficulties of bankruptcy resolution. "Lenders were not collecting outstanding debts partially due to the inefficiencies and costs believed to be involved in formal insolvency proceedings" (Anderson, 2006). Accordingly, firms were strained by debt overhang, while banks were burdened by nonperforming loans and often opted to evergreen such loans as default resolution was cumbersome (resulting in zombie lending). These issues exacerbated credit contractions, resource misallocations, and economic downturns. In 1996, Japan started a comprehensive reform of its bankruptcy system, which was completed in 2005. The reform improved the efficiency of the bankruptcy system and its ability to implement restructuring. "Proceeding times decreased radically and successful rehabilitations became the norm rather than extremely rare exceptions" (Anderson, 2006). Over this period, Japan went from having one of the lowest rates of business bankruptcy filings in the developed world to having filing numbers comparable to other countries (Tan, 2004; Anderson, 2006).

The Japanese case shows that bankruptcy institutions matter for the macroeconomic consequences of credit booms, and its relevance is recognized by policymakers. We examine this relationship systematically in the rest of this paper.

3 Data

We describe the main datasets in this section.

3.1 Bankruptcy Efficiency

The quality of the institutions for business bankruptcy varies substantially around the world. Djankov et al. (2008) pioneered the measurement of the performance of these institutions. Building on their work, the World Bank has constructed a systematic country-year level dataset covering up to 190 countries from 2003 to 2019 (World Bank, 2020). Accordingly, our empirical analyses focus on this period.

To make the measurement comparable across countries, this line of work presents a schematic case to legal professionals in each country, and asks them to assess the likely outcomes. Having a uniform case is useful because the observed bankruptcy cases can differ a lot by country. The benchmark case features a viable firm in financial distress, which is worth 100 if it continues to operate and 70 if it liquidates. The legal professionals assess whether such a company in their country can stay as a going concern (instead of being disbanded and liquidated piecemeal), and estimate the total payoffs to claimholders (after resolution costs) as well as the likely duration of the bankruptcy case.

We use the World Bank dataset and measure bankruptcy efficiency with the total recovery rate, i.e., total payment to claimholders net of total bankruptcy costs normalized by the full going-concern value 100. Table 1 presents the summary statistics. In the full sample, the average country can preserve 39% of the maximum going-concern value of the firm. The standard deviation is 25%. In the sample we use for analysis later in Section 4, which is restricted by business credit data from the BIS, the average bankruptcy efficiency is higher at 63%. Even in this case, the average loss of value is substantial. Given the dataset covers 16 years, variations in bankruptcy efficiency are mainly across countries rather than within countries (e.g., country fixed effects have R^2 around 0.9). Legal origins are important (Djankov et al., 2008), with R^2 around 0.33.

In Figure 1, we plot the total recovery rate and the likely duration of the bankruptcy case across countries for the example year of 2015. The solid blue dots indicate countries where the company

Figure 1. Bankruptcy Outcomes across Countries
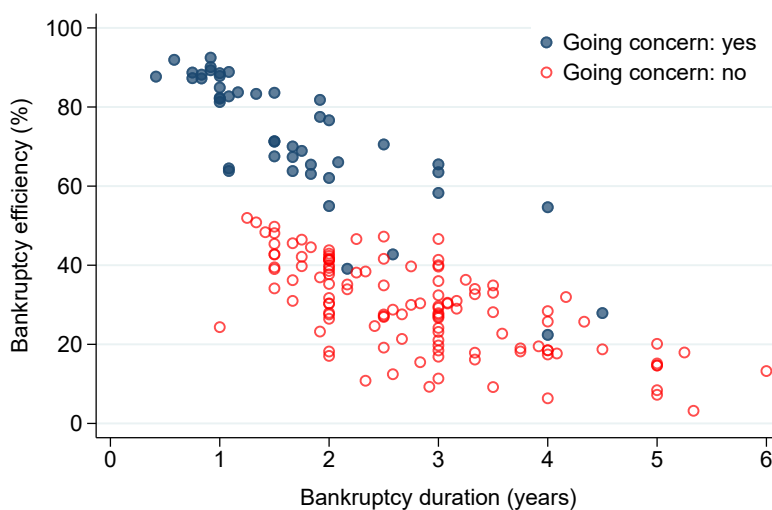
Notes: This figure shows a scatter plot for 165 countries in 2015, where each dot is a country. The data come from the World Bank Doing Business database following the methodology of Djankov et al. (2008). The blue dots represent countries where the business can continue to operate as a going concern, and the red dots represent countries where the business is expected to be liquidated. Bankruptcy efficiency uses the fraction of economic value that can be preserved in bankruptcy. It measures total recovery less bankruptcy costs, discounted by resolution duration divided by the going concern value (100).

can stay as a going concern, and the hollow red dots indicate places where it cannot. We see that the viable company is expected to stay a going concern in only about half of the countries. The recovery is naturally higher in these settings. In many countries, however, the company cannot remain a going concern yet the bankruptcy case is expected to take a long time. Accordingly, recovery is very low.

In countries with higher bankruptcy efficiency, we also observe less reliance of business credit on pledging physical assets, as shown in Figure 2. In particular, if it is difficult to preserve viable firms as operating businesses, then business lending is likely to have a stronger focus on pledging physical assets (such as real estate). Lian and Ma (2021) analyze debt composition among companies in 56 countries between 2003 and 2018, using CapitalIQ data to classify firms' outstanding debt contracts into a) those backed by physical and other separable assets (real estate, equipment, working capital, etc.), where creditors have security interests in these particular assets and claims against their values, and b) those backed by the value of the business as a whole, where creditors have security interests in the company as a whole (e.g., blanket liens) or in its equity or general unsecured claims.[3] They refer to these two groups

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[3]The detailed classification algorithm is described in Appendix IA2. The same procedure is applied in all countries to maintain consistency and restrict degrees of freedom, although some assumptions in the estimation may ideally change based on the country's institutional setting. For instance, while in the U.S. we assume corporate bonds are largely cash flow-based, in liquidation-focused countries this may not hold. For foreign firms, CapitalIQ sometimes has less detailed information, so the estimates can be less precise than our results for the U.S.

Figure 2. Bankruptcy Institutions and Composition of Business Lending
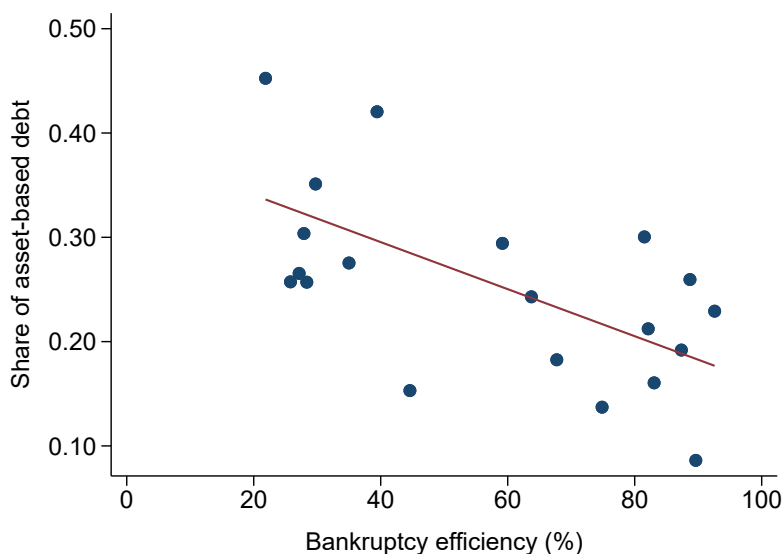
Notes: This figure shows binscatter plots for 48 countries in 2015. The share of asset-based debt in total debt is taken from Lian and Ma (2021), using data from CapitalIQ. Bankruptcy efficiency uses the fraction of economic value that can be preserved in from bankruptcy measured by the World Bank Doing Business database following the methodology of Djankov et al. (2008).

as "asset-based debt" and "cash flow-based debt," respectively, which build on common terminologies among creditors.[4] In Figure 2, we see that business lending has a stronger focus on pledging physical assets in countries with low bankruptcy efficiency.

3.2 Other Data

We obtain data on business credit from the Bank of International Settlements (BIS). This dataset contains both business credit issued by banks and credit extended by nonbanks (e.g., corporate bonds). Some work focuses on bank credit (Müller and Verner, 2023; Ivashina et al., 2024). We focus on all business credit combined. We use data on on GDP, investment, unemployment rate, and consumption from the World Economic Outlook and the World Bank World Development Indicator databases.

Table 1 presents the summary statistics. Panel A shows the summary statistics for all country-years with respective data. Panel B shows the summary statistics for the regression sample that we use in Section 4, where we need data on bankruptcy efficiency, business credit, and economic outcomes. The

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[4]As they explain, this analysis across countries faces a number of challenges and is inevitably imperfect (e.g., CapitalIQ data is restricted to public companies and sometimes information on the characteristics of debt contracts is incomplete). Despite imperfections that mostly will noise up true cross-country differences, they find that countries with weaker bankruptcy institutions have a higher share of asset-based debt.

<div align="center">Table 1 – Summary Statistics</div>

	(A) Full sample						(B) Regression sample					
	N	Mean	SD	Q25	Q50	Q75	N	Mean	SD	Q25	Q50	Q75
Bankruptcy efficiency (%)	1,757	39.3	24.6	21.3	32.4	51.0	560	63.1	23.5	42.9	68.6	83.0
Business debt-to-GDP ratio (%)	649	80.7	40.7	49.4	76.6	107.1	560	83.0	40.0	53.9	80.4	109.4
Business debt-to-GDP, 5-year change (pp.)	621	6.5	15.0	-2.0	5.5	14.1	560	6.9	15.3	-2.0	6.1	14.6
Real GDP growth, annual (%)	1,930	4.1	8.9	1.4	4.1	7.2	560	2.8	3.8	1.0	2.7	4.6
Real investment growth, annual (%)	1,802	4.5	22.6	-1.7	4.8	11.5	560	2.8	9.6	-1.1	3.4	7.3
Unemployment rate (%)	1,983	6.8	4.7	3.5	5.4	9.1	560	7.4	4.3	4.6	6.8	8.7

Notes: The table presents descriptive statistics for our main variables for years 2003 to 2019. Panel A shows statistics for all countries covered by a given variable. Panel B shows statistics for our regression sample, i.e., countries jointly covered by all 5 variables. The bankruptcy efficiency measure is from World Bank (2020). Business debt to GDP is from the BIS. Real GDP, real investment, and unemployment rate are from the World Economic Outlook and the World Development Indicator databases.

size of the regression sample is mainly limited by the coverage of the BIS business credit data. Figure IA1 shows the list of countries covered by the baseline regression sample.

4 Bankruptcy Resolution and The Macroeconomic Impact of Credit Booms: Empirical Evidence

Basic Results Credit cycles represent one of the most important challenges for macroeconomic stability. A growing volume of studies document that credit booms predict recessions and crises. We analyze how macroeconomic outcomes following credit booms vary with the efficiency of business bankruptcy institutions. We estimate state-dependent local projections:

$$\Delta_h Y_{i,t+h} = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} \left(B_{i,t} \times \Delta_5 c_{i,t} \right) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}, \tag{1}$$

for annual horizons of $h = 1, ..., 5$. The outcome variable $\Delta_h Y_{i,t+h}$ begins with the change in log real GDP; we also study log real investment, unemployment rate, and log real private consumption later on. The independent variable $\Delta_5 c_{i,t}$ is the change in business credit to GDP in the past 5 years in country i and year t using BIS data, and $B_{i,t}$ is the measure of bankruptcy efficiency. We control for 5 lags of real GDP growth as well as the cumulative change in household credit relative to GDP since year $t - 5$. We include horizon-specific country fixed effects $\alpha_{i,h}$. The sample covers annual data from an unbalanced

Figure 3. GDP following Business Credit Booms
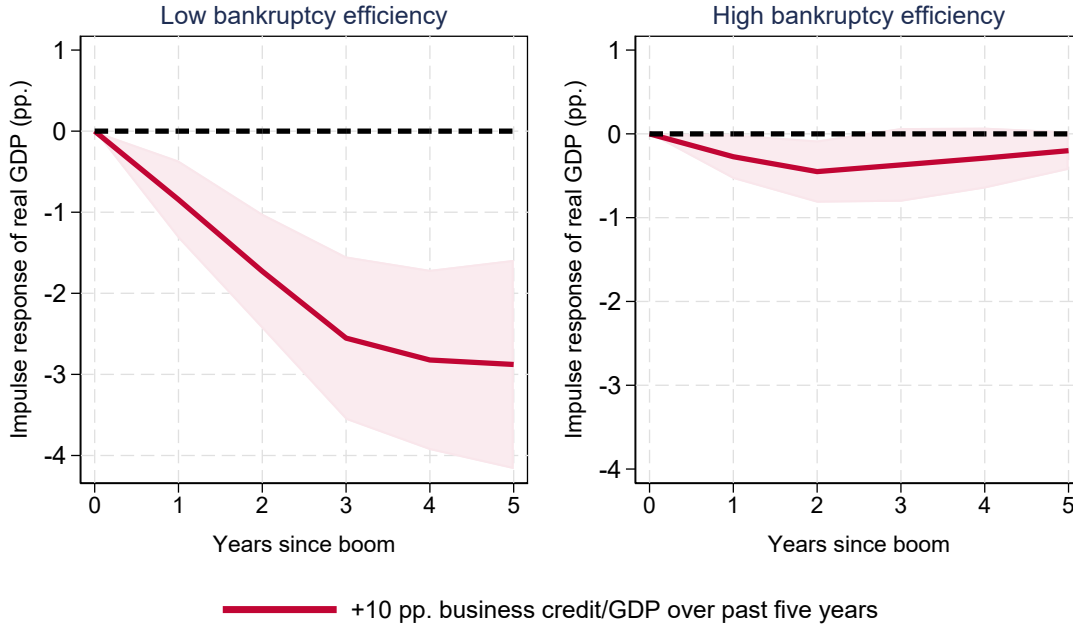
Notes: This figure shows the GDP trajectory following a 10 percentage point increase in the business credit to GDP ratio over the preceding 5 years. We estimate state-dependent local projections: $\Delta_h \log(\text{real GDP}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h}B_{i,t} + \beta_{2,h}\Delta_5 c_{i,t} + \beta_{3,h}\left(B_{i,t} \times \Delta_5 c_{i,t}\right) + \gamma_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.

panel of 39 countries over the period of 2003 to 2019.[5] We use Driscoll and Kraay (1998) standard errors with 5 lags.

In Figure 3, we start with the path of GDP following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. The plots for low (high) bankruptcy efficiency represent the paths when bankruptcy efficiency ($B_{i,t}$) is at the 25th (75th) percentile of the regression sample. Table 2 presents the underlying regressions, where we interact the bankruptcy efficiency measure with the business credit boom as in Equation (1). We observe that business credit booms are followed by considerably greater declines of GDP in countries with low bankruptcy efficiency. The economic magnitude is substantial. A business credit boom on the scale of a 10 percentage point increase in business credit to GDP occurs in roughly a third of our sample observations (the average change in

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[5]The time frame is constrained by bankruptcy efficiency data first becoming available in 2003 and running up until 2020. We excluded 2020 to prevent the pandemic confounding our estimates.

Table 2 – Change in Log Real GDP

	(1) $h = 1$	(2) $h = 2$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
Δ_5 Business credit/GDP $\times$ Bankruptcy efficiency	0.143***	0.319***	0.546***	0.633***	0.669***
	(0.048)	(0.080)	(0.114)	(0.134)	(0.172)
Δ_5 Business credit/GDP	-0.146***	-0.310***	-0.490***	-0.555***	-0.576***
	(0.046)	(0.072)	(0.103)	(0.119)	(0.145)
Bankruptcy efficiency	-0.939	-1.385	-0.700	-0.260	-0.082
	(0.954)	(1.185)	(1.965)	(2.887)	(3.293)
Country FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.42	0.52	0.60	0.66	0.71
Observations	560	522	484	446	408

Notes: This table shows results from the following state-dependent local projections: $\Delta_h \log(\text{real GDP}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h}\Delta_5 c_{i,t} + \beta_{3,h} (B_i \times \Delta_5 c_{i,t}) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Driscoll-Kraay standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

business credit to GDP over 5 years is 7 percentage points, and the standard deviation is 19 percentage points). Following a boom of this size, real GDP declines by about 3 percentage points in the next 5 years for a country at the bottom quartile of bankruptcy efficiency (left panel of Figure 3), whereas real GDP barely declines for a country at the top quartile of bankruptcy efficiency (right panel of Figure 3). The cumulative output loss over five years is about 9 percentage points larger under low bankruptcy efficiency than under high bankruptcy efficiency.[6] Interestingly, in low bankruptcy efficiency countries, real GDP does not yet recover by year 5. We verify in Figure IA2 that the recovery gradually occurs between year 6 and year 10. However, since the bankruptcy efficiency data only began in 2003, the number of observations falls for longer-term local projections, so we use local projections for subsequent 5 years in the baseline results.

Robustness Checks We perform several robustness checks. First, we verify that the differences in macroeconomic outcomes along the dimension of bankruptcy efficiency are not driven by bankruptcy

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[6]The cumulative output loss is equal to the integral of the impulse responses in Figure 3 (cf. Ramey, 2016). Under low bankruptcy efficiency, the annual losses over the first 5 years accumulate to around 10.8 percent of real GDP at $h = 0$. By contrast, they accumulate to only around 1.5 percent under high bankruptcy efficiency.

efficiency being correlated with development status, exchange rate pegging, or general rule of law, which might be some other factors that can affect the shape of credit cycles. We present results that control for these variables interacted with business credit booms in Figures IA3, IA4, and IA5, and the corresponding regressions in Tables IA1, IA2, and IA3. Similar to the baseline results in Figure 3 and Table 2, macroeconomic outcomes following credit booms are substantially worse in countries with low bankruptcy efficiency.

Second, a possible concern is reverse causality: maybe bad economic conditions lead to low observed bankruptcy efficiency (e.g., courts get overcrowded when economic conditions are difficult). To address this concern, we also use bankruptcy efficiency fixed at the beginning of the sample in Figure IA6, examine macroeconomic outcomes thereafter, and verify that the results are similar.

Third, we follow previous work and instrument bankruptcy efficiency with legal origins. We use 4 indicator variables for legal origins: English, French, German, and Nordic as in Djankov et al. (2008). These legal origin variables explain about 30% of the variations in bankruptcy efficiency. The results instrumenting bankruptcy efficiency with legal origins are shown in Figure IA7 and Table IA4. The key patterns and magnitudes here are similar to those in the baseline results in Figure 3 and Table 2. Since legal origins may also affect general rule of law, in Panel B of Figure IA7 and Table IA4, we additionally control for rule of law and its interaction with changes in business credit (like in Figure IA5 and Table IA3), and obtain similar results. Indeed, bankruptcy efficiency is significantly related to legal origins, which often influence judicial philosophies, even when controlling for the general rule of law index. As Djankov et al. (2008) document, French and German legal origins are especially unfriendly towards reorganization, automatic stay, and allowing existing management to remain, which tend to make it more challenging to preserve the continuing operation of the company as discussed in Section 2.2.

Fourth, we check that the main results are similar if we measure changes of business credit to GDP over alternative windows, such as the past 3 years or 8 years instead of the past 5 years above, shown in Figure IA8. Panel A (B) shows the path of output after a 6 (16) percentage point increase in business credit to GDP over the past 3 (8) years; in other words, we scale the change in business credit to GDP to 2 percentage points per year.

Fifth, a possible question is whether countries with low bankruptcy efficiency happen to have high debt burden, so they are more vulnerable to negative shocks. We perform several checks. First, Figure

IA9 plots business credit to GDP against bankruptcy efficiency. If anything, we observe a positive correlation: countries with high bankruptcy efficiency are those that bear more corporate debt relative to output. Second, the baseline results are similar if we additionally control for the level of business credit to GDP at horizon 0, as shown in Figure IA10. In other words, for the same debt level, countries with low bankruptcy efficiency still experience worse macroeconomic outcomes subsequently.

Symmetry of Credit Booms and Contractions   Our exposition and figures use credit booms (i.e., positive changes in business credit to GDP) for simplicity of illustration; the underlying regressions use $\Delta_5 c_{i,t}$ directly and are not limited to $\Delta_5 c_{i,t} > 0$. We verify in the appendix that the results are symmetric for negative changes in business credit to GDP. Intuitively, when the bankruptcy efficiency is high and default is less likely to end in inefficient liquidations, the GDP increase driven by fewer defaults after credit contractions would be smaller. Figure IA11 shows the path of output following credit contractions, which is the opposite of that following credit booms in Figure 3. Table IA5 follows Ben Zeev, Ramey, and Zubairy (2023) to test against symmetric paths after credit booms and contractions. In particular, we use an indicator variable for credit booms (i.e., positive change in business credit to GDP over the past 5 years), and add a triple interaction of this indicator variable with credit booms and bankruptcy efficiency. This triple interaction is insignificant for horizons $h = 3, 4$ and 5.

Other Outcomes   In addition to GDP, we plot the path of investment and employment following business credit booms in Figures 4 and 5. We observe that investment declines substantially and unemployment rises moderately in countries with low bankruptcy efficiency. These negative outcomes are less pronounced in countries with high bankruptcy efficiency. In Figure IA12, we look at productivity using TFP from the Penn World Tables. We observe larger TFP declines following credit booms in low bankruptcy efficiency countries.

The negative consequences of firms' financial distress can be propagated across the economy in several ways. First, reductions in investment and employment can depress aggregate demand and in turn decrease consumption. In Figure 6, we plot the path of consumption following business credit booms. We observe that consumption declines substantially in countries with low bankruptcy efficiency. In contrast, consumption remains largely stable in countries with high bankruptcy efficiency. Second, financial trouble among firms can depress capital markets and raise the cost of financing. In Figure IA13, we look at the path of stock prices of nonfinancial corporations (using data from various sources

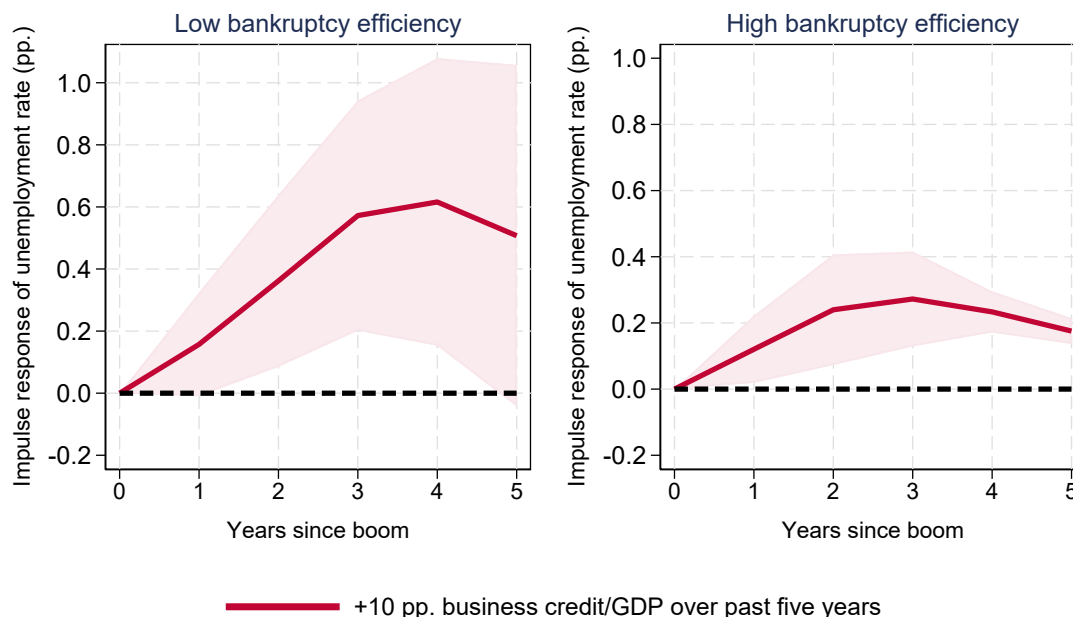# Figure 4. Investment following Business Credit Booms
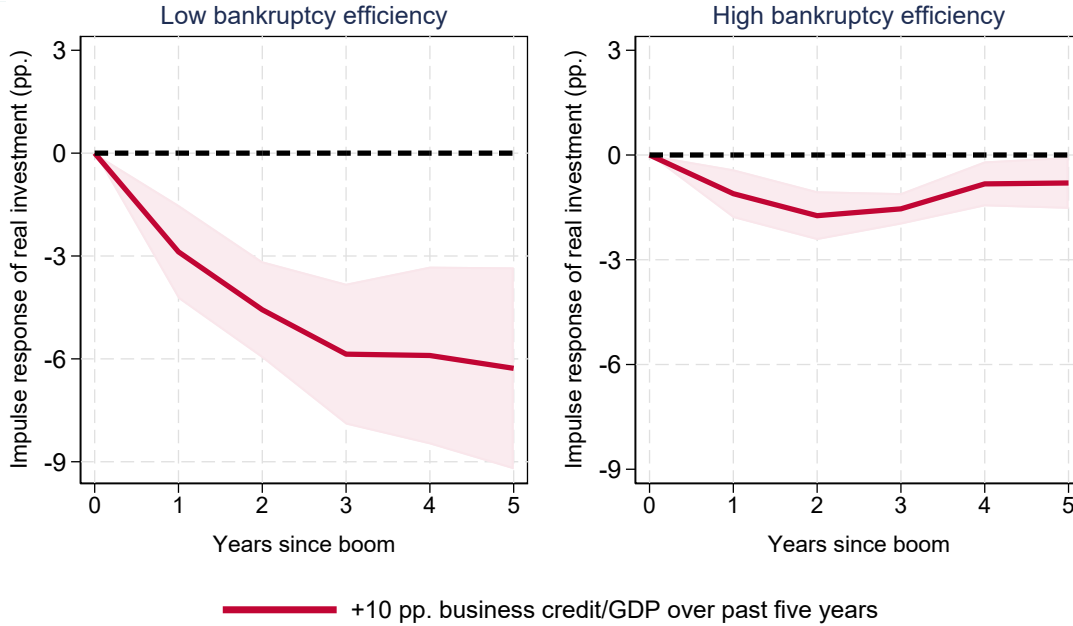
Notes: This figure shows the investment trajectory following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate state-dependent local projections: $\Delta_h \log(\text{real investment}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real investment in country i from year t to year $t+h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t-5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth and real investment growth, as well as the cumulative change in household credit to GDP since year $t-5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas are 90% confidence intervals based on Driscoll-Kraay standard errors.

compiled by Baron, Verner, and Xiong (2021) and Jordà et al. (2021) for 36 countries), and credit spreads (using data from Global Financial Data and other sources compiled by Mian, Sufi, and Verner (2017) and Baron, Verner, and Xiong (2021) for 20 countries, updated to 2019). We observe that stock prices decline and credit spreads rise in low bankruptcy efficiency countries, but not in high bankruptcy efficiency countries; the standard errors are slightly larger in the smaller sample with asset price data. Deteriorating capital market conditions in countries with low bankruptcy efficiency could further exacerbate economic downturns.

There are two possibilities for worse macro outcomes following credit booms in countries with low bankruptcy efficiency. First, the probability of recession can be higher in countries with low bankruptcy efficiency. Second, recessions can be more severe in those countries. Recent work by Jordà et al. (2022) study the severity of recessions, and document that countries with lower bankruptcy

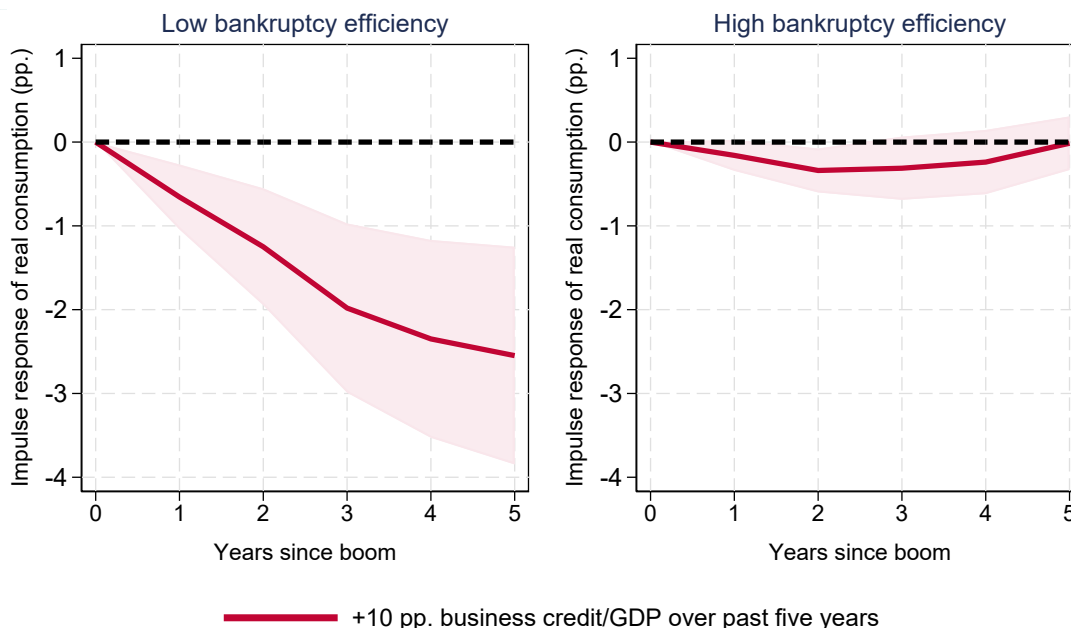Figure 5. Unemployment Rate following Business Credit Booms

Notes: This figure shows the unemployment rate trajectory following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate state-dependent local projections: $\Delta_h$unemployment rate$_{i,t+h} = \alpha_{i,h} + \beta_{1,h}B_{i,t} + \beta_{2,h}\Delta_5 c_{i,t} + \beta_{3,h}(B_{i,t} \times \Delta_5 c_{i,t}) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in unemployment rate in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth and unemployment rate changes, as well as the cumulative change in household credit relative to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.

efficiency experience slower recoveries during recessions. Their analysis conditions on the occurrence of recessions (defined as negative GDP growth). In Figure 7, we show that the probability of recessions following business credit booms is significantly higher for countries with low bankruptcy efficiency. Three years after a 10 percentage point increase of business credit boom to GDP, countries at the bottom quartile of bankruptcy efficiency have higher cumulative recession probability by about 7.4 percentage points, whereas there is no significant effect for countries at the top quartile of bankruptcy efficiency.

Finally, given the prominence of financial crises in recent research (Schularick and Taylor, 2012; Chodorow-Reich, 2014; Greenwood et al., 2022; Frydman and Xu, 2023), we examine the likelihood of financial crises following business credit booms in Figure IA14. We use financial crisis coding by Baron, Verner, and Xiong (2021). In our sample, business credit booms do not predict financial crises, regardless of bankruptcy efficiency. This is likely because our sample period is 2003 to 2019 (due to

Figure 6. Private Consumption following Business Credit Booms

Low bankruptcy efficiency | High bankruptcy efficiency

Impulse response of real consumption (pp.)

Years since boom

+10 pp. business credit/GDP over past five years

Notes: This figure shows the trajectory of real private consumption following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate state-dependent local projections: $\Delta_h \log(\text{real consumption})_{i,t+h} = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h x_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real private consumption in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $x_{i,t}$ include contemporaneous and 5 lags of real GDP growth and real consumption growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.

the availability of bankruptcy efficiency data), and the main financial crises during this time frame are related to the Global Financial Crisis which is more tied to household credit than business credit. Using a longer sample since 1940, Ivashina et al. (2024) find that corporate credit booms have substantial predictive power for financial crises. If bankruptcy efficiency measures can be extended further back in time, it is possible that financial crises are more likely to occur following business credit booms in countries with low bankruptcy efficiency.

Figure 7. Recession Risk following Business Credit Booms
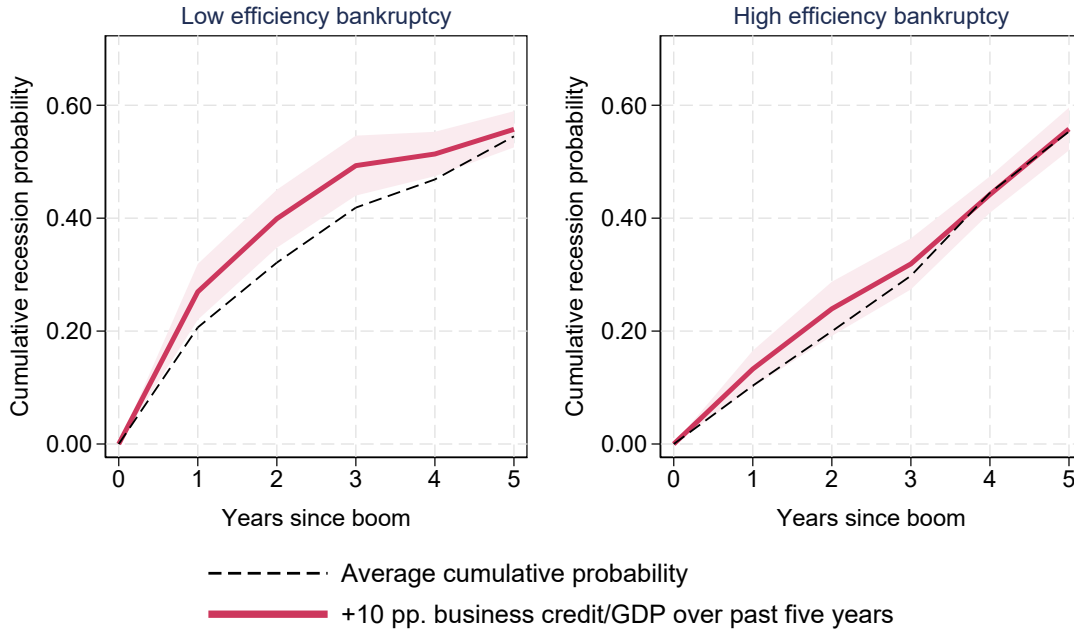
Notes: This figure shows the cumulative probability of a recession with (solid red line) and without (dashed black line) a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate linear probability models using state-dependent local projections: $\mathbb{1}(\text{recession since } t)_{i,t+h} = \alpha_{i,h} + \beta_{1,h}B_{i,t} + \beta_{2,h}\Delta_5 c_{i,t} + \beta_{3,h}\left(B_{i,t} \times \Delta_5 c_{i,t}\right) + \gamma_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the occurrence of a recession in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth and recession indicators, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.

5   Bankruptcy Resolution and The Macroeconomic Impact of Credit Booms: A Simple Theoretical Framework

Empirical evidence in the previous section shows that business credit booms are followed by severe economic downturns in countries with low bankruptcy efficiency, but not in countries with high bankruptcy efficiency. In this section, we use a simple model to lay out how bankruptcy resolution affects macroeconomic outcomes, and why more efficient bankruptcy systems can mitigate the negative consequences of credit booms. The model is stylized and aims to provide the simplest illustration of the economic mechanisms.

5.1 Environment

Time is discrete, and there are two periods, $t \in \{1, 2\}$. The economy is populated by a representative unit mass of creditors and firms. Creditors are identical, and have preferences described by $\mathbb{E}[c_1 + \beta c_2]$, where $\beta \in (0, 1)$ denotes the creditors' subjective discount factor and c_t denotes their consumption in period t. Firms' objective is to maximize $\mathbb{E}[\text{div}_{j1} + \beta_f \text{div}_{j2}]$, where $\beta_f \in (0, \beta)$ is a discount factor and div_{jt} are dividends transferred by firm j to its owners in period t.[7]

In the first period, each firm j has access to a risky investment opportunity, which requires an initial investment of $I > 0$ consumption goods and yields a stochastic cash flow of z_j consumption goods in the second period. To obtain analytical results, we assume that the cash flow of the risky project of firm j, z_j, is drawn from an i.i.d. uniform distribution with a measure 1 support, $[\underline{z}, \bar{z}]$, where $\underline{z} \geq 0$. That is, the probability density function is given by $\phi(z_j) = 1$ for $z_j \in [\underline{z}, \bar{z}]$, and the cumulative distribution function is given by $\Phi(z_j) = z_j - \underline{z}$ for $z_j \in [\underline{z}, \bar{z}]$.

Firms can borrow from creditors in competitive markets. In the second period, each firm j faces a non-negative dividend constraint ($\text{div}_{j2} \geq 0$), which implies that debt is defaultable. Following a default, the firm obtains a dividend of zero. With probability $\xi \in (0, 1)$, the project can continue to operate (for simplicity, we assume that continuing operation is efficient) and maintain the cash flow z_j. With probability $1 - \xi$, the project gets liquidated inefficiently, obtaining a value $z^{\text{liq}} = \underline{z}$, which, for simplicity, is set to be the lowest realization of cash flow if the firm continues to operate. The parameter ξ, which governs the probability of continuing operation, captures bankruptcy efficiency in the economy and is the main focus of the comparative statics linked to our empirical evidence.

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[7]We assume that creditors are more patient than firms to ensure that firms borrow in equilibrium. For simplicity, we abstract from explicitly mentioning firms' owners, which can be thought of as an agent with preferences $\mathbb{E}[c_{f1} + \beta_f c_{f2}]$.

5.2 Optimality

The expected value for a firm j pursuing the investment opportunity is given by

$$V_f(\beta, \beta_f, \xi) = \max_{b \geq 0} \left(\mathrm{div}_1 + \beta_f \mathbb{E}[\mathrm{div}_2]\right) \tag{2}$$

$$\text{s.t. } \mathrm{div}_1 + I = q(b, \beta, \xi)b, \tag{3}$$

$$\mathrm{div}_2 = \begin{cases} z_j - b & \text{if } b < z_j, \\ 0 & \text{if } b > z_j. \end{cases} \tag{4}$$

where b is the face value of debt in period 2, and $q(b, \beta, \xi)$ is the debt price schedule faced by firms in period 1 (discussed further below). Equation (3) is the period-1 flow-of-funds constraint, which indicates that dividend payments and investment have to be financed with proceeds from borrowing. Equation (4) is the period-2 flow-of-funds constraint, which indicates that if the firm does not default, it transfers a dividend payment that is equal to the cash flow net of debt payment; otherwise, if the firm defaults, it does not transfer dividend payments. From Equation (2), it follows that firms are willing to pursue the investment opportunity if and only if $V_f \geq 0$.

The debt price schedule is determined by the free entry of creditors to the lending market, and given by:

$$q(b, \beta, \xi) = \beta \mathbb{E}\left[\mathbb{I}_{\{b \leq z_j\}} + \mathbb{I}_{\{b > z_j\}} \frac{(1 - \xi)z^{\mathrm{liq}} + \xi z_j}{b}\right], \tag{5}$$

where $\mathbb{I}$ is the indicator function.

Finally, we make the following parametric assumption, which guarantees that the firm prefers investing to not investing in the first period:

Assumption 1. *The investment cost is such that* $I < \frac{\beta}{2} \left(\frac{1 - \xi \frac{\beta_f}{\beta}}{2 - \xi - \frac{\beta_f}{\beta}}\right) + \beta \underline{z}$.

5.3 Macroeconomic Impact of Bankruptcy Resolution Efficiency

The default resolution and bankruptcy procedure described above also lead to the expression for aggregate output, given the face value of debt b chosen in the first period (since all firms are ex ante identical, they choose the same face value of debt in the first period) and bankruptcy efficiency ξ. That

is, for $b \in [\underline{z}, \bar{z}]$ (which holds for the optimally chosen face value of debt $b^*(\beta, \beta_f, \xi)$ in (2)):

$$Y(b, \xi) = \mathbb{E}[z_j] - \underbrace{(1 - \xi) \int_{\underline{z}}^{b} \left(z_j - z^{\text{liq}}\right) \phi(z_j) \, dz_j,}_{\text{output loss from inefficient liquidation}} \quad (6)$$

where the second term captures the output loss from inefficient liquidation, which depends on the probability of liquidation conditional on bankruptcy $(1 - \xi)$ and the output loss conditional on liquidation (liquidating a firm with cash flow z_j results in output loss of $z_j - z^{\text{liq}}$). From this expression, we can see that a more efficient bankruptcy system leads to higher aggregate output, conditional on the amount of borrowing. For $b \in (\underline{z}, \bar{z}]$,

$$\frac{\partial Y(b, \xi)}{\partial \xi} = \int_{\underline{z}}^{b} \left(z_j - z^{\text{liq}}\right) \phi(z_j) \, dz_j > 0. \quad (7)$$

That is, a higher ξ leads to more efficient allocations of resources: firms can continue to operate efficiently, instead of undergoing inefficient liquidation, which leads to higher aggregate output.

We now use the model to shed light on our empirical evidence. We consider both nonfundamental credit booms driven by increases in credit supply or demand due to changes in discount rates or biased beliefs and fundamental credit booms driven by rational expectations of increases in firms' productivity. We start with nonfundamental credit booms. We examine those driven by credit supply, due to shocks to creditors' discount rates. In this case, a one unit increase in total business credit, $b^*(\beta, \beta_f, \xi)$, results from a $1 / \frac{\partial b^*(\beta, \beta_f, \xi)}{\partial \beta}$ unit increase in the discount factor β. We also examine booms driven by credit demand, due to shocks to firms' discount rates. In this case, a one unit increase in total business credit, $b^*(\beta, \beta_f, \xi)$, results from a $1 / \frac{\partial b^*(\beta, \beta_f, \xi)}{\partial \beta_f}$ unit increase in the discount factor β_f. In Appendix IA3, we additionally study the case where nonfundamental credit booms are driven by shocks to creditors' or firms' beliefs (rather than by shocks to their discount rates) as modeled in Dávila and Walther (2023), which does not affect our main results in Proposition 1.

Nonfundamental credit booms Our empirical analysis examines macroeconomic outcomes following a one unit change in total business credit (e.g., the response of output $Y^*(\beta, \beta_f, \xi) \equiv Y(b^*(\beta, \beta_f, \xi), \xi))$,

which corresponds to

$$\varepsilon\left(\beta,\beta_f,\xi\right) = \frac{\frac{\partial Y^*\left(\beta,\beta_f,\xi\right)}{\partial\beta}}{\frac{\partial b^*\left(\beta,\beta_f,\xi\right)}{\partial\beta}} = \frac{\frac{\partial Y^*\left(\beta,\beta_f,\xi\right)}{\partial\beta_f}}{\frac{\partial b^*\left(\beta,\beta_f,\xi\right)}{\partial\beta_f}} = \frac{\partial Y\left(b^*\left(\beta,\beta_f,\xi\right),\xi\right)}{\partial b} \tag{8}$$

in the model. Because credit booms only affect aggregate output $Y\left(b^*\left(\beta,\beta_f,\xi\right),\xi\right)$ through the impact on total business credit $b^*\left(\beta,\beta_f,\xi\right)$, the effect $\varepsilon\left(\beta,\beta_f,\xi\right)$ does not depend on whether the boom is driven by credit demand or credit supply.

We now examine the macroeconomic implications of a more efficient bankruptcy system.

Proposition 1. *Under Assumption 1,*

1. A more efficient bankruptcy system (a higher ξ) is associated with a larger credit market: $\frac{\partial b^*\left(\beta,\beta_f,\xi\right)}{\partial\xi} > 0.$

2. Nonfundamental credit booms have negative effects on macroeconomic outcomes: $\varepsilon\left(\beta,\beta_f,\xi\right) < 0.$ *Furthermore, a more efficient bankruptcy system (a higher ξ) dampens the negative impact of nonfundamental credit booms on macroeconomic outcomes:* $\frac{\partial\varepsilon\left(\beta,\beta_f,\xi\right)}{\partial\xi} > 0.$

Part 1 of the Proposition shows that a more efficient bankruptcy system leads to a larger credit market. An increase in bankruptcy efficiency, ξ, enhances the debt valuation given the face value of debt b, $q_b\left(b,\beta,\xi\right)$, because it increases creditors' payoffs in the event of bankruptcy. This higher debt valuation incentivizes firms to borrow more, which generates a larger credit market: $\frac{\partial b^*\left(\beta,\beta_f,\xi\right)}{\partial\xi} > 0.$

Part 2 of the Proposition shows that the impact of credit boom $\varepsilon\left(\beta,\beta_f,\xi\right) < 0$ is negative because it increases the promised debt payment $b^*\left(\beta,\beta_f,\xi\right)$ in the second period and leads to more defaults, which may be resolved inefficiently and negatively impact aggregate output $Y^*\left(\beta,\beta_f,\xi\right)$. Moreover, Part 2 shows that a more efficient bankruptcy system mitigates the negative impact of a credit boom on macroeconomic outcomes and attenuates the credit cycle (even though the credit market is larger). To understand this, from Equation (8), we recognize that the efficiency of the bankruptcy system, ξ, influences the impact of a credit boom, $\varepsilon\left(\beta,\beta_f,\xi\right)$, through two channels:

$$\underbrace{\frac{\partial\varepsilon\left(\beta,\beta_f,\xi\right)}{\partial\xi}}_{>0} = \underbrace{\frac{\partial^2 Y\left(b^*\left(\beta,\beta_f,\xi\right),\xi\right)}{\partial b\partial\xi}}_{>0} + \underbrace{\frac{\partial^2 Y\left(b^*\left(\beta,\beta_f,\xi\right),\xi\right)}{\partial b^2}\frac{\partial b^*\left(\beta,\beta_f,\xi\right)}{\partial\xi}}_{<0}. \tag{9}$$

First, holding the size of the credit market fixed at $b^*\left(\beta,\beta_f,\xi\right)$, a more efficient bankruptcy system

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mitigates the negative impact of a credit boom on aggregate output. That is, the first term in Equation (9) is positive. Recall that the impact of a credit boom on aggregate output, $\frac{\partial Y\left(b^*\left(\beta,\beta_f,\xi\right),\xi\right)}{\partial b} < 0$ is negative because it leads to more defaults, which will generate inefficient liquidations with probability $1 - \xi$. A higher ξ lowers the probability of inefficient liquidations, and dampens the negative impact of a credit boom on aggregate output: $\frac{\partial^2 Y\left(b^*\left(\beta,\beta_f,\xi\right),\xi\right)}{\partial b \partial \xi} > 0$. Second, by increasing the size of the credit market, $b^*\left(\beta,\beta_f,\xi\right)$, a more efficient bankruptcy system could exacerbate the negative impact of a credit boom. That is, the second term in (9) is negative because $\frac{\partial b^*\left(\beta,\beta_f,\xi\right)}{\partial \xi} > 0$ and $\frac{\partial^2 Y\left(b^*\left(\beta,\beta_f,\xi\right),\xi\right)}{\partial b^2} < 0$. A larger promised debt payment, $b^*\left(\beta,\beta_f,\xi\right)$, means that the marginal firms that default have higher cash flows (firms with cash flows z_j up to $b^*\left(\beta,\beta_f,\xi\right)$ default), and suffer more output loss after inefficient liquidations. This exacerbates the negative impact of a credit boom on aggregate output. Part 2 of the Proposition shows that the first channel dominates the second channel, consistent with our empirical evidence.

We note that the predictions in Proposition 1 are symmetric: the comparative statics apply to both credit booms and contractions. That is, the impact of credit contractions on macroeconomic outcomes is positive, because credit contractions lead to fewer subsequent defaults and inefficient liquidations. A more efficient bankruptcy system now dampens the positive impact of credit contractions: when default is less likely to end in inefficient liquidations, the efficiency gain from fewer subsequent defaults (after credit contractions) is smaller. In the data, we observe this symmetry as well, as shown in Figure IA11 and Table IA5.

Finally, Appendix IA3 shows that the results in the second part of Proposition 1 are robust to considering other sources of nonfundamental credit booms. We study booms driven by shocks to creditors' or firms' beliefs (rather than by shocks to their discount rates), following the long tradition of belief-driven credit cycles (Kindleberger, 1972; Minsky, 1986). We establish that higher bankruptcy efficiency still dampens the negative impact of credit booms in this setting. Moreover, we show that Proposition 1 extends to settings where the cash flow of the risky project z_j is drawn from a general class of distributions, not limited to the uniform distribution case examined in the main analysis.

Our model focuses on direct channels through which bankruptcy efficiency affects economic activity. In practice, some but not necessarily all firms experience distress following credit booms, and spillovers from firms in distress to other firms may also contribute to the empirical patterns we observe in Section

4. To account for such spillovers, our baseline framework could be extended to incorporate various amplification mechanisms, such as aggregate demand forces, financial amplification, or input output linkages (Kiyotaki and Moore, 1997; Bernanke, Gertler, and Gilchrist, 1999; Christiano, Eichenbaum, and Evans, 2005; Baqaee and Farhi, 2019).

Overall, the predictions in Proposition 1 are consistent with the empirical evidence. First, credit booms are followed by worse macroeconomic outcomes. Second, the negative outcomes are especially severe under inefficient bankruptcy systems.

Fundamental driven credit booms   We then turn to credit booms driven by rational expectations of an increase in firms' future productivity. Formally, each firm j's risky cash flow z_j is now drawn i.i.d. from the uniform distribution $[\underline{z}+\Delta, \bar{z}+\Delta]$, where Δ captures shocks to firms' future productivity. Define aggregate output/GDP $Y^*(\Delta, \xi) \equiv Y(\Delta, b^*(\Delta, \xi), \xi)$ based on the optimally chosen face value of debt $b^*(\Delta, \xi)$, where β and β_f are eliminated as arguments because they are fixed here.

Here, a one unit increase in total business credit, $b^*(\Delta, \xi)$, results from a $1/\frac{\partial b^*(\Delta,\xi)}{\partial \Delta}$ unit increase in Δ. The impact of a one unit increase in total business credit on subsequent macroeconomic outcomes is then given by:

$$\varepsilon(\Delta, \xi) = \frac{\frac{\partial Y^*(\Delta,\xi)}{\partial \Delta}}{\frac{\partial b^*(\Delta,\xi)}{\partial \Delta}} = \underbrace{\frac{\partial Y(\Delta, b^*(\Delta, \xi), \xi)}{\partial \Delta} \cdot \left(\frac{\partial b^*(\Delta, \xi)}{\partial \Delta}\right)^{-1}}_{\text{direct productivity effect, } > 0} + \underbrace{\frac{\partial Y(\Delta, b^*(\Delta, \xi), \xi)}{\partial b}}_{\text{effect through credit changes, } < 0} .$$

Compared to (8), the impact of fundamental driven credit boom has an extra direct productivity effect. Indeed, this term dominates and it overturns Proposition 1. As formalized in Proposition IA3 in Appendix IA3.4, the impact of a fundamental driven credit boom on macroeconomic outcomes is now positive: $\varepsilon(\Delta, \xi) > 0$. The increase in firms' productivity means that fundamental driven credit booms are followed by fewer defaults and higher output because of fewer inefficient liquidations. Moreover, a more efficient bankruptcy system (a higher ξ) now dampens the positive impact of a credit boom on macroeconomic outcomes: $\frac{\partial \varepsilon(\Delta,\xi)}{\partial \xi} < 0$. This is because a more efficient bankruptcy system leaves less room for increases in firms' productivity to improve macroeconomic outcomes by decreasing the number of defaults and inefficient bankruptcies. Finally, we note that the predictions in Proposition IA3 are again symmetric: the comparative statics apply to both fundamental driven credit booms and contractions.

Overall, the predictions here are inconsistent with the empirical evidence. First, we do not observe better macroeconomic outcomes following credit booms, in line with a growing amount of empirical studies of credit cycles (Schularick and Taylor, 2012; Mian, Sufi, and Verner, 2017). Second, the prediction about how macroeconomic outcomes following credit booms vary with bankruptcy efficiency also goes against the data.

In summary, the model analysis in the section suggests that higher bankruptcy efficiency helps ameliorate the impact of nonfundamental credit cycles. Such credit cycles are well recognized to undermine macroeconomic stability. Accordingly, our results point to the importance of incorporating default risks and bankruptcy institutions in the theory and practice of macroprudential policy design.

6   Conclusion

Legal institutions can influence the severity of financial frictions and in turn the contour of macroeconomic fluctuations. We explore these connections in the context of how business bankruptcy relates to the consequences of credit booms. The evidence supports the view that credit booms are especially detrimental when default resolution functions poorly. Indeed, this view has motivated reforms of bankruptcy institutions like in the case of Japan.

In general, understanding default resolution in practice can be useful for macroeconomic analyses. In many macro models, default resolution is akin to liquidation. Models that feature restructuring are less common. In ongoing work, we aim to develop a quantitative model to analyze the macro implications of restructuring versus liquidation, and evaluate how much different schemes of default resolution can affect economic fluctuations.

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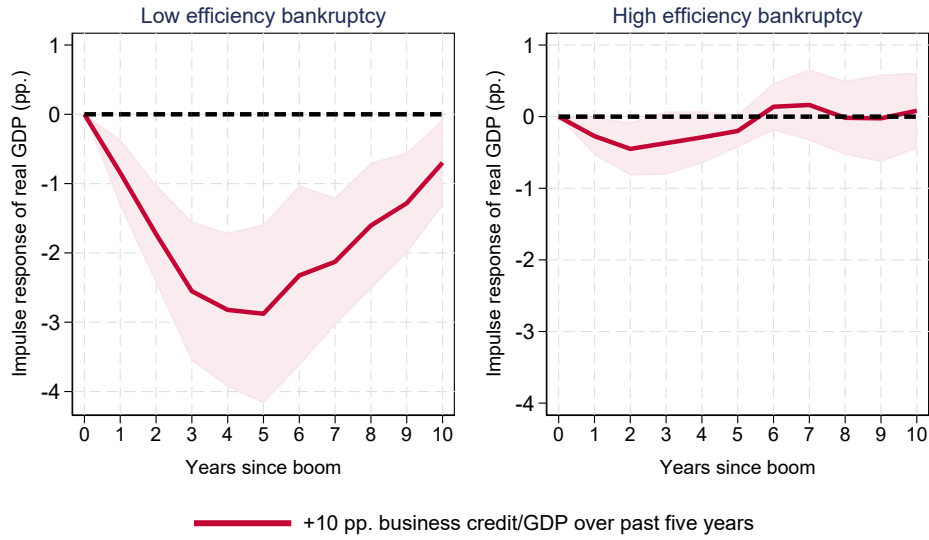# Internet Appendix: For Online Publication

IA1   Additional Results
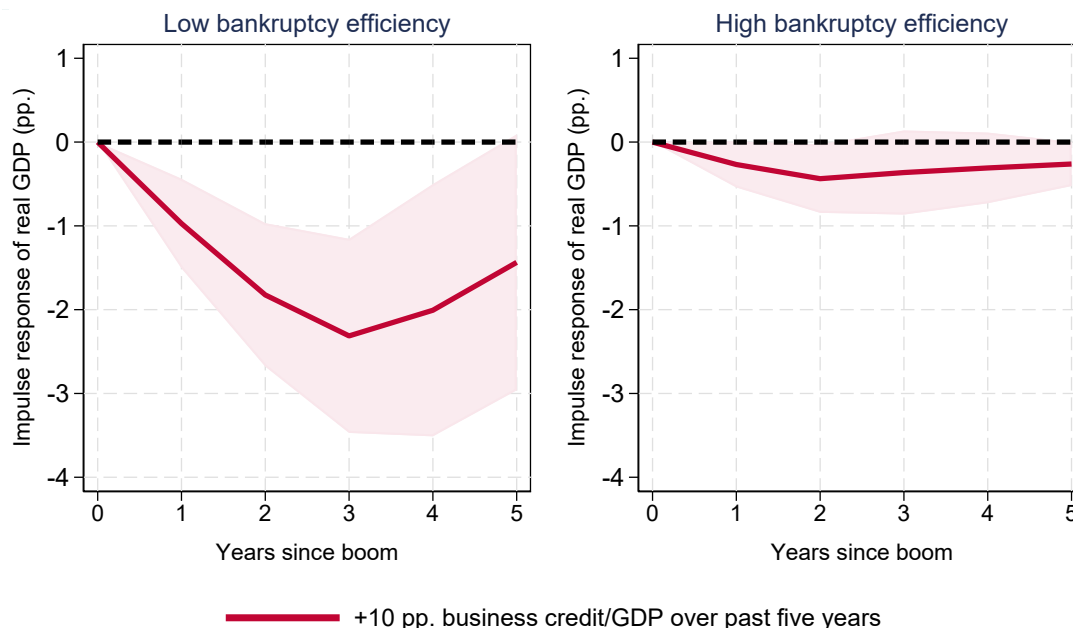
Figure IA1. Regression Sample
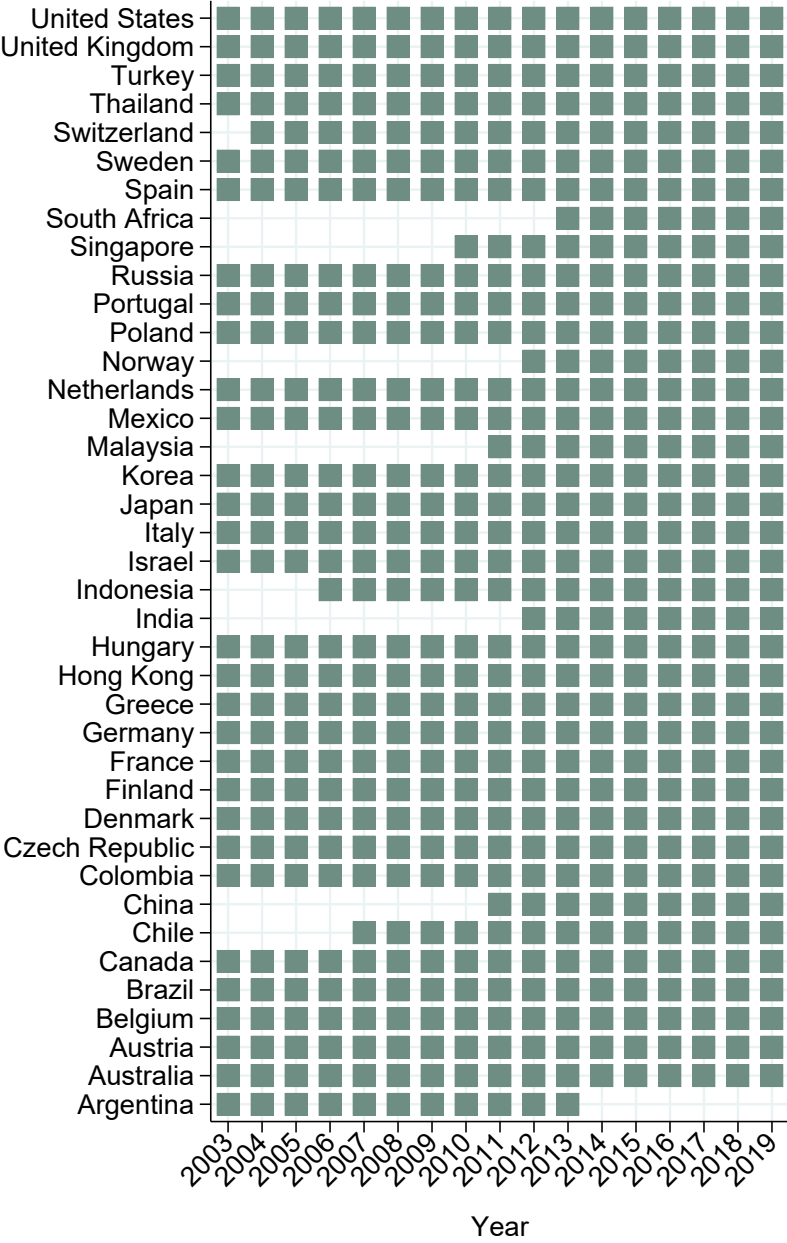
Notes: This figure shows the sample of countries and years covered in the baseline local projection regressions for GDP.

Figure IA2. GDP after Business Credit in the Longer Term

Notes: This figure shows the longer-term GDP trajectory following a 10 percentage point increase in the business credit-to-GDP ratio over the past 5 years. We estimate the following state-dependent local projections: $\Delta_h \log(\text{real GDP}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_i \times \Delta_5 c_{i,t}) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 10$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019.

Figure IA3. GDP following Business Credit Booms, Controlling for Development Status

+10 pp. business credit/GDP over past five years

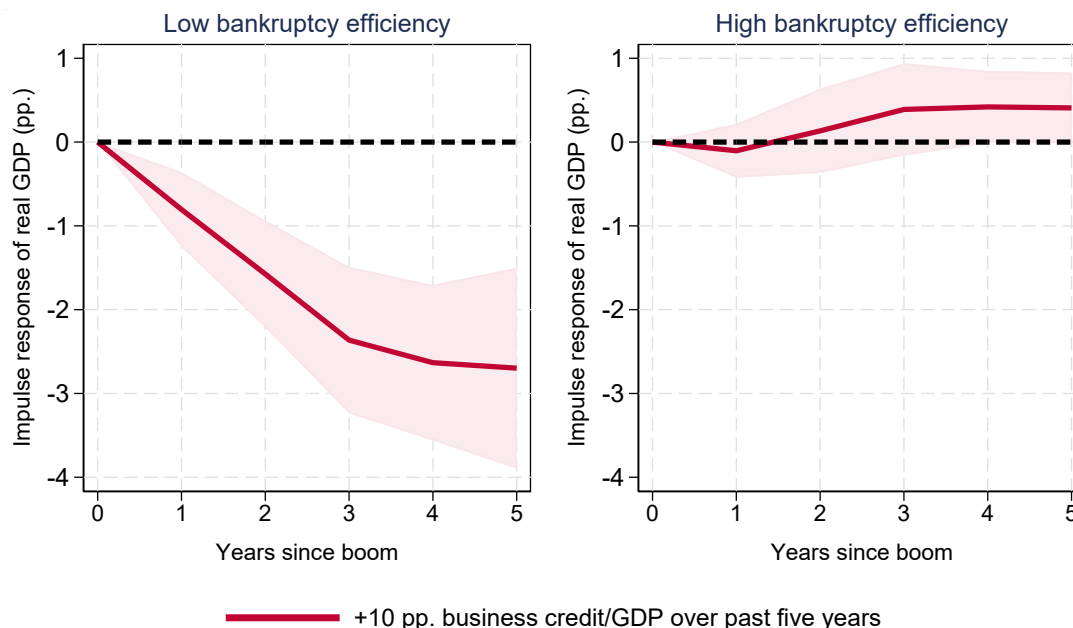*Notes:* This figure shows the trajectory of GDP following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate state-dependent local projections: $\Delta_h \log(\text{real GDP})_{i,t+h} = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h}\Delta_5 c_{i,t} + \beta_{3,h}(B_{i,t} \times \Delta_5 c_{i,t}) + \beta_{4,h}\text{eme}_{i,t} + \beta_{5,h}(\text{eme}_{i,t} \times \Delta_5 c_{i,t}) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The indicator variable $\text{eme}_{i,t}$ is one for low and middle-income countries. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). For both panels, $\text{eme}_{i,t}$ is set to 0. The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.

Figure IA4. GDP following Business Credit Booms, Controlling for Exchange Rate Regime

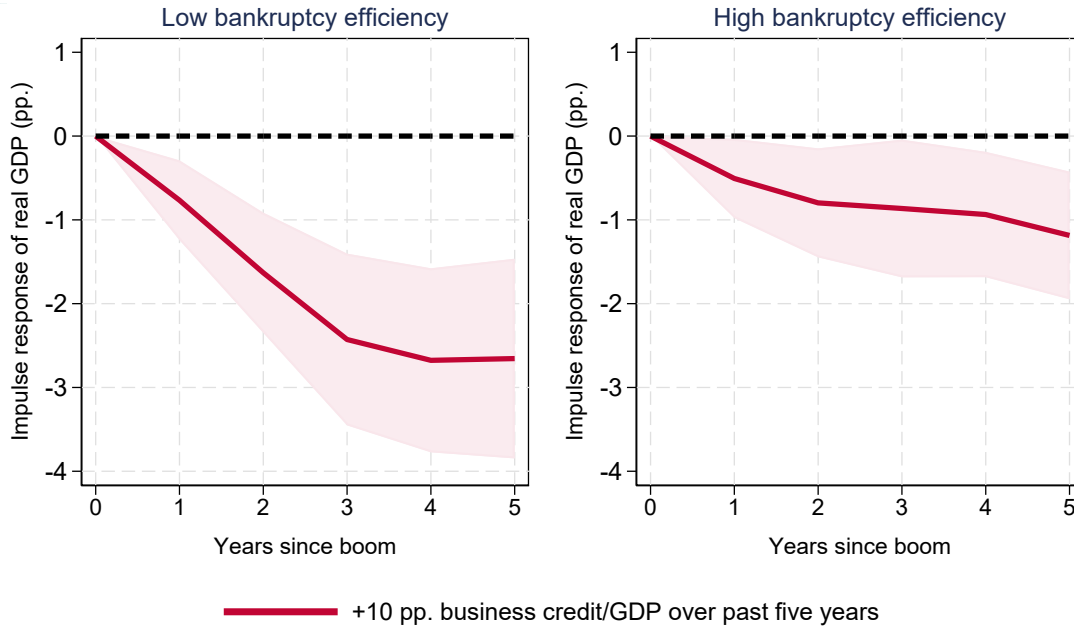

+10 pp. business credit/GDP over past five years

Notes: This figure shows the trajectory of GDP following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate state-dependent local projections: $\Delta_h \log(\text{real GDP})_{i,t+h} = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} \left(B_{i,t} \times \Delta_5 c_{i,t} \right) + \beta_{4,h} \text{peg}_{i,t} + \beta_{5,h} \left(\text{peg}_{i,t} \times \Delta_5 c_{i,t} \right) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The indicator variable $\text{peg}_{i,t}$ is one if the country has a fixed exchange rate, i.e., a value of one to four on the scale of foreign exchange regimes classified by Ilzetzki, Reinhart, and Rogoff (2019). The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). For both panels, $\text{peg}_{i,t}$ is set to 0. The sample contains annual data from an unbalanced panel of 39 cnountries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.

Figure IA5. GDP following Business Credit Booms, Controlling for Rule of Law

Low bankruptcy efficiency   **High bankruptcy efficiency**

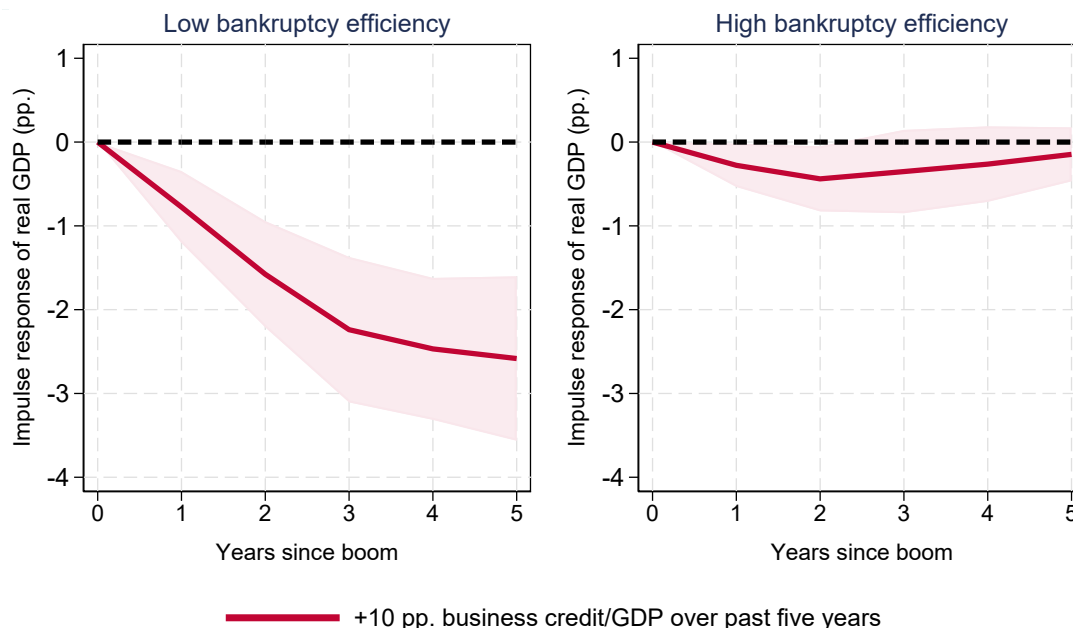+10 pp. business credit/GDP over past five years

Notes: This figure shows the trajectory of GDP following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate state-dependent local projections: $\Delta_h \log(\text{real GDP})_{i,t+h} = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_5 c_{i,t}) + \beta_{4,h} R_{i,t} + \beta_{5,h} (R_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h x_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ the bankruptcy efficiency measure. The variable $R_{i,t}$ measures the strength of the rule of law (Kaufmann and Kraay, 2023). The controls $x_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). For panels, $R_{i,t}$ is set to its sample mean. The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.

Figure IA6. GDP following Business Credit Booms with Fixed Bankruptcy Efficiency Measure

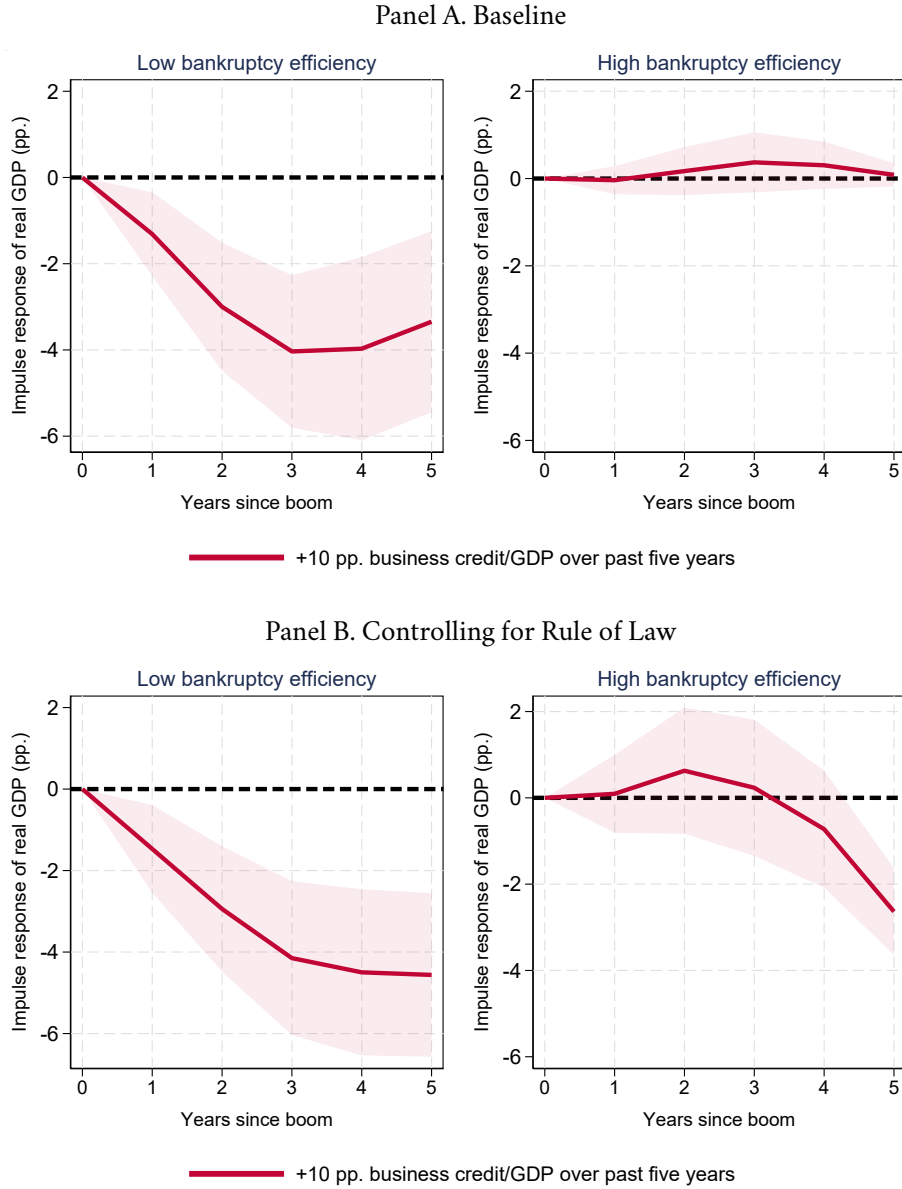+10 pp. business credit/GDP over past five years

Notes: This figure shows the trajectory of GDP following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate state-dependent local projections: $\Delta_h \log(\text{real GDP})_{i,t+h} = \alpha_{i,h} + \beta_{1,h} B_i + \beta_{2,h}\Delta_5 c_{i,t} + \beta_{3,h}\left(B_i \times \Delta_5 c_{i,t}\right) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and B_i is bankruptcy efficiency measured at the start of the sample. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.

Figure IA7. GDP following Business Credit Booms, Instrumenting Bankruptcy Efficiency

Panel A. Baseline

+10 pp. business credit/GDP over past five years

Panel B. Controlling for Rule of Law
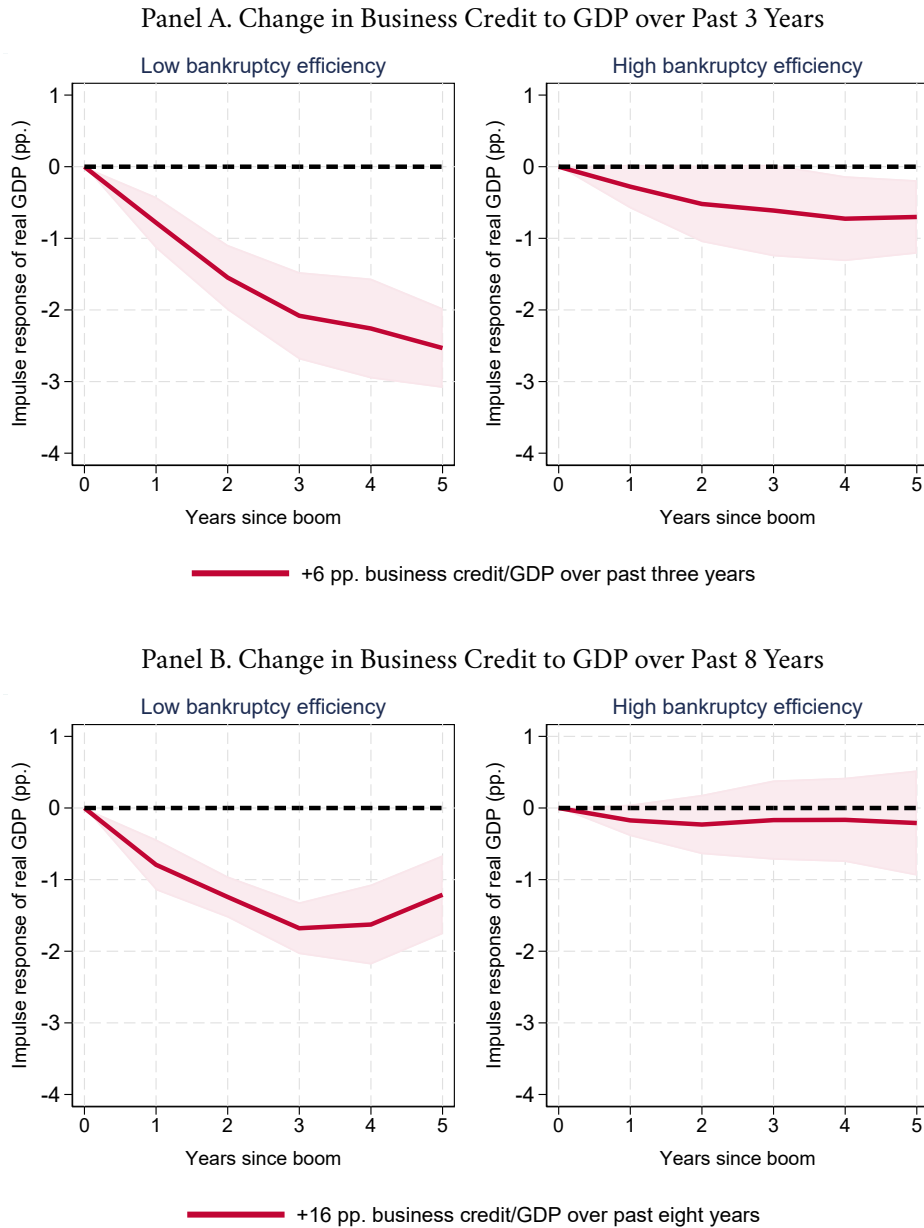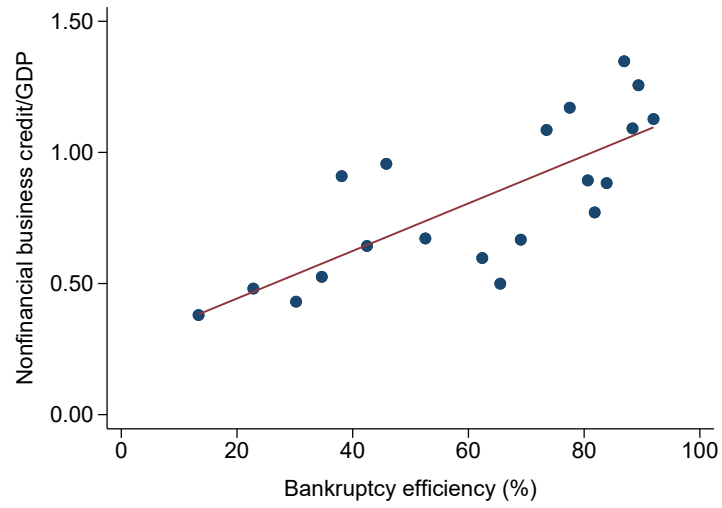

+10 pp. business credit/GDP over past five years

Notes: This figure shows the trajectory of GDP following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate state-dependent instrumental variable local projections: $\Delta_h \log(\text{real GDP}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h}\hat{B}_{i,t} + \beta_{2,h}\Delta_5 c_{i,t} + \beta_{3,h}\left(B_i \widehat{\times \Delta_5} c_{i,t}\right) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t and $B_{i,t}$ is the bankruptcy efficiency measure, instrumented by three dummies indicating English, French, or German legal origin with Nordic legal origin as base category. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Panel B additionally controls for the rule of law index (Kaufmann and Kraay, 2023) and its interaction with business credit fluctuations $\Delta_5 c_{i,t}$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.

Figure IA8. Measuring Credit Booms over Alternative Windows

Panel A. Change in Business Credit to GDP over Past 3 Years

+6 pp. business credit/GDP over past three years

Panel B. Change in Business Credit to GDP over Past 8 Years

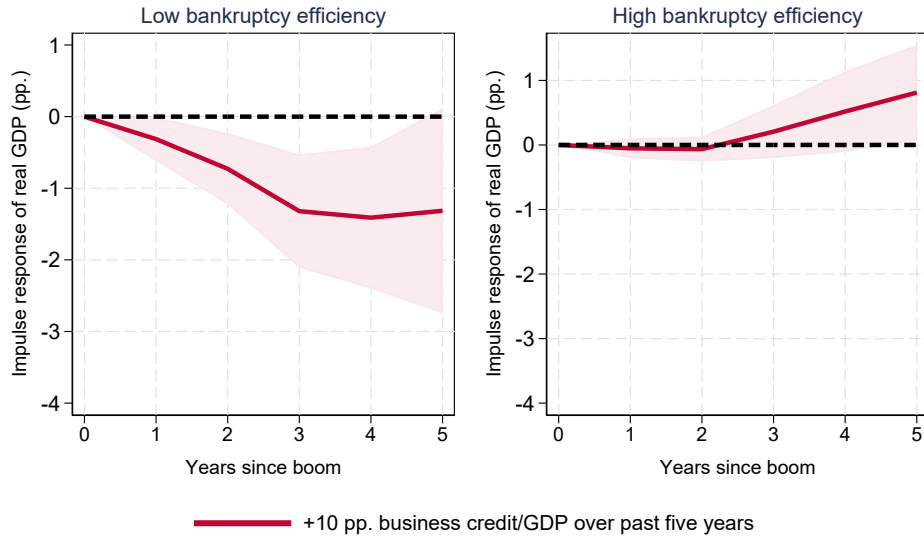+16 pp. business credit/GDP over past eight years

Notes: Panel A (B) shows the GDP trajectory following a 6 (16) percentage point increase in the business credit to GDP ratio over the past 3 (8) years. We normalize the change in business credit to GDP to 2 percentage points per year of the measurement window, following the baseline figures (10 percentage points over the past 5 years). We estimate the following state-dependent local projections: $\Delta_h \log(\text{real GDP}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_l c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_l c_{i,t}) + \gamma_h x_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_l c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - l$ to year t where $l \in \{3, 8\}$. $B_{i,t}$ is the bankruptcy efficiency measure. The controls $x_{i,t}$ include contemporaneous and 5 lags of real GDP growth and real investment growth, as well as the cumulative change in household credit to GDP since year $t - l$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panels evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas are 90% confidence intervals based on Driscoll-Kraay standard errors.

Figure IA9. Bankruptcy Efficiency and Level of Business Credit/GDP


Notes: This figure shows a binned scatter plot for the relationship between bankruptcy efficiency and credit to nonfinancial businesses relative to GDP. The sample comprises data from 39 countries over the period of 2003 to 2019. The line represents the linear prediction.

Figure IA10. Controlling for Debt Levels

Low bankruptcy efficiency

High bankruptcy efficiency

— +10 pp. business credit/GDP over past five years

Notes: The figure shows the GDP trajectory following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate the following state-dependent local projections: $\Delta_h \log(\text{real GDP}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_5 c_{i,t}) + \beta_{4,h} c_{i,t} + \beta_{5,h} (B_{i,t} \times c_{i,t}) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variables $c_{i,t}$ and $\Delta_5 c_{i,t}$ denote the level of business credit to GDP in country i in year t, and the change of business credit to GDP in country i from year $t - 5$ to year t. $B_{i,t}$ is the bankruptcy efficiency measure. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth and real investment growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panels evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas are 90% confidence intervals based on Driscoll-Kraay standard errors.

Figure IA11. GDP following Business Credit Contractions

Low bankruptcy efficiency — High bankruptcy efficiency
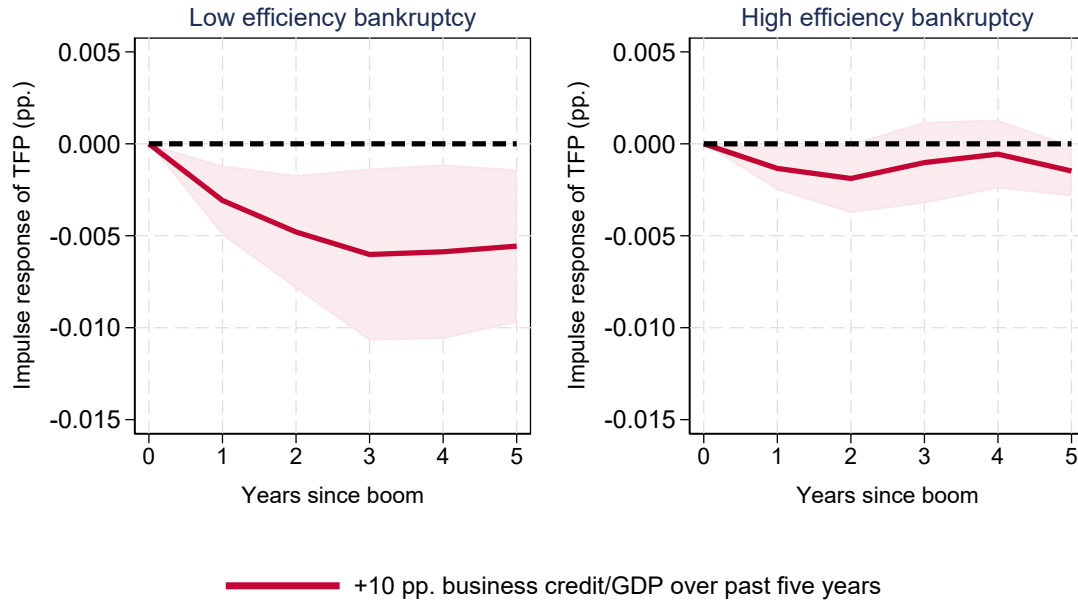
-10 pp. business credit/GDP over past five years
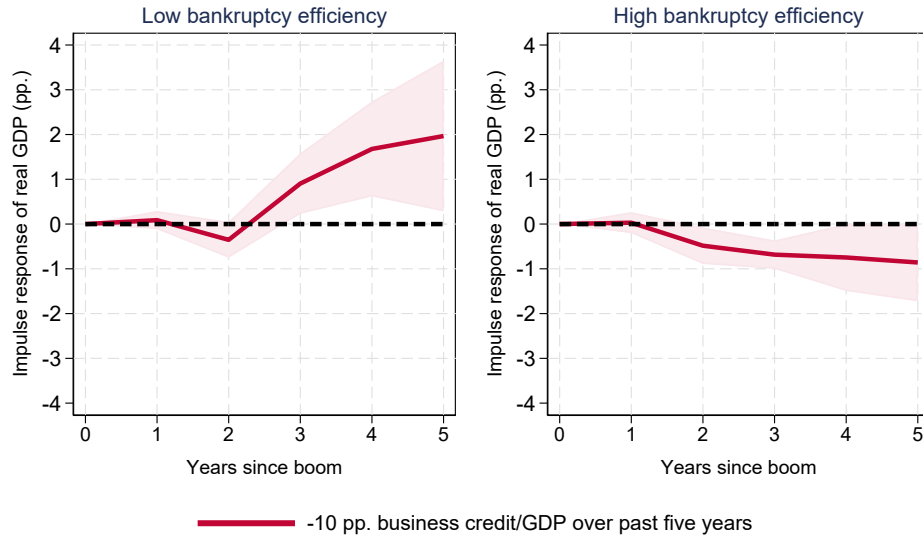
Notes: This figure shows the GDP trajectory following a 10 percentage point decrease in the business credit to GDP ratio over the past 5 years. We estimate the following state-dependent local projections implementing sign dependence following Ben Zeev, Ramey, and Zubairy (2023): $\Delta_h \log(\text{real GDP}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h x_{i,t} + \Delta^+ \left[\beta_{1,h}^+ B_{i,t} + \beta_{2,h}^+ \Delta_5 c_{i,t} + \beta_{3,h}^+ (B_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h^+ x_{i,t} \right] + \epsilon_{i,t}$ for $h = 1, ..., 5$. Δ^+ is a dummy variable indicating $\Delta_5 c_{i,t} > 0$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $x_{i,t}$ include contemporaneous and 5 lags of real GDP growth and real investment growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas are 90% confidence intervals based on Driscoll-Kraay standard errors.

Figure IA12. Total Factor Productivity following Business Credit Booms

+10 pp. business credit/GDP over past five years

Notes: This figure shows the trajectory of total factor productivity (TFP) following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate state-dependent local projections: $\Delta_h \log(\text{TFP}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_5 c_{i,t}) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log TFP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth and TFP growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.
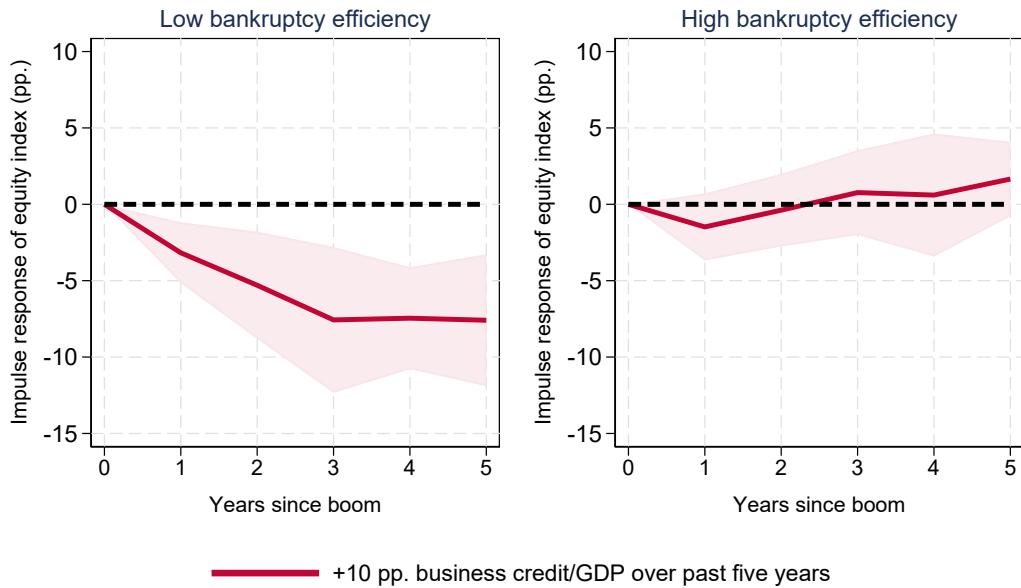
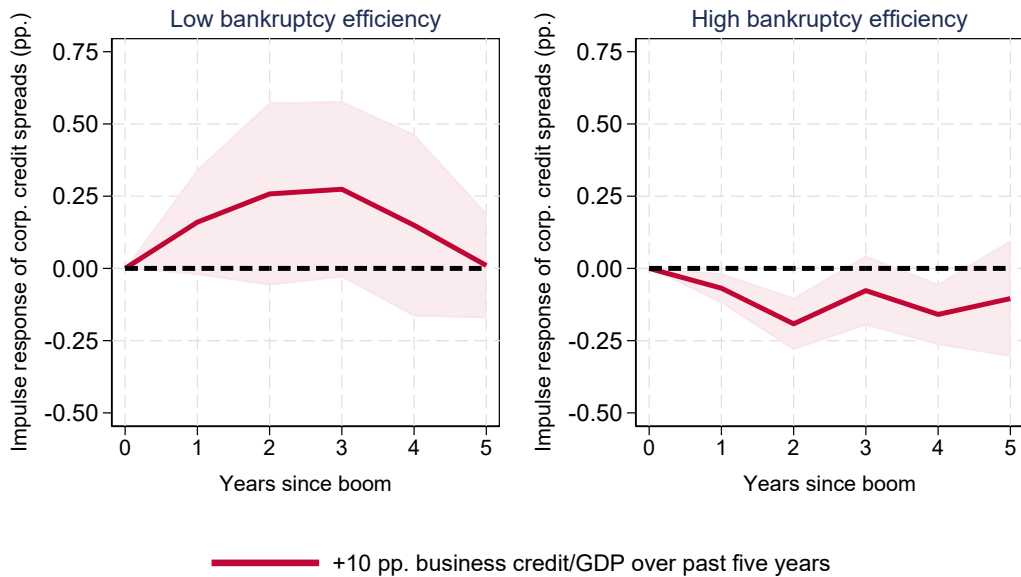## Figure IA13. Asset Prices following Business Credit Booms

Panel A. Stock Prices following Business Credit Booms

+10 pp. business credit/GDP over past five years

Panel B. Credit Spreads following Business Credit Booms

+10 pp. business credit/GDP over past five years

Notes: This figure shows the trajectory of real stock prices (Panel A) and credit spreads between long-term corporate and the government bonds (Panel B) following a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate state-dependent local projections: $\Delta_h \text{asset price}_{i,t+h} = \alpha_{i,h} + \beta_{1,h}B_{i,t} + \beta_{2,h}\Delta_5 c_{i,t} + \beta_{3,h}(B_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h x_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real stock price index (Panel A) and credit spread (Panel B) in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $x_{i,t}$ include contemporaneous and 5 lags of real GDP growth and the asset price change, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 36 advanced and emerging economies in Panel A, and 20 primarily advanced economies in Panel B. The sample period is 2003 to 2019. Shaded areas are 90% confidence intervals based on Driscoll-Kraay standard errors.

Figure IA14. Crisis Probability following Business Credit Booms

Low efficiency bankruptcy — High efficiency bankruptcy

- - - - - Average cumulative probability
━━━━━ +10 pp. business credit/GDP over past five years
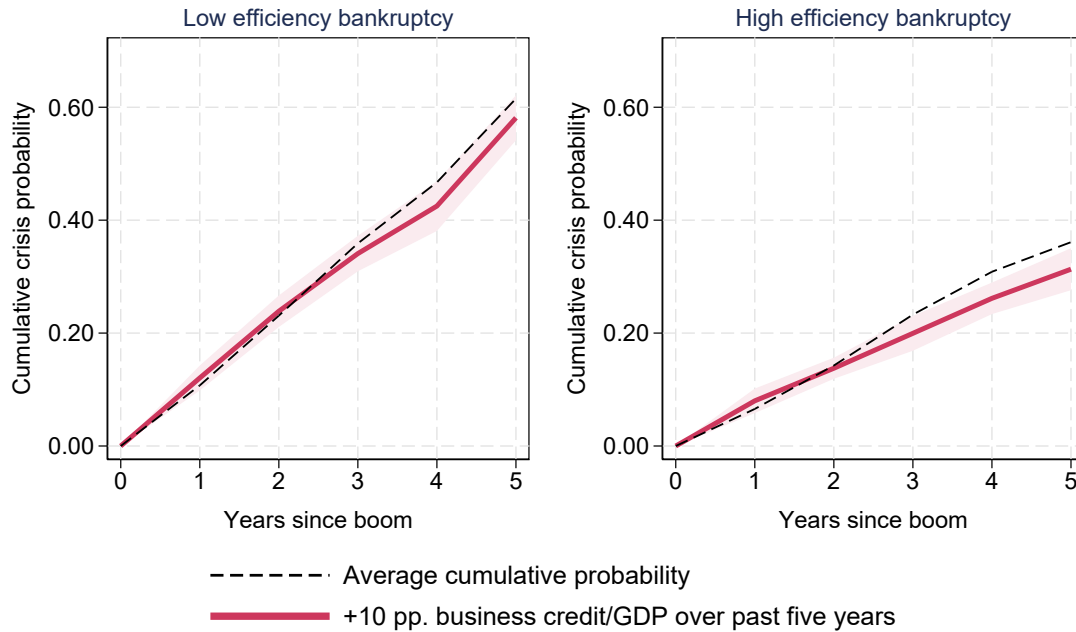
Notes: This figure shows the cumulative probability of a financial crisis with (solid red line) and without (dashed black line) a 10 percentage point increase in the business credit to GDP ratio over the past 5 years. We estimate linear probability models using state-dependent local projections: $\mathbb{1}(\text{crisis since } t)_{i,t+h} = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h x_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the occurrence of a financial crisis in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $x_{i,t}$ include contemporaneous and 5 lags of real GDP growth and crisis indicators, as well as the cumulative change in household credit to GDP since $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The left (right) panel evaluates the impulse response using $B_{i,t}$ at the bottom (top) quartile, which is equal to 43% (83%). The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Shaded areas mark 90% confidence intervals based on Driscoll-Kraay standard errors.

Table IA1 – Change in Log Real GDP, Controlling for Development Status

	(1) $h = 1$	(2) $h = 2$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
Δ_5 Business credit/GDP $\times$ Bankruptcy efficiency	0.176**	0.347***	0.487***	0.425**	0.293
	(0.075)	(0.116)	(0.154)	(0.183)	(0.195)
Δ_5 Business credit/GDP	-0.173**	-0.331***	-0.441***	-0.383**	-0.270
	(0.060)	(0.095)	(0.128)	(0.162)	(0.168)
Bankruptcy efficiency	-0.869	-0.863	0.743	2.989**	4.708*
	(0.907)	(1.206)	(1.007)	(1.103)	(2.240)
Δ_5 Business credit/GDP $\times$ Emerging market economy	0.058	0.105	0.064	-0.028	-0.123***
	(0.047)	(0.064)	(0.081)	(0.066)	(0.037)
Emerging market economy	2.043*	5.279**	7.058**	9.159***	11.465***
	(0.968)	(1.977)	(2.350)	(2.942)	(3.275)
Country FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.44	0.54	0.62	0.67	0.72
Observations	560	522	484	446	408

Notes: This table shows results from the following state-dependent local projections: $\Delta_h \log(\text{real GDP})_{i,t+h} = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} \left(B_{i,t} \times \Delta_5 c_{i,t} \right) + \beta_{4,h} \text{eme}_{i,t} + \beta_{5,h} \left(\text{eme}_{i,t} \times \Delta_5 c_{i,t} \right) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The indicator variable $\text{eme}_{i,t}$ is one for low and middle-income countries. The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Driscoll-Kraay standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table IA2 – Change in Log Real GDP, Controlling for Exchange Rate Regime

	(1) $h = 1$	(2) $h = 2$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
Δ_5 Business credit/GDP $\times$ Bankruptcy efficiency	0.175**	0.427***	0.688***	0.763***	0.776***
	(0.063)	(0.106)	(0.144)	(0.168)	(0.189)
Δ_5 Business credit/GDP	-0.156***	-0.341***	-0.532***	-0.591***	-0.604***
	(0.049)	(0.077)	(0.107)	(0.123)	(0.146)
Bankruptcy efficiency	-1.514*	-2.748**	-2.746	-1.795	-0.928
	(0.841)	(1.106)	(1.873)	(2.733)	(3.101)
Δ_5 Business credit/GDP $\times$ Currency peg	-0.025	-0.088**	-0.118**	-0.111*	-0.096
	(0.021)	(0.038)	(0.053)	(0.062)	(0.054)
Currency peg	1.426	3.312*	5.528**	4.731*	2.852
	(0.813)	(1.580)	(2.242)	(2.440)	(2.010)
Country FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.43	0.52	0.60	0.66	0.71
Observations	560	522	484	446	408

Notes: This table shows results from the following state-dependent local projections: $\Delta_h \log(\text{real GDP})_{i,t+h} = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_5 c_{i,t}) + \beta_{4,h} \text{peg}_{i,t} + \beta_{5,h} (\text{peg}_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h x_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The indicator variable $\text{peg}_{i,t}$ is one if the country has a fixed exchange rate, i.e., a value of one to four on the scale of foreign exchange regimes classified by Ilzetzki, Reinhart, and Rogoff (2019). The controls $x_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Driscoll-Kraay standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table IA3 – Change in Log Real GDP, Controlling for Rule of Law

	(1) $h = 1$	(2) $h = 2$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
Δ_5 Business credit/GDP $\times$ Bankruptcy efficiency	0.065	0.208**	0.391***	0.435**	0.367*
	(0.051)	(0.088)	(0.122)	(0.143)	(0.196)
Δ_5 Business credit/GDP	-0.105**	-0.253***	-0.411***	-0.455***	-0.424**
	(0.041)	(0.069)	(0.100)	(0.115)	(0.144)
Bankruptcy efficiency	-0.235	-0.203	1.610	3.621	6.223
	(0.957)	(1.222)	(2.311)	(3.702)	(4.390)
Δ_5 Business credit/GDP $\times$ Rule of law	0.037*	0.055*	0.079*	0.105**	0.160***
	(0.020)	(0.029)	(0.044)	(0.045)	(0.051)
Rule of law	-0.184	-0.432	-1.827	-4.008*	-7.579*
	(0.872)	(1.120)	(1.423)	(2.149)	(4.084)
Country FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.43	0.52	0.60	0.66	0.71
Observations	560	522	484	446	408

Notes: This table shows results from the following state-dependent local projections: $\Delta_h \log(\text{real GDP})_{i,t+h} = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_5 c_{i,t}) + \beta_{4,h} R_{i,t} + \beta_{5,h} (R_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h x_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The variable $R_{i,t}$ measures the strength of the rule of law (Kaufmann and Kraay, 2023). The controls $x_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Driscoll-Kraay standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table IA4 – Change in GDP, Instrumenting Bankruptcy Efficiency

Panel A. Baseline

	(1) $h = 1$	(2) $h = 2$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
Δ_5 Business credit/GDP × Bankruptcy efficiency (instr.)	0.212** (0.095)	0.528*** (0.157)	0.734*** (0.185)	0.712*** (0.209)	0.572*** (0.191)
Δ_5 Business credit/GDP	-0.195** (0.077)	-0.458*** (0.122)	-0.624*** (0.144)	-0.611*** (0.171)	-0.506*** (0.164)
Country FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
First stage F	24.77	21.95	17.94	14.58	13.98
R^2	0.13	0.13	0.17	0.21	0.25
Observations	560	522	484	446	408

Panel B. Controlling for Rule of Law

	(1) $h = 1$	(2) $h = 2$	(3) $h = 3$	(4) $h = 4$	(5) $h = 5$
Δ_5 Business credit/GDP × Bankruptcy efficiency (instr.)	0.260* (0.143)	0.595*** (0.219)	0.730*** (0.208)	0.629*** (0.216)	0.321* (0.165)
Δ_5 Business credit/GDP	-0.225** (0.095)	-0.473*** (0.139)	-0.634*** (0.150)	-0.638*** (0.163)	-0.552*** (0.148)
Δ_5 Business credit/GDP × Rule of Law	-0.305 (2.283)	-2.482 (3.346)	1.084 (4.024)	6.694* (3.855)	16.954*** (2.929)
Rule of law index	0.012 (1.036)	-0.120 (1.446)	-1.610 (1.542)	-3.840* (2.166)	-7.638* (4.187)
Country FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
First stage F	8.14	10.35	9.81	9.41	8.47
R^2	0.13	0.13	0.18	0.22	0.26
Observations	560	522	484	446	408

Notes: This table shows state-dependent instrumented variable local projections: $\Delta_h \log(\text{real GDP}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h}\hat{B}_{i,t} + \beta_{2,h}\Delta_5 c_{i,t} + \beta_{3,h}\left(\widehat{B_i \times \Delta_5 c_{i,t}}\right) + \boldsymbol{\gamma}_h \boldsymbol{x}_{i,t} + \epsilon_{i,t}$ for $h = 1, ..., 5$. $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t. $B_{i,t}$ is the bankruptcy efficiency measure, instrumented by three indicator variables for English, French, or German legal origin (Nordic legal origin is the base category). The controls $\boldsymbol{x}_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since $t - 5$. Panel B additionally controls for the rule of law index (Kaufmann and Kraay, 2023) and its interaction with business credit fluctuations $\Delta_5 c_{i,t}$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. Since the legal origin instruments are time-invariant, we cannot identify the base coefficient $\beta_{1,h}$ for bankruptcy efficiency alongside country fixed effects. The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Driscoll-Kraay standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table IA5 – Change in Log Real GDP after Business Credit Contractions and Expansions

	(1) $h=1$	(2) $h=2$	(3) $h=3$	(4) $h=4$	(5) $h=5$
Δ_5 Business credit/GDP $\times$ Bankruptcy efficiency	0.014	0.033	0.397***	0.606**	0.706***
	(0.054)	(0.076)	(0.109)	(0.202)	(0.227)
Δ_5 Business credit/GDP	-0.015	0.021	-0.261***	-0.428**	-0.500**
	(0.034)	(0.050)	(0.083)	(0.141)	(0.185)
Bankruptcy efficiency	-2.273***	-3.634*	-1.246	0.014	0.786
	(0.761)	(1.912)	(3.013)	(4.447)	(4.847)
$\Delta^+ \times \Delta_5$ Business credit/GDP $\times$ Bankruptcy efficiency	0.223**	0.450***	0.194	-0.058	-0.178
	(0.076)	(0.139)	(0.154)	(0.213)	(0.217)
$\Delta^+ \times \Delta_5$ Business credit/GDP	-0.211***	-0.488***	-0.291**	-0.088	0.035
	(0.061)	(0.132)	(0.131)	(0.156)	(0.166)
$\Delta^+ \times$ Bankruptcy efficiency	-0.286	0.206	0.144	0.589	-0.322
	(0.509)	(0.997)	(1.106)	(1.003)	(1.671)
Country FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.46	0.55	0.62	0.67	0.72
Observations	560	522	484	446	408

Notes: This table shows results from the following state-dependent local projections implementing sign dependence following Ben Zeev, Ramey, and Zubairy (2023): $\Delta_h \log(\text{real GDP}_{i,t+h}) = \alpha_{i,h} + \beta_{1,h} B_{i,t} + \beta_{2,h} \Delta_5 c_{i,t} + \beta_{3,h} (B_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h x_{i,t} + \Delta^+ \left[\beta_{1,h}^+ B_{i,t} + \beta_{2,h}^+ \Delta_5 c_{i,t} + \beta_{3,h}^+ (B_{i,t} \times \Delta_5 c_{i,t}) + \gamma_h^+ x_{i,t} \right] + \epsilon_{i,t}$ for $h = 1, ..., 5$. Δ^+ is a dummy variable indicating $\Delta_5 c_{i,t} > 0$, namely having a credit boom. The outcome variable is the change in log real GDP in country i from year t to year $t + h$. The independent variable $\Delta_5 c_{i,t}$ denotes the change of business credit to GDP in country i from year $t - 5$ to year t, and $B_{i,t}$ is the bankruptcy efficiency measure. The controls $x_{i,t}$ include contemporaneous and 5 lags of real GDP growth, as well as the cumulative change in household credit to GDP since year $t - 5$. Horizon-specific country fixed effects $\alpha_{i,h}$ are included. The sample contains annual data from an unbalanced panel of 39 countries. The sample period is 2003 to 2019. Driscoll-Kraay standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

IA2 Classification Procedure of Asset-Based Debt and Cash Flow-Based Debt

In the following, we explain the categorization of asset-based lending and cash flow-based lending, using debt-level data for nonfinancial firms in CapitalIQ.

We begin with debt-level information from CapitalIQ, available since 2002. For each debt, CapitalIQ provides information about the amount outstanding, together with detailed descriptions of the debt (e.g., debt type, collateral structure, lender, etc.). CapitalIQ is very helpful because it covers all types of debt and tracks the amount outstanding for each debt in each firm-year, which facilitates a comprehensive analysis. CapitalIQ assembles these data from various filings. It covers about 80% of Compustat firms and 90% of debt by value in Compustat. The total debt value for each firm matches well based on CapitalIQ data and Compustat data. We supplement information from CapitalIQ with additional information on debt attributes from DealScan, FISD, and SDC Platinum. We examine nonfinancial firms, which have SIC codes outside of 6000 to 6999.

We categorize firms' debt into four groups: 1) asset-based lending, 2) cash flow-based lending, 3) personal loans, 4) miscellaneous and unclassified borrowing. We proceed in several steps:

1. We classify a debt as asset-based lending if

   - the debt information contains the following key words (and their variants): asset-based, ABL, borrowing base, mortgage, real estate/building, equipment, machine, fixed asset, inventory, receivable, working capital, automobile/vehicle, aircraft, capital lease, SBA/small business, oil/drill/rig, reserve-based, factoring, industrial revenue bond, finance company, capital lease, construction, project finance;

   - it is a secured revolver (since asset-based revolvers are more common than cash flow-based revolvers with blanket liens).

2. We classify a debt as personal loan if

   - the lender is an individual (Mr./Ms., etc);

   - it is from directors/executive/chairman/founder/shareholders/related parties.

3. We also assign a debt to the miscellaneous/unclassified category if it is

   - borrowing from governments or a pollution control bond;

   - insurance-related borrowing, or borrowing from vendor/seller/supplier/landlord;

   - borrowing from affiliated companies.

4. We classify a debt as cash flow-based lending if it **does not belong to any of the categories above** and

- it explicitly says "cash flow-based"/"cash flow loan";

- it is unsecured, is a "debenture", or is secured by "substantially all assets";

- it contains the following key words and their variants, which are representative of cash flow-based loans: first lien/second lien/third lien, term facility/term loan facility/term loan a, b, c..., syndicated, tranche, acquisition line, bridge loan;

- it is a bond or it contains standard key words for bonds, such as senior subordinated, senior notes, x% notes due, private placement, medium term notes;

- it is a convertible bond.

5. We assign all remaining secured debt to asset-based lending to be conservative.

IA3 Proofs and Theoretical Extensions

IA3.1 Proof of Proposition 1.

The firm's optimally chosen face value of debt $b^*(\beta, \beta_f, \xi)$ in (2) subject to (3) and (4) satisfies the first-order condition:[8]

$$\frac{\partial \left(q_b(b, \beta, \xi) \cdot b\right)}{\partial b}\Bigg|_{b=b^*\left(\beta, \beta_f, \xi\right)} = \beta_f \int_{b^*\left(\beta, \beta_f, \xi\right)}^{z_j} \phi\left(z_j\right) dz_j = \beta_f \left(1 - \Phi\left(b^*\left(\beta, \beta_f, \xi\right)\right)\right). \tag{IA1}$$

From (5) for the price schedule $q_b(b, \beta, \xi)$, we know that, for $b \in (\underline{z}, \bar{z})$,

$$q_b(b, \beta, \xi) \cdot b = \beta \left(b\left(1 - \Phi(b)\right) + (1 - \xi)\Phi(b)z^{\text{liq}} + \xi \int_{\underline{z}}^{b} z_j \phi(z_j) dz_j\right), \tag{IA2}$$

and

$$\frac{\partial(q_b(b, \beta, \xi) \cdot b)}{\partial b} = \beta \left(1 - \Phi(b) - (1 - \xi)\left(b - z^{\text{liq}}\right)\phi(b)\right).$$

Together, the optimal face value of debt $b^*(\beta, \beta_f, \xi)$ satisfies:

$$\beta \left(1 - \Phi(b^*(\beta, \beta_f, \xi)) - (1 - \xi)\left(b^*(\beta, \beta_f, \xi) - z^{\text{liq}}\right)\phi(b^*(\beta, \beta_f, \xi))\right) = \beta_f \left(1 - \Phi(b^*(\beta, \beta_f, \xi))\right). \tag{IA3}$$

Note that z_j is drawn from a uniform distribution with a measure 1 support $[\underline{z}, \bar{z}]$ and $z^{\text{liq}} = \underline{z}$, then (IA3) becomes:

$$\beta_f(\bar{z} - b^*(\beta, \beta_f, \xi)) = \beta(\bar{z} - b^*(\beta, \beta_f, \xi) - (1 - \xi)(b^*(\beta, \beta_f, \xi) - \underline{z})),$$

which means that:

$$b^*(\beta, \beta_f, \xi) = \bar{z} - \frac{1 - \xi}{2 - \xi - \frac{\beta_f}{\beta}} = \underline{z} + \frac{1 - \frac{\beta_f}{\beta}}{2 - \xi - \frac{\beta_f}{\beta}}. \tag{IA4}$$

Because $\xi \in (0, 1)$ and $\beta_f < \beta$, we know that $0 < \frac{1 - \xi}{2 - \xi - \frac{\beta_f}{\beta}} < 1$, which means that $b^*(\beta, \beta_f, \xi) \in (\underline{z}, \bar{z})$. This means that the optimal face value of debt is interior to the interval $(\underline{z}, \bar{z})$, and there is a positive measure of firms both going bankrupt and not going bankrupt in the second period.

We still have to verify that the firm is willing to invest ($V_f > 0$):

$$V_f > 0 \iff \beta_f \mathbb{E}[\text{div}_2] + \beta \mathbb{E}\left[\mathbb{I}_{\{b^*(\beta, \beta_f, \xi) \leq z_j\}} \cdot b^*(\beta, \beta_f, \xi) + \mathbb{I}_{\{b^*(\beta, \beta_f, \xi) > z_j\}} \cdot \left((1 - \xi)z^{\text{liq}} + \xi z_j\right)\right] \geq I, \tag{IA5}$$

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[8](IA1) uses the fact that the optimal face value of debt $b^*(\beta, \beta_f, \xi) \in (\underline{z}, \bar{z})$, which we verify below.

where we replace div_1 using (3) and replace $q_b(b, \beta, \xi)$ using (5). (IA5) is equivalent to:

$$\beta_f \int_{b^*}^{\bar{z}} (z_j - b^*)\phi(z_j)dz_j + \beta \left(b^*(1 - \Phi(b^*)) + (1 - \xi)\Phi(b^*)z^{\text{liq}} + \xi \int_{\underline{z}}^{b^*} z_j\phi(z_j)dz_j \right) > I,$$

$$\iff \frac{\beta_f}{2}(\bar{z} - b^*)^2 + \beta \left(b^*(\bar{z} - b^*) + (1 - \xi)(b^* - \underline{z})\underline{z} + \frac{\xi}{2}\left((b^*)^2 - (\underline{z})^2\right) \right) > I,$$

$$\iff \frac{\beta_f}{2}\left(\frac{1 - \xi}{2 - \xi - \frac{\beta_f}{\beta}}\right)^2 + \beta \left(\left(1 - \frac{\xi}{2}\right)\frac{1 - \frac{\beta_f}{\beta}}{2 - \xi - \frac{\beta_f}{\beta}}\frac{1 - \xi}{2 - \xi - \frac{\beta_f}{\beta}} + \frac{\xi}{2}\frac{1 - \frac{\beta_f}{\beta}}{2 - \xi - \frac{\beta_f}{\beta}} + \underline{z} \right) > I,$$

$$\iff \frac{\beta}{2}\left(\frac{1 - \xi\frac{\beta_f}{\beta}}{2 - \xi - \frac{\beta_f}{\beta}}\right) + \beta\underline{z} > I,$$

where we condense the notation of $b^*(\beta, \beta_f, \xi)$ to b^* for simplicity. Hence by Assumption 1 we can see the firm is willing to invest.

For the first part of Proposition 1, we take the derivative of $b^*(\beta, \beta_f, \xi)$ in (IA4) with respect to ξ:

$$\frac{\partial b^*(\beta, \beta_f, \xi)}{\partial \xi} = \frac{1 - \frac{\beta_f}{\beta}}{\left(2 - \xi - \frac{\beta_f}{\beta}\right)^2} > 0,$$

where we use the fact that $\beta_f < \beta$.

For the second part, using the formula for output in (6) and the fact z_j that is drawn from a uniform distribution with a measure 1 support $[\underline{z}, \bar{z}]$, we know that, for $b \in (\underline{z}, \bar{z})$,

$$Y(b, \xi) = \underline{z} + \frac{1}{2} - \frac{1 - \xi}{2}(b - \underline{z})^2.$$

Together with (8), the impact of the credit boom in the first period on aggregate output in the second period is given by:

$$\varepsilon(\beta, \beta_f, \xi) = \frac{\partial Y(b^*(\beta, \beta_f, \xi), \xi)}{\partial b} = -(1 - \xi)\left(\frac{1 - \frac{\beta_f}{\beta}}{2 - \xi - \frac{\beta_f}{\beta}}\right) < 0.$$

Finally, note that

$$\frac{\partial \varepsilon(\beta, \beta_f, \xi)}{\partial \xi} = \frac{\left(1 - \frac{\beta_f}{\beta}\right)\left(2 - \xi - \frac{\beta_f}{\beta}\right) - (1 - \xi)\left(1 - \frac{\beta_f}{\beta}\right)}{\left(2 - \xi - \frac{\beta_f}{\beta}\right)^2} = \left[\frac{1 - \frac{\beta_f}{\beta}}{2 - \xi - \frac{\beta_f}{\beta}}\right]^2 > 0.$$

IA3.2   The Impact of Credit Booms Driven by Creditors' Beliefs

Here, we show that the results in Proposition 1 are robust to credit booms driven by creditors' beliefs. That is, higher bankruptcy efficiency still dampens the negative impact of credit booms when the booms are driven by shocks to creditors' beliefs (rather than by shocks to the discount rate), as modeled in Dávila and Walther (2023). Specifically, consider the environment in Section 5, but creditors' and firms' discount rates are fixed at a value $\beta > \beta_f$. Firms still have rational expectations, believing that z_j is drawn from the uniform distribution $[\underline{z}, \bar{z}]$. Creditors instead have irrational expectations, believing that z_j is drawn from the uniform distribution $[\underline{z} + \Delta, \bar{z} + \Delta]$, where Δ captures shocks to creditors' beliefs. For example, when $\Delta > 0$, creditors are overly optimistic about the potential cash flows from firms' investment opportunities, leading to a belief-driven increase in credit supply. We will keep $z^{\text{liq}} = \underline{z}$, and both firms and creditors believe so.

In this case, the price schedule $q_b(b, \xi, \Delta)$ is given by a variant of (5), where rational expectations are replaced with creditors' subjective expectations. That is, (IA2) becomes as follows. For $b \in (\underline{z} + \Delta, \bar{z} + \Delta)$,

$$
q_b(b, \xi, \Delta) \cdot b = \beta \left(b\left(1 - \Phi(b - \Delta)\right) + (1 - \xi)\Phi(b - \Delta)z^{\text{liq}} + \xi \int_{\underline{z}}^{(b-\Delta)} (z_j + \Delta)\phi(z_j)dz_j \right),
\tag{IA6}
$$

where β is eliminated as an argument because it is fixed (similarly, we drop β_f as an argument below). Each firm optimally chooses the face value of debt $b^*(\Delta, \xi)$ in (2) subject to (3) and (4) and the price schedule $q_b(b, \xi, \Delta)$ here.

Here, credit booms are driven by shocks to creditors' belief Δ. A one-unit increase in total business credit results from a $1/\frac{\partial b^*(\Delta, \xi)}{\partial \Delta}$ increase in unit increase in Δ. The impact of a one unit increase in total business credit on subsequent macroeconomic outcomes (e.g., aggregate output/GDP $Y^*(\Delta, \xi) \equiv Y(b^*(\Delta, \xi), \xi)$), is then given by:

$$
\varepsilon(\Delta, \xi) = \frac{\frac{\partial Y^*(\Delta, \xi)}{\partial \Delta}}{\frac{\partial b^*(\Delta, \xi)}{\partial \Delta}} = \frac{\partial Y(b^*(\Delta, \xi), \xi)}{\partial b},
\tag{IA7}
$$

Now, we show that Proposition 1 is robust to credit booms driven by creditors' beliefs.

Proposition IA1. *Consider credit booms driven by creditors' beliefs. Under Assumption 1, there exists a $\bar{\Delta} > 0$ such that, for all $|\Delta| < \bar{\Delta}$,*

1. A more efficient bankruptcy system (a higher ξ) is associated with a larger credit market: $\frac{\partial b^*(\Delta, \xi)}{\partial \xi} > 0$.

2. The impact of credit booms on macroeconomic outcomes is negative: $\varepsilon(\Delta, \xi) < 0$. Furthermore, a more efficient bankruptcy system (a higher ξ) dampens the negative impact of credit booms on macroeconomic outcomes: $\frac{\partial \varepsilon(\Delta, \xi)}{\partial \xi} > 0$.

Proof of Proposition IA1:

The firm's optimally chosen face value of debt $b^*(\Delta, \xi)$ in (2) subject to (3) and (4) satisfies the first-order condition:[9]

$$\left.\frac{\partial(q_b(b,\xi,\Delta)\cdot b)}{\partial b}\right|_{b=b^*(\Delta,\xi)} = \beta_f \int_{b^*(\Delta,\xi)}^{\bar{z}_j} \phi(z_j)dz_j = \beta_f\left(1-\Phi(b^*(\Delta,\xi))\right).$$

From the price schedule (IA6), we know that, for $b \in (\underline{z}+\Delta, \bar{z}+\Delta)$,

$$\frac{\partial(q_b(b,\xi,\Delta)\cdot b)}{\partial b} = \beta\left(1-\Phi(b-\Delta)-(1-\xi)\left(b-z^{\text{liq}}\right)\phi(b-\Delta)\right).$$

Combining everything and using the fact that $\Phi(\cdot)$ and $\phi(\cdot)$ are based on a uniform distribution with support $[\underline{z}, \bar{z}]$ and that $z^{\text{liq}} = \underline{z}$, the optimal face value of debt $b^*(\Delta, \xi)$ solves:[10]

$$\beta_f(\bar{z}-b^*(\Delta,\xi)) = \beta(\bar{z}+\Delta-b^*(\Delta,\xi)-(1-\xi)(b^*(\Delta,\xi)-\underline{z})),$$

which means that

$$b^*(\Delta,\xi) = \bar{z} - \frac{1-\xi-\Delta}{2-\xi-\frac{\beta_f}{\beta}} = \underline{z} + \frac{1-\frac{\beta_f}{\beta}+\Delta}{2-\xi-\frac{\beta_f}{\beta}}$$

is continuous in Δ and ξ. The condition such that the firm is willing to invest reduces to:

$$\frac{\beta_f}{2}\left[\frac{1-\xi-\Delta}{2-\xi-\frac{\beta_f}{\beta}}\right]^2 + \beta\left[\frac{1-\xi+\Delta(1-\xi-\frac{\beta_f}{\beta})}{2-\xi-\frac{\beta_f}{\beta}}\right]\left(\left(1-\frac{\xi}{2}\right)\frac{1-\frac{\beta_f}{\beta}+\Delta}{2-\xi-\frac{\beta_f}{\beta}}-\frac{\xi}{2}\Delta\right)$$
$$+\beta\frac{\xi}{2}\left(\frac{1-\frac{\beta_f}{\beta}+\Delta}{2-\xi-\frac{\beta_f}{\beta}}\right)+\beta\left(\frac{\xi}{2}\Delta+\underline{z}\right) \geq I. \quad \text{(IA8)}$$

If $\Delta = 0$, the condition becomes the restriction (IA5) in the proof of Proposition 1. That is, under Assumption 1, (IA8) holds with a strict inequality when $\Delta = 0$. Further note that from the left hand side of the above condition and $b^*(\Delta,\xi)$ being continuous in Δ, we know there exists a $\bar{\Delta} \in (0, 1-\frac{\beta_f}{\beta})$ such that for all $|\Delta| < \bar{\Delta}$, (IA8) holds under Assumption 1 and $b^*(\Delta,\xi) \in (\underline{z},\bar{z}) \cap (\underline{z}+\Delta,\bar{z}+\Delta)$.

For the first result of Proposition IA1, take the derivative of $b^*(\Delta,\xi)$ with respect to ξ:

$$\frac{\partial b^*(\Delta,\xi)}{\partial \xi} = \frac{1-\frac{\beta_f}{\beta}+\Delta}{\left(2-\xi-\frac{\beta_f}{\beta}\right)^2} > 0,$$

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[9]Here we use the fact that the optimal face value of debt $b^*(\Delta,\xi) \in (\underline{z},\bar{z})$, which is true because $b^*(0,\xi) \in (\underline{z},\bar{z})$ as in Proposition 1, b^* is continuous in Δ as shown below, and we pick $\bar{\Delta} > 0$ small enough.

[10]Here we use the fact that the optimal face value of debt $b^*(\Delta,\xi) \in (\underline{z}+\Delta,\bar{z}+\Delta)$, which is true because $b^*(0,\xi) \in (\underline{z},\bar{z})$ as in Proposition 1, b^* is continuous in Δ as shown below, and we pick $\bar{\Delta} > 0$ small enough.

where we used the fact that $|\Delta| < \bar{\Delta} < 1 - \frac{\beta_f}{\beta}$. For the second part, using the formula for output in (6) and the fact that z_j is drawn from a uniform distribution with a measure 1 support $[\underline{z}, \bar{z}]$, we know that, for $b \in (\underline{z}, \bar{z})$,

$$Y(b, \xi) = \underline{z} + \frac{1}{2} - \frac{1 - \xi}{2} (b - \underline{z})^2 .$$

Together with (IA7), the impact of credit boom in the first period on aggregate output in the second period is given by:

$$\varepsilon(\Delta, \xi) = \frac{\partial Y\left(b^*\left(\Delta, \xi\right), \xi\right)}{\partial b} = -(1 - \xi) \left(\frac{1 - \frac{\beta_f}{\beta} + \Delta}{2 - \xi - \frac{\beta_f}{\beta}}\right) < 0.$$

Finally, note that

$$\frac{\partial \varepsilon(\Delta, \xi)}{\partial \xi} = \left(1 - \frac{\beta_f}{\beta} + \Delta\right) \frac{1 - \frac{\beta_f}{\beta}}{\left(2 - \xi - \frac{\beta_f}{\beta}\right)^2} > 0,$$

where we again used the fact that $|\Delta| < \bar{\Delta} < 1 - \frac{\beta_f}{\beta}$.

IA3.3 The Impact of Credit Booms Driven by Firms' Beliefs

Here, we show that the results in Proposition 1 are robust to credit booms driven by firms' beliefs. That is, higher bankruptcy efficiency still dampens the negative impact of credit booms when the booms are driven by shocks to firms' beliefs (rather than by shocks to the discount rate). Specifically, consider the environment in Section 5, but creditors and firms' discount rates are fixed at a value $\beta > \beta_f$. Creditors still have rational expectations, believing that z_j is drawn from the uniform distribution $[\underline{z}, \bar{z}]$. Firms instead have biased expectations, believing that z_j is drawn from the uniform distribution $[\underline{z} + \Delta, \bar{z} + \Delta]$, where Δ captures shocks to firms' beliefs. For example, when $\Delta > 0$, firms are overly optimistic about the potential cash flows from their investment opportunities, leading to a belief-driven increase in credit demand. We will keep $z^{\text{liq}} = \underline{z}$, and both firms and creditors believe so.

In this case, the price schedule $q_b(b, \xi)$ is still determined by (5), where β is eliminated as an argument because it is fixed (similarly, we drop β_f as an argument below). Each firm optimally chooses the face value of debt $b^*(\Delta, \xi)$ in (2) subject to (3) and (4) and the price schedule $q_b(b, \xi)$, with rational expectations replaced with firms' subjective expectations.

Here, credit booms are driven by shocks to firms' beliefs Δ. A one-unit increase in total business credit results from a $1/\frac{\partial b^*(\Delta, \xi)}{\partial \Delta}$ increase in Δ. The impact of a one unit increase in total business credit on subsequent macroeconomic outcomes (e.g., aggregate output/GDP $Y^*(\Delta, \xi) \equiv Y(b^*(\Delta, \xi), \xi)$), is then given by:

$$\varepsilon\left(\Delta, \xi\right) = \frac{\frac{\partial Y^*(\Delta,\xi)}{\partial \Delta}}{\frac{\partial b^*(\Delta,\xi)}{\partial \Delta}} = \frac{\partial Y\left(b^*\left(\Delta, \xi\right), \xi\right)}{\partial b}, \tag{IA9}$$

Now, we show that Proposition 1 is robust to credit booms driven by firms' beliefs.

Proposition IA2. *Consider credit booms driven by firms' beliefs. Under Assumption 1, there exists a $\bar{\Delta} > 0$ such that, for all $|\Delta| < \bar{\Delta}$,*

1. A more efficient bankruptcy system (a higher ξ) is associated with a larger credit market: $\frac{\partial b^*(\Delta,\xi)}{\partial \xi} > 0$.

2. The impact of credit boom on macroeconomic outcomes is negative: $\varepsilon\left(\Delta, \xi\right) < 0$. Furthermore, a more efficient bankruptcy system (a higher ξ) dampens the negative impact of a credit boom on macroeconomic outcomes: $\frac{\partial \varepsilon(\Delta,\xi)}{\partial \xi} > 0$.

Proof of Proposition IA2

The firm's optimally chosen face value of debt $b^*(\Delta, \xi)$ in (2) subject to (3) and (4) satisfies the First-order Condition:[11]

$$\left.\frac{\partial(q_b(b, \xi, \Delta) \cdot b)}{\partial b}\right|_{b=b^*(\Delta,\xi)} = \beta_f \int_{(b^*(\Delta,\xi)-\Delta)}^{\bar{z}_j} \phi(z_j)dz_j = \beta_f\left(1 - \Phi(b^*(\Delta, \xi) - \Delta)\right).$$

From the price schedule (IA2), we know that, for $b \in (\underline{z}, \bar{z})$,

$$\frac{\partial(q_b(b, \beta, \xi) \cdot b)}{\partial b} = \beta\left(1 - \Phi(b) - (1 - \xi)\left(b - z^{\text{liq}}\right)\phi(b)\right).$$

Combining everything and using the fact that $\Phi(\cdot)$ and $\phi(\cdot)$ are based on a uniform distribution with support $[\underline{z}, \bar{z}]$ and that $z^{\text{liq}} = \underline{z}$, the optimal face value of debt $b^*(\Delta, \xi)$ solves:[12]

$$\beta_f(\bar{z} + \Delta - b^*(\Delta, \xi)) = \beta(\bar{z} - b^*(\Delta, \xi) - (1 - \xi)(b^*(\Delta, \xi) - \underline{z})),$$

which means that

$$b^*(\Delta, \xi) = \bar{z} - \frac{1 - \xi + \frac{\beta_f}{\beta}\Delta}{2 - \xi - \frac{\beta_f}{\beta}} = \underline{z} + \frac{1 - \frac{\beta_f}{\beta}(1 + \Delta)}{2 - \xi - \frac{\beta_f}{\beta}}.$$

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[11]Here we use the fact that the optimal face of debt $b^*\left(\Delta, \xi\right) \in (\underline{z} + \Delta, \bar{z} + \Delta)$, which is true because $b^*\left(0, \xi\right) \in (\underline{z}, \bar{z})$ as in Proposition 1, b^* is continuous in Δ as shown below, and we pick $\bar{\Delta} > 0$ small enough.

[12]Here we use the fact that the optimal face of debt $b^*\left(\Delta, \xi\right) \in (\underline{z}, \bar{z})$, which is true because $b^*\left(0, \xi\right) \in (\underline{z}, \bar{z})$ as in Proposition 1, b^* is continuous in Δ as shown below, and we pick $\bar{\Delta} > 0$ small enough.

continuous in Δ and ξ. The condition such that the firm is willing to invest reduces to:

$$\frac{\beta_f}{2}\left[\frac{\Delta(2-\xi)+1-\xi}{2-\xi-\frac{\beta_f}{\beta}}\right]^2 + \beta\left[\frac{1-\frac{\beta_f}{\beta}(1+\Delta)}{2-\xi-\frac{\beta_f}{\beta}}\right]\left(\left(1-\frac{\xi}{2}\right)\frac{1-\xi+\frac{\beta_f}{\beta}\Delta}{2-\xi-\frac{\beta_f}{\beta}}+\frac{\xi}{2}\right)+\beta\underline{z} \geq I.$$

$$(\text{IA}10)$$

If $\Delta = 0$, the condition becomes the restriction (IA5) in the proof of Proposition 1. That is, under Assumption 1, (IA10) holds with a strict inequality when $\Delta = 0$. Further note that the LHS of the above condition and $b^*(\Delta, \xi)$ is continuous in Δ, we know there exists a $\bar{\Delta} \in (0, \frac{\beta}{\beta_f}-1)$ such that for all $|\Delta| < \bar{\Delta}$, (IA10) holds under Assumption 1 and $b^*(\Delta, \xi) \in (\underline{z}, \bar{z}) \cap (\underline{z}+\Delta, \bar{z}+\Delta)$.

For the first result of Proposition IA2, take the derivative of $b^*(\Delta, \xi)$ with respect to ξ:

$$\frac{\partial b^*(\Delta, \xi)}{\partial \xi} = \frac{1-\frac{\beta_f}{\beta}(1+\Delta)}{(2-\xi-\frac{\beta_f}{\beta})^2} > 0.$$

where we used the fact that $|\Delta| < \bar{\Delta} < \frac{\beta}{\beta_f}-1$.

For the second part, using the formula for output (6) and the fact z_j is drawn from a uniform distribution with a measure 1 support $[\underline{z}, \bar{z}]$, we know that, for $b \in (\underline{z}, \bar{z})$,

$$Y(b, \xi) = \underline{z} + \frac{1}{2} - \frac{1-\xi}{2}(b-\underline{z})^2.$$

Together with (IA9), the impact of credit boom in the first period on aggregate output in the second period is given by:

$$\varepsilon(\Delta, \xi) = \frac{\partial Y(b^*(\Delta, \xi), \xi)}{\partial b} = -(1-\xi)\frac{(1-\frac{\beta_f}{\beta}(1+\Delta))}{2-\xi-\frac{\beta_f}{\beta}} < 0.$$

We can then prove the second part of Proposition IA2:

$$\frac{\partial \varepsilon(\Delta, \xi)}{\partial \xi} = \left(1-\frac{\beta_f}{\beta}(1+\Delta)\right)\frac{(1-\frac{\beta_f}{\beta})}{\left(2-\xi-\frac{\beta_f}{\beta}\right)^2} > 0.$$

where we again used the fact that $|\Delta| < \bar{\Delta} < \frac{\beta}{\beta_f}-1$.

IA3.4   The Impact of Credit Booms Driven by Fundamentals

Here, we show that the second part of Proposition 1 can be different if we consider credit booms driven by rational expectations of firms' fundamentals. In particular, we consider credit booms driven

by an increase in firms' productivity. The impact of such a fundamental-driven credit boom on macroeconomic outcomes (e.g., aggregate output) is now positive. However, we find opposite predictions of the impact of bankruptcy efficiency. A more efficient bankruptcy system now dampens the positive impact of a credit boom on macroeconomic outcomes.

Formally, each firm j's risky cash flow z_j is now drawn i.i.d. from the uniform distribution $[\underline{z} + \Delta, \bar{z} + \Delta]$, where Δ captures shocks to firms' future productivity. Both creditors and firms have rational expectations. Their discount rates are fixed at a value $\beta > \beta_f$. We will keep $z^{\text{liq}} = \underline{z}$.

In this case, the price schedule $q_b(b, \xi, \Delta)$ given by (IA2) becomes as follows. For $b \in (\underline{z} + \Delta, \bar{z} + \Delta)$,

$$q_b(b, \xi, \Delta) \cdot b = \beta \left(b\left(1 - \Phi(b - \Delta)\right) + (1 - \xi)\Phi(b - \Delta)z^{\text{liq}} + \xi \int_{\underline{z}}^{(b-\Delta)} (z_j + \Delta)\phi(z_j)dz_j \right),$$
(IA11)

where β is eliminated as an argument because it is fixed (similarly, we drop β_f as an argument below).

Each firm optimally chooses face value of debt $b^*(\Delta, \xi)$ in (2) subject to (3) and (4) and the price schedule $q_b(b, \xi, \Delta)$ here. Different from previous cases, aggregate output now directly depends on the productivity shock Δ, because it shifts the true distribution of z_j. That is, for $b \in [\underline{z} + \Delta, \bar{z} + \Delta]$, (6) becomes

$$Y(\Delta, b, \xi) = \int_{\underline{z}}^{\bar{z}} (z_j + \Delta)\,\phi(z_j)\,dz_j - \underbrace{(1 - \xi)\int_{\underline{z}}^{(b-\Delta)} \left(z_j + \Delta - z^{\text{liq}}\right)\phi(z_j)\,dz_j}_{\text{output loss from inefficient liquidation}}.$$
(IA12)

Define aggregate output/GDP $Y^*(\Delta, \xi) \equiv Y(\Delta, b^*(\Delta, \xi), \xi)$ based on the optimally chosen face value of debt $b^*(\Delta, \xi)$. We can see that the impact of productivity shock Δ on aggregate output is given by

$$\frac{\partial Y^*(\Delta, \xi)}{\partial \Delta} = \underbrace{\frac{\partial Y(\Delta, b^*(\Delta, \xi), \xi)}{\partial \Delta}}_{\text{direct productivity effect}} + \underbrace{\frac{\partial Y(\Delta, b^*(\Delta, \xi), \xi)}{\partial b} \cdot \frac{\partial b^*(\Delta, \xi)}{\partial \Delta}}_{\text{effect through credit changes}}.$$

Here, credit booms are driven by fundamental shocks to firms' productivity Δ. A one unit increase in total business credit, $b^*(\Delta, \xi)$, results from a $1/\frac{\partial b^*(\Delta, \xi)}{\partial \Delta}$ unit increase in Δ. The impact of a one unit increase in total business credit on subsequent macroeconomic outcomes is then given by:

$$\varepsilon(\Delta, \xi) = \frac{\frac{\partial Y^*(\Delta, \xi)}{\partial \Delta}}{\frac{\partial b^*(\Delta, \xi)}{\partial \Delta}} = \underbrace{\frac{\partial Y(\Delta, b^*(\Delta, \xi), \xi)}{\partial \Delta} \cdot \left(\frac{\partial b^*(\Delta, \xi)}{\partial \Delta}\right)^{-1}}_{\text{direct productivity effect, } > 0} + \underbrace{\frac{\partial Y(\Delta, b^*(\Delta, \xi), \xi)}{\partial b}}_{\text{effect through credit changes, } < 0}, \quad \text{(IA13)}$$

In fact, as proved below, the net impact of fundamental-driven credit boom $\varepsilon(\Delta, \xi) > 0$ is positive, as the direct productivity effect dominates. In this case, Proposition 1 is overturned, as a more efficient bankruptcy system now dampens the positive impact of a credit boom on macroeconomic outcomes.

Proposition IA3. *Consider credit booms driven by fundamentals. Under Assumption 1, there exists a $\bar{\Delta} > 0$ such that, for all $|\Delta| < \bar{\Delta}$,*

1. A more efficient bankruptcy system (a higher ξ) is associated with a larger credit market: $\frac{\partial b^*(\Delta,\xi)}{\partial \xi} > 0$.

2. The impact of a fundamental credit boom on macroeconomic outcomes is now positive: $\varepsilon(\Delta,\xi) > 0$. Furthermore, a more efficient bankruptcy system (a higher ξ) dampens the positive impact of a credit boom on macroeconomic outcomes: $\frac{\partial \varepsilon(\Delta,\xi)}{\partial \xi} < 0$.

Proof of Proposition IA3:

The firm's optimally chosen face value of debt $b^*(\Delta, \xi)$ in (2) subject to (3) and (4) satisfies the first-order condition:[13]

$$\left.\frac{\partial(q_b(b,\xi,\Delta)\cdot b)}{\partial b}\right|_{b=b^*(\Delta,\xi)} = \beta_f \int_{(b^*(\Delta,\xi)-\Delta)}^{\bar{z}_j} \phi(z_j)dz_j = \beta_f\left(1-\Phi(b^*(\Delta,\xi)-\Delta)\right). \quad \text{(IA14)}$$

From the price schedule (IA11), we know that, for $b \in (\underline{z}+\Delta, \bar{z}+\Delta)$,

$$\frac{\partial(q_b(b,\xi,\Delta)\cdot b)}{\partial b} = \beta\left(1-\Phi(b-\Delta)-(1-\xi)\left(b-z^{\text{liq}}\right)\phi(b-\Delta)\right).$$

Combining everything and using that z_j is drawn from a uniform distribution with support $[\underline{z}+\Delta, \bar{z}+\Delta]$ and that $z^{\text{liq}} = \underline{z}$, the optimal face value of debt $b^*(\Delta,\xi)$ solves:[14]

$$\beta_f(\bar{z}+\Delta-b^*(\Delta,\xi)) = \beta(\bar{z}+\Delta-b^*(\Delta,\xi)-(1-\xi)(b^*(\Delta,\xi)-\underline{z})),$$

which means that

$$b^*(\Delta,\xi) = \bar{z} - \frac{1-\xi-\Delta\left(1-\frac{\beta_f}{\beta}\right)}{2-\xi-\frac{\beta_f}{\beta}} = \underline{z} + \frac{(1-\frac{\beta_f}{\beta})(1+\Delta)}{2-\xi-\frac{\beta_f}{\beta}} \quad \text{(IA15)}$$

is continuous in Δ and ξ. The condition such that the firm is willing to invest reduces to:

$$\frac{\beta_f}{2}\left[\frac{(1-\xi)(1+\Delta)}{2-\xi-\frac{\beta_f}{\beta}}\right]^2 + \beta\left[\frac{(1-\xi)(1+\Delta)}{2-\xi-\frac{\beta_f}{\beta}}\right]\left(\left(1-\frac{\xi}{2}\right)\frac{(1-\frac{\beta_f}{\beta})(1+\Delta)}{2-\xi-\frac{\beta_f}{\beta}}-\frac{\xi}{2}\Delta\right)$$

$$+ \beta\frac{\xi}{2}\left(\frac{(1-\frac{\beta_f}{\beta})(1+\Delta)}{2-\xi-\frac{\beta_f}{\beta}}\right) + \beta\left(\frac{\xi}{2}\Delta+\underline{z}\right) \geq I. \quad \text{(IA16)}$$

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[13](IA14) uses the fact that the optimal face value of debt $b^*(\Delta,\xi) \in (\underline{z}+\Delta, \bar{z}+\Delta)$, which is true because $b^*(0,\xi) \in (\underline{z}, \bar{z})$ as in Proposition 1, b^* is continuous in Δ as shown below, and we pick $\bar{\Delta} > 0$ small enough.

[14]Here we use the fact that the optimal face value of debt $b^*(\Delta,\xi) \in (\underline{z}+\Delta, \bar{z}+\Delta)$, which is true because $b^*(0,\xi) \in (\underline{z}, \bar{z})$ as in Proposition 1, b^* is continuous in Δ as shown below, and we pick $\bar{\Delta} > 0$ small enough.

If $\Delta = 0$, the condition becomes the restriction (IA5) in the proof of Proposition 1. That is, under Assumption 1, (IA16) holds with a strict inequality when $\Delta = 0$. Further note that from the left hand side of the above condition and $b^*(\Delta, \xi)$ being continuous in Δ, we know there exists a $\bar{\Delta}_1 \in (0, 1)$ such that for all $|\Delta| < \bar{\Delta}_1$, (IA16) holds under Assumption 1 and $b^*(\Delta, \xi) \in (\underline{z} + \Delta, \bar{z} + \Delta)$.

For the first part of Proposition IA3, we take the derivative of $b^*(\Delta, \xi)$ in (IA15) with respect to ξ:

$$\frac{\partial b^*(\Delta, \xi)}{\partial \xi} = \frac{\left(1 - \frac{\beta_f}{\beta}\right)(1 + \Delta)}{\left(2 - \xi - \frac{\beta_f}{\beta}\right)^2} > 0.$$

where we used the fact that $|\Delta| < \bar{\Delta}_1 < 1$.

For the second part, by using the output formula in (IA12) and the fact z_j that is drawn from a uniform distribution with a measure 1 support $[\underline{z} + \Delta, \bar{z} + \Delta]$, we know that, for $b \in (\underline{z} + \Delta, \bar{z} + \Delta)$,

$$Y(\Delta, b, \xi) = \underline{z} + \frac{1}{2} + \Delta + \frac{(1 - \xi)}{2}\Delta^2 - \frac{1 - \xi}{2}(b - \underline{z})^2.$$

To apply (IA13), we note that

$$\frac{\partial b^*(\Delta, \xi)}{\partial \Delta} = \frac{1 - \frac{\beta_f}{\beta}}{2 - \xi - \frac{\beta_f}{\beta}} > 0,$$

$$\frac{\partial Y(\Delta, b^*(\Delta, \xi), \xi)}{\partial b} = -(1 - \xi)\left[\frac{(1 - \frac{\beta_f}{\beta})(1 + \Delta)}{2 - \xi - \frac{\beta_f}{\beta}}\right] < 0,$$

$$\frac{\partial Y(\Delta, b^*(\Delta, \xi), \xi)}{\partial \Delta} = 1 + (1 - \xi)\Delta > 0,$$

where we used the fact that $|\Delta| < \bar{\Delta}_1 < 1$. As a result,

$$\varepsilon(\Delta, \xi) = \underbrace{\frac{\left(2 - \xi - \frac{\beta_f}{\beta}\right)}{1 - \frac{\beta_f}{\beta}} - (1 - \xi)\frac{\left(1 - \frac{\beta_f}{\beta}\right)}{2 - \xi - \frac{\beta_f}{\beta}}}_{a_1} + \Delta \underbrace{\left[\frac{(1 - \xi)\left(2 - \xi - \frac{\beta_f}{\beta}\right)}{1 - \frac{\beta_f}{\beta}} - (1 - \xi)\frac{\left(1 - \frac{\beta_f}{\beta}\right)}{2 - \xi - \frac{\beta_f}{\beta}}\right]}_{a_2},$$

where $\varepsilon(\Delta, \xi)$ is a linear function on Δ. We now show that the intercept a_1 is positive:

$$a_1 > 0 \iff \left(2 - \xi - \frac{\beta_f}{\beta}\right)^2 > (1 - \xi)\left(1 - \frac{\beta_f}{\beta}\right)^2,$$

$$\iff \left(1 - \frac{\beta_f}{\beta}\right)^2 + 2\left(1 - \frac{\beta_f}{\beta}\right)(1 - \xi) + (1 - \xi)^2 > (1 - \xi)\left(1 - \frac{\beta_f}{\beta}\right)^2,$$

$$\iff \xi\left(1 - \frac{\beta_f}{\beta}\right)^2 + 2\left(1 - \frac{\beta_f}{\beta}\right)(1 - \xi) + (1 - \xi)^2 > 0.$$

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As a result, there exists $\bar{\Delta}_2 \in \left(0, \bar{\Delta}_1\right)$ such that for all $|\Delta| < \bar{\Delta}_2$, $\varepsilon(\Delta, \xi) > 0$.

For the last part of Proposition IA3,

$$\frac{\partial \varepsilon(\Delta, \xi)}{\partial \xi} = \underbrace{\left[\frac{1 - \frac{\beta_f}{\beta}}{2 - \xi - \frac{\beta_f}{\beta}}\right]^2 - \frac{1}{1 - \frac{\beta_f}{\beta}}}_{a_3} + \Delta \underbrace{\left[\left(\frac{1 - \frac{\beta_f}{\beta}}{2 - \xi - \frac{\beta_f}{\beta}}\right)^2 - \frac{3 - 2\xi - \frac{\beta_f}{\beta}}{1 - \frac{\beta_f}{\beta}}\right]}_{a_4}.$$

This derivative is also a linear function of Δ. We now show that the intercept a_3 is negative:

$$a_3 < 0 \iff \left(1 - \frac{\beta_f}{\beta}\right)^3 < \left(2 - \xi - \frac{\beta_f}{\beta}\right)^2,$$

which is true because $\frac{\beta_f}{\beta}, \xi \in (0, 1)$. As a result, there exists $\bar{\Delta} \in \left(0, \bar{\Delta}_2\right)$ such that for all $|\Delta| < \bar{\Delta}$, $\frac{\partial \varepsilon(\Delta, \xi)}{\partial \xi} < 0$. Together, we know that, for all $|\Delta| < \bar{\Delta}$, Proposition IA3 holds.

IA3.5 Generalizing the Cash Flow Distribution of the Risky Project.

Here, we show that Proposition 1 extends to settings where the cash flow of the risky project z_j is drawn from a general class of distributions, not limited to the uniform distribution case examined in the main analysis. Specifically, consider the environment in Section 5, but we relax the assumption that the stochastic cash flow is drawn from a uniform distribution.

Assumption IA1. *The cash flow of the risky project of each firm j, z_j, is drawn from a i.i.d. distribution with support $[\underline{z}, \bar{z}]$, where $\underline{z} \geq 0$. Define $f(z_j) = (z_j - \underline{z})\frac{\phi(z_j)}{1 - \Phi(z_j)}$, where $\phi(z_j)$ and $\Phi(z_j)$ are probability density function and cumulative distribution function. We assume that $\phi(z_j)$ is strictly positive and bounded in $z_j \in [\underline{z}, \bar{z}]$ and $f(z_j)$ strictly increases in $z_j \in [\underline{z}, \bar{z})$.*

Assumption IA1 holds under commonly studied distributions, such as the case of uniform distributions and the case of distributions with monotone hazard rates ($\frac{\phi(z_j)}{1 - \Phi(z_j)}$ increases in $z_j \in [\underline{z}, \bar{z}]$). We also generalize Assumption 1, which guarantees that the firm prefers investing to not investing.

Assumption IA2. *The investment cost is such that:*

$$I < \beta_f \cdot V_f(\beta, \xi) + \beta \mathbb{E}\left[b^*(\beta, \beta_f, \xi) \cdot \mathbb{I}_{\{b^*(\beta, \beta_f, \xi) \leq z_j\}} + ((1 - \xi)\underline{z} + \xi z_j) \cdot \mathbb{I}_{\{b^*(\beta, \beta_f, \xi) > z_j\}}\right],$$

where $b^*(\beta, \beta_f, \xi)$ is firm's optimally chosen face value of debt and V_f is the expected value for the firm given the optimal choice in (2) subject to (3) and (4).

We can show that Proposition 1 extends to this setting with a general class of distributions.

Proposition IA4. *Consider credit booms driven by credit supply. Under Assumptions IA1 and IA4,*

1. A more efficient bankruptcy system (a higher ξ) is associated with a larger credit market: $\frac{\partial b^*(\beta,\beta_f,\xi)}{\partial \xi} > 0$.

2. The impact of credit boom on macroeconomic outcomes is negative: $\varepsilon(\beta,\beta_f,\xi) < 0$. Furthermore, a more efficient bankruptcy system (a higher ξ) dampens the negative impact of a credit boom on macroeconomic outcomes: $\frac{\partial \varepsilon(\beta,\beta_f,\xi)}{\partial \xi} > 0$.

Proof of Proposition IA4.

The firm's optimally chosen face value of debt $b^*(\beta,\beta_f,\xi)$ satisfies the first-order condition:[15]

$$\left.\frac{\partial(q_b(b,\beta,\xi) \cdot b)}{\partial b}\right|_{b=b^*(\beta,\beta_f,\xi)} = \beta_f\left(1 - \Phi\left(b^*(\beta,\beta_f,\xi)\right)\right). \tag{IA17}$$

From (5) for the price schedule $q_b(b,\beta,\xi)$, we know that, for $b \in (\underline{z}, \bar{z})$,

$$q_b(b,\beta,\xi) \cdot b = \beta\left(b\left(1 - \Phi(b)\right) + (1-\xi)\Phi(b)z^{\mathrm{liq}} + \xi \int_{\underline{z}}^b z_j \phi(z_j) dz_j\right), \tag{IA18}$$

and

$$\frac{\partial(q_b(b,\beta,\xi) \cdot b)}{\partial b} = \beta\left(1 - \Phi(b) - (1-\xi)\left(b - z^{\mathrm{liq}}\right)\phi(b)\right).$$

Together, the optimal face value of debt $b^*(\beta,\beta_f,\xi)$ satisfies:

$$\beta\left(1 - \Phi(b^*(\beta,\beta_f,\xi)) - (1-\xi)\left(b^*(\beta,\beta_f,\xi) - z^{\mathrm{liq}}\right)\phi(b^*(\beta,\beta_f,\xi))\right) = \beta_f\left(1 - \Phi(b^*(\beta,\beta_f,\xi))\right), \tag{IA19}$$

which can be rewritten as

$$f\left(b^*(\beta,\beta_f,\xi)\right) = \left(b^*(\beta,\beta_f,\xi) - \underline{z}\right)\frac{\phi\left(b^*(\beta,\beta_f,\xi)\right)}{1 - \Phi\left(b^*(\beta,\beta_f,\xi)\right)} = \frac{\beta - \beta_f}{\beta(1-\xi)}. \tag{IA20}$$

From Assumption IA1, we know that $f(\underline{z}) = 0$, $f(z_j)$ strictly increases in $z_j \in [\underline{z}, \bar{z})$, $\lim_{z_j \to \bar{z}} f(\bar{z}) = +\infty$. We know that there exists a unique $b^*(\beta,\beta_f,\xi) \in (\underline{z}, \bar{z})$ that solves (IA19), which pins down $b^*(\beta,\beta_f,\xi)$. Moreover, $b^*(\beta,\beta_f,\xi)$ strictly increases in $\beta > \beta_f$ and ξ. The fact that the firm is willing

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[15](IA17) uses the fact that the optimal face value of debt $b^*(\beta,\beta_f,\xi) \in (\underline{z}, \bar{z})$, which we verify below.

to invest ($V_f > 0$) then follows directly from Assumption IA2. From (IA19), we know that

$$\frac{\partial b^* \left(\beta, \beta_f, \xi \right)}{\partial \xi} = \frac{\left(b^* (\beta, \beta_f, \xi) - \underline{z} \right)}{(1 - \xi) \frac{\phi' \left(b^* (\beta, \beta_f, \xi) \right)}{\phi \left(b^* (\beta, \beta_f, \xi) \right)} \left(b^* (\beta, \beta_f, \xi) - \underline{z} \right) + 2 - \frac{\beta_f}{\beta} - \xi}.$$

Because $b^*(\beta, \beta_f, \xi)$ strictly increases in ξ, we know that $\frac{\partial b^* \left(\beta, \beta_f, \xi \right)}{\partial \xi} > 0$ and

$$(1 - \xi) \frac{\phi' \left(b^* (\beta, \beta_f, \xi) \right)}{\phi \left(b^* (\beta, \beta_f, \xi) \right)} \left(b^* (\beta, \beta_f, \xi) - \underline{z} \right) + 2 - \frac{\beta_f}{\beta} - \xi > 0. \tag{IA21}$$

This finishes the proof of part 1 of Proposition IA4.

To prove Part 2 of Proposition IA4, from (8), we know that $\frac{\partial Y \left(b^* \left(\beta, \beta_f, \xi \right), \xi \right)}{\partial b} < 0$. Moreover,

$$\frac{\partial \varepsilon \left(\beta, \beta_f, \xi \right)}{\partial \xi} = \frac{\partial^2 Y \left(b^* \left(\beta, \beta_f, \xi \right), \xi \right)}{\partial b \partial \xi} + \frac{\partial^2 Y \left(b^* \left(\beta, \beta_f, \xi \right), \xi \right)}{\partial b^2} \frac{\partial b^* \left(\beta, \beta_f, \xi \right)}{\partial \xi}. \tag{IA22}$$

Using the formula for output in (6), we know that, for $b \in (\underline{z}, \bar{z})$,

$$\frac{\partial Y \left(b, \xi \right)}{\partial b} = - (1 - \xi) (b - \underline{z}) \phi (b)$$

$$\frac{\partial^2 Y \left(b, \xi \right)}{\partial b \partial \xi} = (b - \underline{z}) \phi (b)$$

$$\frac{\partial^2 Y \left(b, \xi \right)}{\partial b^2} = - (1 - \xi) \phi (b) - (1 - \xi) (b - \underline{z}) \phi' (b).$$

Together with (IA22), we know that

$$\frac{\partial \varepsilon \left(\beta, \beta_f, \xi \right)}{\partial \xi} = \frac{\left(1 - \frac{\beta_f}{\beta} \right) \left(b^* (\beta, \beta_f, \xi) - \underline{z} \right) \phi \left(b^* (\beta, \beta_f, \xi) \right)}{(1 - \xi) \frac{\phi' \left(b^* (\beta, \beta_f, \xi) \right)}{\phi \left(b^* (\beta, \beta_f, \xi) \right)} \left(b^* (\beta, \beta_f, \xi) - \underline{z} \right) + 2 - \frac{\beta_f}{\beta} - \xi} > 0,$$

where we use the fact that ϕ is strictly positive on $[\underline{z}, \bar{z}]$ and (IA21).