The Effects of Credit on Firms' Performance: A Survey*

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Abstract:

This paper surveys recent empirical literature examining the impact of credit supply shocks on firm performance. A critical methodological challenge is distinguishing between supply-driven and demand-driven changes in credit. We review studies employing matched bank-firm data and exploiting idiosyncratic bank-level variation to isolate supply shocks. The survey first explores how banks react to adverse shocks, often contracting credit. We then analyze how firms respond, highlighting the role of alternative financing sources. The core analysis focuses on the consequences of credit supply contractions for firm investment, employment, exports, and prices. The evidence indicates that investment is the most sensitive variable, with significant negative effects. Employment impacts are also generally negative, but often smaller and less consistent. We discuss indirect effects via the value chain and emphasize heterogeneous firm responses, particularly based on size and pre-existing credit constraints. Bank characteristics, such as capitalization, liquidity, and risk exposure, significantly influence their lending behavior during periods of stress. This survey synthesizes recent findings, including those from emerging economies, and identifies areas where further research is needed. The findings have important implications for policies aimed at strengthening the banking system and mitigating the adverse effects of credit supply shocks on firm performance.

Keywords: credit supply shocks, firm performance.

JEL Classification: E51; E52; G21.

* We thank Miguel Acosta-Henao, Elías Albagli, Sofía Bauducco, Mauricio Calani, Mariana García-Schmidt, Juan Guerra-Salas, and Patricio Toro for their valuable comments. The views and conclusions presented in this paper are exclusively those of the authors and do not necessarily reflect the position of the Central Bank of Chile or its Board members.

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1. INTRODUCTION

1. Firms rely on credit to finance activities such as investment and working capital. The sensitivity of firms' performance to changes in the availability or cost of borrowing is a relevant empirical question for understanding the consequences of aggregate shocks or policy changes that affect the bank credit supply. This paper reviews the empirical evidence and underlying mechanisms through which changes in credit supply affect firms' performance, and how these effects vary across firm characteristics.

2. Identifying the causal effects of credit supply on firm performance requires isolating exogenous shocks to bank credit supply. A key methodological challenge is to separate changes in credit supply from changes in credit demand. This paper reviews recent methodological contributions that allow for a credible identification of credit supply shocks, relying on access to matched bank-firm data and exploiting idiosyncratic variation in banks' credit supply. While this identification strategy identifies firm-level effects (e.g., causal elasticities), it may not fully capture the aggregate effects of credit supply shocks.

3. Building on these methodological considerations, we first study how banks respond to adverse shocks, typically by contracting credit supply. We consider a variety of contexts, from economic crises to changes in monetary and financial policies, including both extreme responses during crises and more gradual adjustments in stable periods. Evidence suggests that banks' ability to extend credit in response to unexpected shocks —such as international crises or unanticipated events—depends on factors such as capital adequacy, liquidity, and portfolio risk.

4. We then show that, in the face of a contraction in bank credit supply, firms resort to alternative sources of finance. The reviewed literature highlights the mechanisms through which access to these alternative sources shapes the effect of credit supply shocks at both the firm and aggregate levels. This literature also finds that firm characteristics affect their ability to substitute bank credit with other financing options.

5. Next, we study the effect of contractions in credit supply on firms' investment, employment, and other outcomes. In general, the literature finds a negative and economically significant effect on firms' investment decisions. Regarding employment, results also show a decline after a contraction in credit supply, although some studies find null effects. A one percentage point (pp) contraction in credit supply, causes a decline of the investment-to-capital ratio between 0 and 3.4 pp, with an average effect of 0.65pp. In the case of employment, the results show a decrease in employment growth between 0 and 0.88pp, and an average effect of 0.27pp. This evidence suggests that investment is more linked to access to credit than employment. The more pronounced effects on investment relative to employment, may be related to the greater factor specificity of employment, which can lead firms to engage in labor hoarding.

6. In addition, we find effects on other firm variables, such as exports and prices, and the presence of indirect effects through the value chain. The evidence shows that firm's exports decline with a contraction in credit supply. For prices, the evidence is mixed, with some studies finding positive effects and others finding negative effects. With respect to the value chain, the evidence shows that firms are affected not only by credit supply shocks from their own banks but also indirectly through the credit supply shocks to their banks' suppliers and customers.

7. Finally, studies find that the effect of credit supply shocks is larger for firms with observables suggesting important credit constraints (e.g., size, indebtedness).

8. This paper is related to Brunnermeier and Krishnamurthy (2020), which reviews the evidence on corporate financing and its macroeconomic implications. Their work highlights the relationship between corporate indebtedness and macroeconomic consequences, especially in response to aggregate shocks such as the Covid-19 pandemic. Our closest predecessor is Güler et al. (2021), that analyzes the effects of credit supply shocks on firms' outcomes. Our review incorporates the most recent papers in an active field of research, and places greater emphasis on the evidence from emerging countries, which has received less attention thus far.

9. The remainder of this paper proceeds as follows. Section 2 reviews the evidence and mechanisms on the effects on firms' performance, with subsections covering the methodology of the studies reviewed, changes in the supply of bank credit, effects on equilibrium credit, and finally the effects on performance indicators. Section 3 presents

the conclusions of the paper.

2. THE EFFECTS ON FIRMS' PERFORMANCE

2.1 Methodologies to measure the effects of credit supply: a critical review.

10. In this review, we analyze two types of studies. The first group uses firm-level data and analyze how an event, such as a financial crisis, affects firms with different levels of financial constraints. Examples include Duchin et al. (2010) and Almeida et al. (2011).

11. The second group consists of studies that use matched bank-firm data, incorporating information on firms' banking relations (i.e., the firm's level of debt with each bank). These studies often use syndicated loan data, as in Chodorow- Reich (2014) and Acharya et al. (2018), or credit registry data, as in Khwaja and Mian (2008), Paravisini et al. (2015), Cingano et al. (2016), and Jiménez et al. (2017). One advantage of bank-firm data is the ability to control for credit demand shocks, allowing for a more credible identification of credit supply shocks. For this reason, this review will primarily focus on the second group of studies.

12. Within the second group, two main methodologies are commonly applied to firms with multiple banking relationships (multibank firms). The first, proposed by Khwaja and Mian (2008) (hereafter KM), and the second, by Amiti and Weinstein (2018) (hereafter AW). Both follow a two-stage approach: first, identifying credit supply shocks, and second, estimating their effects on firms' financing conditions and real outcomes such as investment or employment. The main difference between these methods lies in how credit supply shocks are identified in the first stage.

13. For the first stage, KM estimate a regression of the change in a firm's debt owed to a bank on firm-time fixed effects, that capture changes in credit demand, and a measure of the bank's exposure to a shock (X_b), that capture changes in credit supply. The change in the bank's credit supply is calculated as $\Delta\text{Credit supply}_b=\beta X_b$, where β is the estimated coefficient measuring the response of credit supply to an increase in the bank's exposure to the shock.[4/]

14. On the other hand, AW's approach estimates a regression of the change in the firm's debt to the bank and firm-time fixed effects and bank-time fixed effects (β_b), directly measuring changes in credit supply as $\Delta\text{Credit supply}_b=\beta_b$.

15. Once credit supply shocks are identified, both methods follow a similar procedure in the second stage. First, the idiosyncratic change in credit supply faced by each firm is estimated as a weighted average of the changes in credit supply from each bank with which the firm has a relationship, using the share of each bank's debt in the firm's total debt in a baseline period. Then the effect of credit supply on firm-specific outcomes— such as the loan amounts, interest rates, investment and employment—is estimated.

16. Both approaches require some assumptions for a valid identification of the effects credit supply shocks of firm's outcomes. First, both KM and AW are based on data from firms with multiple banking relationships. If the effects differ between multibank and single-bank firms, results may not be directly generalizable to the latter. To address this limitation, Degryse et al. (2019) suggest controlling for sector, size, and location fixed effects. However, this strategy imposes the additional assumption that credit demand shocks occur at these levels and not at the individual firm level to identify the effect of credit supply shocks.

    Second, both approaches assume that, when a bank adjusts its credit supply, the change is transmitted proportionally across all its borrowers, and likewise, that changes in a firm's credit demand affect all its lenders proportionally. If this assumption of homogeneous transmission of credit shocks does not hold and the formation of banking relationships depend on this heterogeneity, estimates of the effects of credit supply may be biased. Gutiérrez et al. (2024) propose a method that, under certain assumptions, allows for this heterogeneity.

[4/] A more detailed description of the KM and AW methodologies is shown in the Appendix.

2.2 Why does the supply of bank credit change?

17. The literature has found that the supply of bank credit reacts to policy changes, both monetary and financial, or to unanticipated shocks such as a financial or debt crisis. While the focus of this paper is to understand the effect of bank credit supply on firms, it is important to note that the nature of the factors that initially cause changes in credit supply may explain some differences in the results.

18. On the monetary policy side, the literature began referring to *the credit channel* to study these effects. Bernanke and Blinder (1988) examine how a shock to the demand for money and credit affects aggregate demand. As an intermediate mechanism, the study shows that changes in monetary policy, such as movements in interest rates, can alter the supply of available credit, which in turn impacts the overall economy. Bernanke and Gertler (1995) and Bernanke et al. (1999) elaborate on this channel by focusing on frictions in credit markets and find that they amplify the effects of monetary policy on the economy.

19. Subsequently, with a more specific term, *the bank lending channel*, the literature puts the focus on the supply of bank loans. Kishan and Opiela (2000) investigate how changes in interest rates set by monetary policy affect the supply of bank loans depending on their level of capitalization. They find that a 100-basis point increase in the federal funds rate induces a fall in loan growth between 3.6% and 4.4% for adequately capitalized banks; a fall between 5% and 7.3% for undercapitalized banks; and an insignificant effect for overcapitalized banks, with the exception of the smallest ones (<USD 50 million).[5/]

20. Ehrmann et al. (2001) focus on the impact of the European Central Bank (ECB)'s monetary policy on the supply of bank credit in the Eurozone. When the ECB raises interest rates, banks tend to reduce their supply of credit due to the resulting increase in the cost of funding. Faced with a 1pp increase in the interest rate, banks reduce their lending by 2.5% on average in Spain and France, and by 0.93% on average in Germany and Italy. More recently, using microdata from Spain, Jiménez et al. (2012) find that, given a 1pp increase in the interest rate, banks in the bottom decile of capitalization and liquidity reduce their lending by 11% more than banks in the top decile.

21. On the financial policy side, the reviewed studies focus on changes in capital requirements (Gropp et al., 2019; Fraisse et al., 2020), changes in the regulation of banks' risk provisions (Jiménez et al., 2017), or decisions to recapitalize banks in the aftermath of a financial crisis (Giannetti and Simonov, 2013; Toro, 2019). The effects on the supply of bank credit depend on how the cost of banks' capital raising is affected, with mixed results.

22. Unanticipated shocks, whether aggregate or idiosyncratic, affect the lending capacity of banks. Unlike policy changes, a financial shock, a debt crisis, or other local events are disruptions that potentially affect the health of banks. The works of Peek and Rosengren (1997, 2000), Klein et al. (2002), Khwaja and Mian (2008), Paravisini (2008), Amiti and Weinstein (2011), Jiménez et al. (2014), Santos (2011) and Chodorow-Reich (2014) provide evidence at the bank level or bank-firm level, showing that deteriorating "bank health" leads banks to contract their lending activity.

23. The literature finds that the effects on credit supply are connected to the characteristics of each bank when facing the same shock; or even to the fact that some banks face it, and others do not. Banks with higher levels of capitalization or liquidity, or lower portfolio risk, respond to shocks with a comparatively higher credit supply than other banks.

24. Peek and Rosengren (2000) provide evidence of how the Japanese banking crisis affected the operation of Japanese banks in the United States. The more capitalized Japanese banks were able to maintain their credit supply in foreign markets, while those less well capitalized had to significantly cut back on their lending operations. Gambacorta and Marques-Ibañez (2011), in their analysis of the financial crisis between 2007 and 2010 examined banks from Europe and the United States and found that banks with higher capitalization responded to the shock with a smaller contraction in credit supply. In contrast, banks with lower capitalization

[5] Kishan and Opiela (2000) define an undercapitalized bank as one that has capital/assets of less than 8%, an adequately capitalized bank has capital/assets between 8% and 10%, and an overcapitalized bank has capital/assets greater than 10%.

show a substantial reduction in their credit supply.

25. Khwaja and Mian (2008) show that, in the face of a negative shock, banks with high liquidity maintained their credit supply, while those with low liquidity responded with a contraction of it. They analyze the supply of credit in Pakistan during the 1998 crisis, a period marked by political and economic unrest in the country. The Pakistani government froze foreign currency deposits in commercial banks to avoid capital flight during the crisis. This caused an immediate liquidity shortage in the banking system, as banks lost access to a sizable portion of their liquid reserves which were mostly denominated in dollars. Banks with lower liquidity reserves, those that were more dependent on foreign currency deposits, responded to the shock by significantly reducing their credit supply. Conversely, banks with higher liquidity reserves were better able to sustain their lending activity.

26. Bottero et al. (2020) show that banks with riskier portfolios responded with a larger credit contraction to the sovereign debt crisis in Europe. Using loan-level data for Italy, the authors find that banks with larger holdings of sovereign bonds, especially from countries such as Greece, tended to significantly reduce their credit supply. Banks with lower sovereign risk were able to maintain a more stable credit supply.

2.3 Alternative sources of finance

27. Several studies in the literature show that firms seek to replace sources of financing. In that case, the total credit used by a firm may not be affected as much. Hence, the effect of credit supply shocks on firms' performance is also dependent on characteristics of alternative sources of finance.

28. Early work by Kashyap et al. (1993) provides evidence that tighter monetary policy leads to a shift in firms' external financing from bank loans to commercial paper. The authors argue that if monetary policy operated solely through a money channel, the demand for both bank loans and commercial paper would decline when the Fed tightens policy. However, if monetary policy reduces the supply of bank credit, firms will substitute towards commercial paper. The mechanism in their model poses that shocks effect the relative costs of loans and paper will be reflected in shifts in the firm's financing mix.

29. This shift is not costless and may involve higher interest rates or other transaction costs. Some firms, particularly smaller or less creditworthy ones, rely heavily on bank loans because they do not have access to capital markets. When monetary policy tightens and the supply of bank loans decreases, these firms face higher borrowing costs or may be unable to obtain financing at all. Firms that have access to capital markets may switch from bank loans to commercial paper when the supply of bank loans decreases. Einarsonn and Marquis (2001) argue that the ability of firms to substitute between bank loans and commercial paper is an important mechanism to match United States' economic data. The authors show that without such ability, interest rates would rise sharply with economic growth, which is counterfactual to their empirical evidence.

30. Finally, the work by Becker and Ivashina (2014) confirms that firms switch from bank loans to commercial paper using firm level data for the GFC period. Their identification of bank supply shocks addresses concerns about compositional changes in the set of firms raising debt. Given that firms differ significantly in size, access to credit, and financial health, they ensure that the findings reflect actual shifts in credit supply conditions rather than changes in the types of firms raising debt. This heterogeneity has led to a strand of literature that examines alternative sources of financing and the nuances in financing access based on firm characteristics (De Blasio 2005; Leary 2009; Garcia-Appendini and Montoriol-Garriga 2013, Iyer et al., 2014; Levine et al., 2016; Iwaki, 2019; Acosta-Henao et al., 2023).

31.

2.4 Effects on firms' performance

32. This section summarizes the effects of credit supply on firm performance indicators such as investment and employment, among others. We also highlight the heterogeneity of these effects across firms with different degrees of credit constraints.

2.4.1 Investment

33. Duchin et al. (2010) and Almeida et al. (2011) study the impact of the 2007 crisis on firms with different degrees of financing constraints, using data from firms in Compustat. Duchin et al. (2010) compare the effect of the crisis for firms with low and high cash-to-assets ratios, finding that a zero-cash firm reduces investment by 0.18pp but firms with one standard deviation higher cash-to-assets ratio (0.213 points) mitigate the decline in investment by 0.1pp. Almeida et al. (2011) compare firms with more than 20% of their long-term debt maturing in the year after the crisis with those that do not meet this condition and find that the former reduced their investment by 2.2pp more than the latter (28% of the mean).

34. These studies suggest that firms with tighter financing constraints reduced their investment to a greater extent during the 2007 financial crisis. However, as previously mentioned, it is difficult to distinguish between changes in credit supply and demand using only firm-level data. Henceforth, we focus on studies using matched bank-firm data, the results of which are summarized in Figure 1.

35. Figure 1 shows the effects on investment of a 1pp credit supply shock for studies using bank-firm data. Before interpreting the figure, a few aspects must be considered. First, the figure includes only those studies in which the effects of a 1pp change in credit supply can be expressed or inferred based on the available information. For example, if the change in credit supply is measured in standard deviations but the standard deviation is not reported in the study, it is not included. Second, investment is measured as the ratio of investment to capital in the initial period or as the growth in capital or fixed assets; in both cases the effect is measured in percentage points. Finally, in those cases where the effect found is not significant at 10%, it is plotted as a null effect.

36. The reviewed papers find that a contraction in bank credit supply reduces investment. However, some exceptions exist, such as Amiti and Weinstein (2018) and Bottero et al. (2020). Amiti and Weinstein (2018) find no overall effect in Japan but do observe a decline in investment among the most indebted firms. Similarly, Bottero et al. (2020) find no significant average effect in Italy, though they find a reduction in investment for small firms. These aspects of heterogeneity are discussed in detail in section 3.4.3.

37. We calculate a simple average of the estimated effects to approximate the size of the effect. On average, the studies find that a 1 pp contraction in credit supply reduces the investment-to-capital ratio by 0.66 pp. However, considerable heterogeneity exists across these estimates, which is expected given the differences in the sources of credit supply shocks, firms samples, and geographical contexts analyzed.

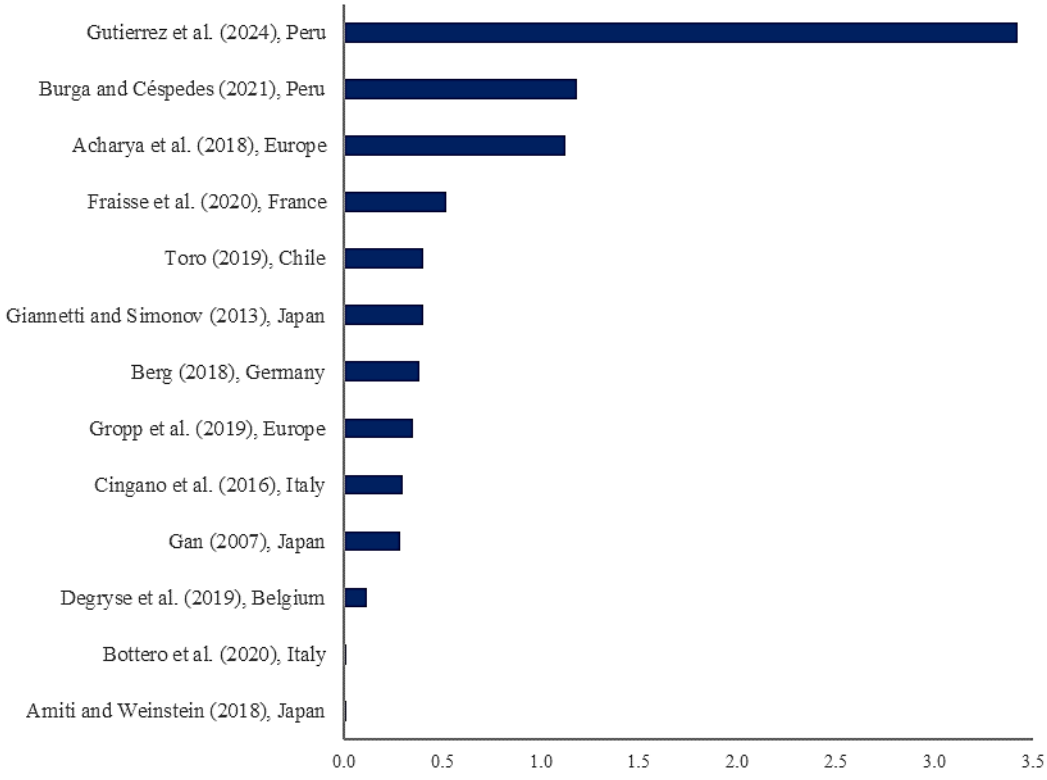
38. Regarding the different sources of variation in credit supply, studies analyze a range of economic and financial shocks. These include financial crises such as the fall in real estate prices in Japan (Gan, 2007), the fall in sovereign bond prices in Europe (Bottero et al., 2020; Acharya et al., 2018), and the 2008 financial crisis (Cingano et al., 2016). Other studies focus on monetary or financial policies, including bank recapitalization (Giannetti and Simonov, 2013; Toro, 2019) and changes in capital requirements (Gropp et al., 2019; Fraisse et al., 2020). Additionally, some studies analyze changes in market structure, such as bank mergers (Burga and Céspedes, 2021), a bank's internal lending policies (Berg, 2018), and heterogeneity across banks in credit supply changes (Amiti and Weinstein, 2018; Degryse et al., 2019; Gutiérrez et al., 2024).

39. With respect to the different firm samples, several studies use data from publicly listed firms (Gan, 2007; Giannetti and Simonov, 2013; Amiti and Weinstein, 2018), or syndicated loans (Acharya et al., 2018; Gropp et al., 2019), while others also include smaller firms (Cingano et al., 2016; Degryse et al., 2019; Toro, 2019; Bottero et al., 2020; Fraisse et al., 2020; Burga and Céspedes, 2021).

40. Finally, in terms of geographic contexts, there is ample evidence for developed economies such as the United States, Japan, and several European countries. However, the evidence for emerging economies is more limited, with the available studies covering Peru and Chile. In this scenario, the estimated effects for emerging economies tend to be at the upper end of the effects found, consistent with tighter credit constraints in these economies.

FIGURE 1 EFFECT ON INVESTMENT OF A CREDIT SUPPLY SHOCK (1 pp)

(in percentage points)



Notes: The figure shows the effects of a 1pp credit supply shock on the investment-to-capital-stock ratio (in pp) found in different studies. The vertical axis shows the authors, year of publication, and country or region of focus. The horizontal axis indicates the magnitude of the effect. For cases where the effect is not significant at 10%, the effect is plotted as zero.
Source: Authors' calculations based on the cited studies.

3.4.2. Employment

41. Several studies study the effects of credit supply on employment in the United States during the Great Recession. These studies are motivated by the sluggish employment recovery that followed the crisis.

42. For instance, Duygan-Bump et al. (2015) compare the probability of transitioning from employment to unemployment among workers in industries with high and low dependence on external financing. Their findings show that, in industries with high external financing dependence, the probability of unemployment is 1.2pp higher than in those with low dependence. Similarly, Siemer (2019) follows a similar strategy to study employment growth and the differential effects for small and young firms. The study finds no significant employment effect for large firms in sectors highly dependent on external financing compared to less dependent sectors. However, young and small firms do experience differential effects. Employment growth is 7.2pp lower for young firms and 1.8pp lower for small firms, compared to similar firms in sectors less dependent on external financing.

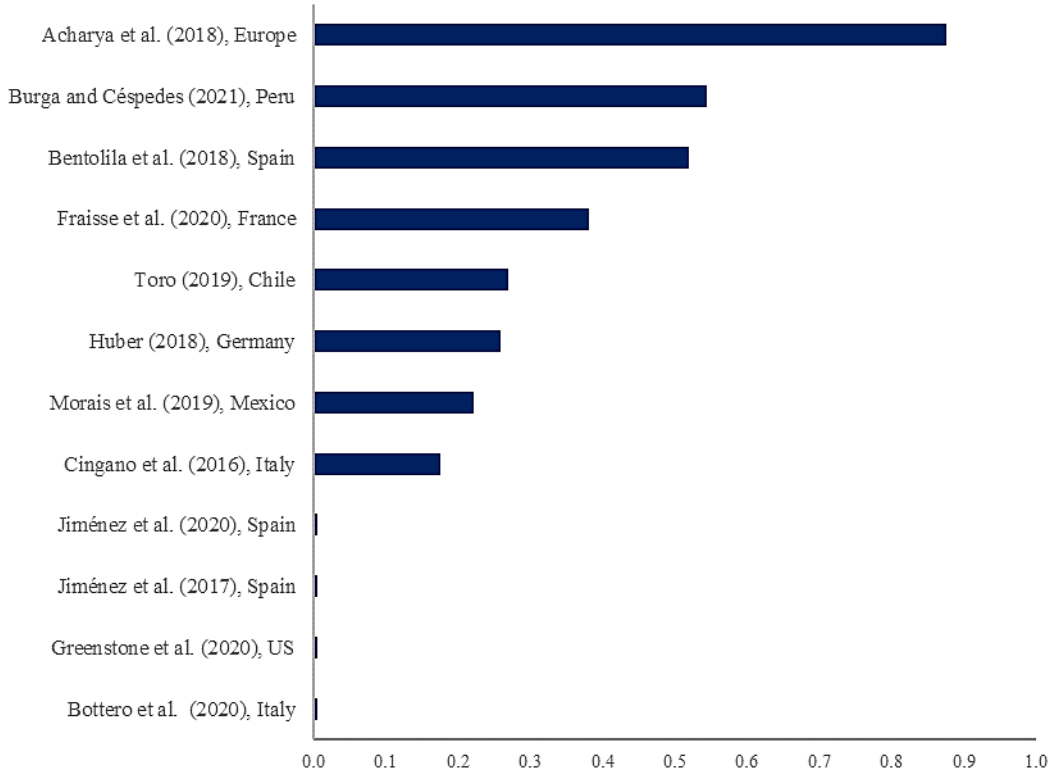
43. Chodorow-Reich (2014) uses detailed syndicated loan data and finds that a one standard deviation decline in a firm's credit supply leads to a 2.38pp reduction in employment growth. This study is particularly relevant as it uses matched bank-firm data and a sample of multibank firms, allowing to control for credit demand shocks. Moreover, the results show that credit constraints matter, even for large firms in a developed financial market

such as the United States.

44. Figure 2 shows the findings of studies that use bank-firm data to estimate the effect of a 1pp increase in credit supply on employment growth, measured in percentage points. On average, the results show that a 1pp contraction in credit supply causes a 0.28 percentage point decline in employment growth. However, as the figure illustrates, several studies report null or statistically insignificant effects.

FIGURE 2 EFFECTS ON EMPLOYMENT OF A CREDIT SUPPLY SHOCK (1 pp)

(in percentage points)



Notes: The figure shows the effects of a 1pp credit supply shock on employment (in pp) found in different studies. The vertical axis shows the authors, year of publication and country or region of focus. The horizontal axis indicates the magnitude of the effect. For cases where the effect is not significant at 10%, the effect is plotted as zero. Source: Authors' calculations based on the cited studies.

45. Greenstone et al. (2020) study the effects of credit supply on employment in the United States during 2007-2009. Unlike Chodorow-Reich (2014), Greenstone and coauthors employ a shift-share design that exploits the importance of banks within counties and changes in small business credit at the aggregate bank level. Although they find effects on access to business credit, they do not find a significant effect on employment. This finding contrasts with the results of Chodorow-Reich (2014), but differences in methodology and firm sample might explain the different results.

46. A related study by Gutiérrez et al. (2023) applies a similar methodology to Greenstone et al. (2020) in the context of Mexico. Their findings suggest that a one standard deviation contraction in credit supply reduces employment by 1.42pp. The authors argue that this finding, which is not observed in the evidence from the United States, may be due to tighter credit constraints in emerging economies.

47. Jiménez et al. (2017, 2020) focus on Spain, studying different sources of variation in credit supply. Jiménez et al. (2017) study the introduction of dynamic provisions in 2000, while Jiménez et al. (2020) study the increase in real estate prices and banks' exposure to mortgage lending. Both papers focus on expansionary business cycles and find no significant employment effects, suggesting that such effects may be dependent on the business cycle.

48. Other studies presented in Figure 2 show negative employment effects from credit supply contractions across different countries and sources of variation. Some analyze economic or financial crises (Cingano et al., 2016; Bentolila et al., 2018; Acharya et al., 2018; Huber, 2018; Popov and Rocholl, 2018), while others study

changes in financial policies (Fraisse et al., 2020; Toro, 2019), bank mergers (Burga and Céspedes, 2021), or changes in monetary policy (Morais et al., 2019).

49. An interesting case Morais et al. (2019), who investigate how monetary policy changes in the United States or the European Union affect credit supply in Mexico through foreign bank subsidiaries. The authors find that tighter monetary policies in developed economies have negative employment effects in Mexico.

50. Overall, the effects of changes in credit supply seems to be weaker for employment than for investment. One plausible explanation for this finding is labor hoarding. According to this theory, firms often delay employment adjustments in response to negative shocks due to hiring, training, and skill-specific costs (Burnside et al., 1993). In contrast, capital is less specific and more easily adjusted. Consistent with the theory, studies such as Dörr et al. (2018) and Liao (2021) show that investment declines more sharply in response to credit contractions when labor frictions generate adjustment costs (Dörr et al., 2018; Liao, 2021).

3.4.3. Other indicators

51. There is evidence of the effect of credit supply on other business outcomes such as sales, exports, and prices. There is also evidence of indirect effects throughout the value chain.

    Regarding exports, using data from Peru, Paravasini et al. (2015) find that, during the financial crisis of 2007-2009, a reduction in credit supply negatively affected the intensive margin of exports. Similarly, for Pakistan, Zia (2008) finds that the elimination of a credit subsidy between 1998 and 2003 led to a decline in exports by smaller firms, although larger and better-connected firms did not suffer the same impact (consistent with evidence that more financially constrained firms are more adversely affected).

52. On pricing, some recent studies find mixed results on the effects of credit supply shocks on product prices. For example, Meinen and Soares (2022) for Germany and Renkin and Zullig (2024) for Denmark find price increases, while Kim (2021) for the United States and Lenzu et al. (2023) for Belgium find price reductions.

53. As for indirect effects through the value chain, the literature highlights the importance of trade credit as a key channel for the transmission of financial shocks. In the United States, Costello (2020) finds that firms experiencing a negative credit supply shock reduce the trade credit they extend to their customers. This, in turn, increases credit risk and negatively affects customer employment, propagating the shock downstream along the supply chain.

54. For Spain, Alfaro et al. (2021) provide evidence of similar downstream effects on employment, production, and investment, though they do not find conclusive results on reverse (upstream) propagation. Meanwhile, Huremovic et al. (2023) shows that the negative impact on bilateral sales is stronger when shocks affect customers rather than suppliers, which could be explained by a higher elasticity of substitution among suppliers.

3.4.4. Heterogeneity

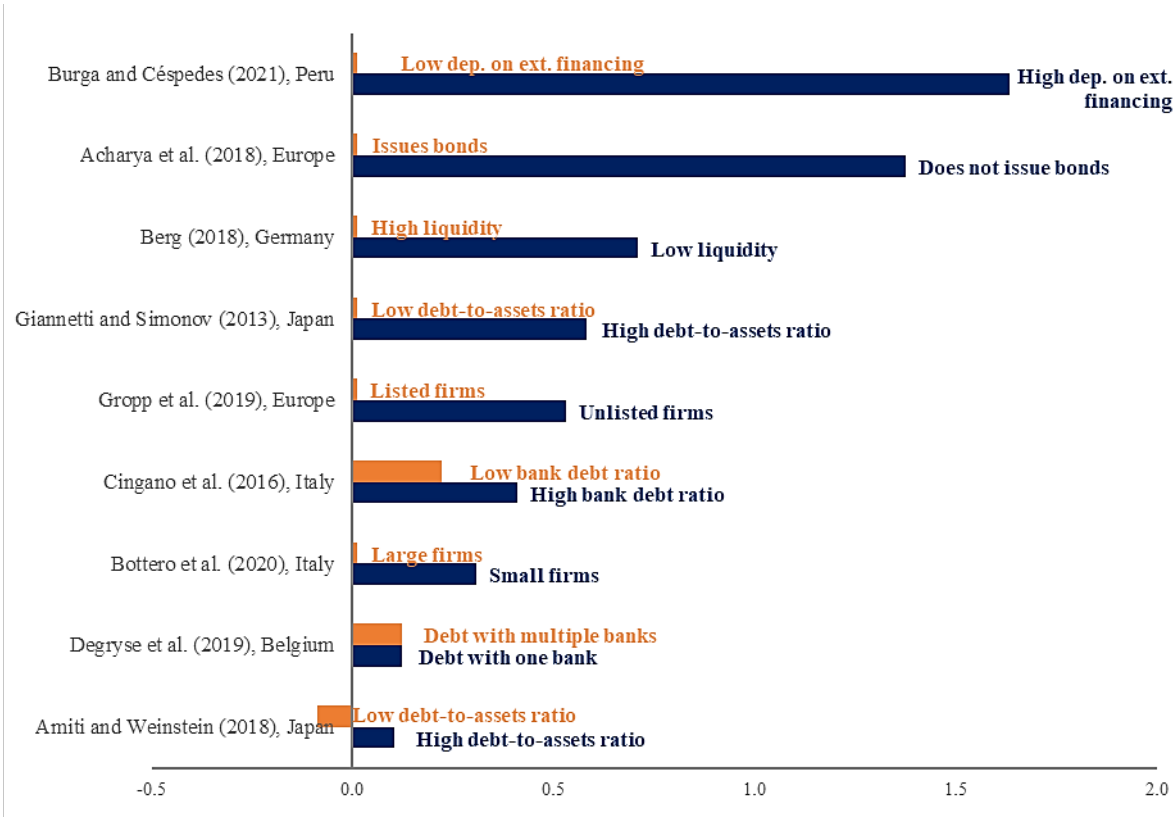
55. The reviewed findings on investment and employment show some dispersion. This heterogeneity may be explained by differences in firms' credit constraints, which vary depending on the country, the business cycle, and firm-specific characteristics such as size, financing alternatives, and capital needs.

56. Figure 3 summarizes the heterogeneity results observed in the studies we reviewed, highlighting the importance of different factors. The evidence suggests that the firms' characteristics are crucial to understand the effects of credit supply. In general, firms more dependent on bank credit are more vulnerable to a credit supply shock. For example, the effects are larger for firms in industries with higher dependence on external financing (Burga and Céspedes, 2021), firms that do not issue bonds (Acharya et al., 2018), firms with lower liquidity (Berg, 2018), more indebted firms (Giannetti and Simonov, 2013; Amiti and Weinstein, 2018), unlisted firms (Gropp et al., 2019), firms with high bank indebtedness (Cingano et al., 2016), and small firms (Bottero et al., 2020).[6/]

[6] On the other hand, there do not seem to be significant differences as a function of the number of banking relations (Degryse et al., 2019), although it should be noted that most studies cannot analyze this margin, as they use samples of firms with multiple banking relations.

FIGURE 3 EFFECT ON INVESTMENT OF A CREDIT SUPPLY SHOCK (1 pp). HETEROGENEITY IN FIRMS' CHARACTERISTICS

(in percentage points)



Notes: This figure shows the effects for different groups of firms of a credit supply shock of 1 pp on the ratio of investment to capital stock (in pp) found in different research papers. The vertical axis identifies the authors, year of publication and country or region of focus. The horizontal axis indicates the magnitude of the effect. For each research paper, the orange bar indicates the effect for firms with more financing alternatives and/or fewer credit restrictions and the blue bar indicates the effect for firms with fewer financing alternatives and/or more credit restrictions. For cases where the effect is not significant at 10%, the effect is plotted as zero. Likewise, when the difference in the effect between the two groups is not significant at 10%, the same effect is plotted for both groups. Source: Authors' estimations based on the cited studies.

3. CONCLUSION

57. The reviewed papers show that fluctuations in credit supply, influenced by aggregate or idiosyncratic economic shocks, as well as monetary and financial policies, can have a relevant impact on the performance of firms, particularly on their ability to invest and hire. In turn, it is evident that the firms most vulnerable to these changes are those with greater credit constraints, such as small firms or those with limited access to alternative sources of financing.

58. In particular, the evidence shows that the ability of banks to continue lending during periods of contraction depends on their characteristics. Banks with higher capitalization, better liquidity and lower-risk portfolios tend to maintain a more stable credit supply, even during a crisis.

59. The contraction in the supply of bank credit has a negative effect on firms' investment decisions, this variable being the most sensitive to credit constraints. Although adverse effects on employment are also observed, the results are not as strong, with some studies finding no significant relationship between credit constraints and the level of employment. In addition, reduction in credit supply affect other important variables, such as exports, which tend to decline, and prices, where the evidence is mixed. Indirect impacts along the value chain are also important, as shocks to the lending capacity of customers or suppliers affect the firm indirectly.

60. Finally, it is important to highlight evidence of heterogeneity in the responses of both banks and firms. The observable characteristics that shape this heterogeneity can serve to inform the expected impacts of policies, whether aimed at strengthening the banking system or at reducing barriers credit access.

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APPENDIX

There are two main methodologies to exploit bank-firm data that measure the effect of changes in credit supply on firm-level variables: Khwaja and Mian (2008) -KM- and Amiti and Weinstein (2018) -AW-. The main idea is to use firms that have banking relations with more than one bank (multibank firms) to control for credit demand using firm fixed effects.

Both methods identify, in a first stage, the supply shocks of bank credit and then, in a second stage, estimate the effects of credit supply shocks on firms' financing conditions and real outcomes such as investment and employment, among others. The differences between the two methods are in the first stage.

KM propose estimating: $\Delta Debt_{f,b}=\alpha_f+\beta X_b+\varepsilon_{f,b}$,

where $\Delta Debt_{f,b}$ is the percentage change in the firm *f*'s debt with bank *b*, α_f is a firm-fixed effect that captures changes in the demand for credit, X_b is a measure of the exposure of bank *b* to a shock or policy change that may affect its credit supply (for example, the shock may be the sovereign bond crisis in Europe and the exposure to the importance of sovereign bonds in the bank's balance sheet), and $\varepsilon_{f,b}$ is an error term.

In KM, the change in credit supply of bank b is: $\Delta Credit\ supply_b=\beta X_b$.

In turn, AW propose estimating: $\Delta Debt_{f,b}=\alpha_f+\beta_b+\varepsilon_{f,b}$,

where β_b is a bank-fixed effect that measures the change in bank *b*'s credit supply, i.e., $\Delta Credit\ Supply_b=\beta_b$

Once the changes in bank credit supply have been identified, the second stage is the same for both methods. They first estimate the change in credit supply faced by firm *f* as

$\Delta Credit\ Supply_f=\Sigma_b\omega_{f,b}\Delta Credit\ Supply_b$,

where $\omega_{f,b}$ is the share of the debt that firm *f* has with bank *b* in the total bank debt that firm *f* has in a baseline period.

Next, they estimate the effect of the change in credit supply on the firm's variables, thus:

$Y_f=\alpha+\theta\ \Delta Credit\ Supply_f+\varepsilon_f$

where Y_f is an outcome variable at the firm level related with firm's financing, like loan amounts or loan interest rate, or related with firm's performance, like investment, employment, or sales.[7]

[7] Khwaja and Mian (2008) propose estimating in the second stage the equation $Y_f=\alpha+\rho\ X_f+\varepsilon_f$, where $X_f=\Sigma_b\omega_{f,b}X_b$ is the average exposure of firm *f*. This model is equivalent to the previous one if we make $\theta=\rho/\beta$.