Box 5.1

The Direct and Indirect Effect of Credit Market Conditions on Investment: Evidence from a Reversal in International Capital Flows

Following a reversal in international capital flows (sudden stop), domestic banks –particularly those with higher ex-ante reliance on global liquidity- reduce their supply of credit more strongly, and firms –particularly smaller, younger or indebted ones— experience a stronger reduction in bank credit supply.[1] In this box, we focus on the period after the Lehman collapse (2008-2009) during which international capital flows to Turkey were retrenched –as was the case for many emerging markets. We examine how a reduction in bank credit supply affects real investments, and whether (and more importantly how) such effects spill over to other firms through firm-to-firm linkages. For empirical identification, we have used rich administrative micro-level databases, i.e., the domestic credit registry that covers the universe of bank-firm loans along with loan-level details, firm balance sheets and income statements that cover the universe of non-financial corporates, and firm-to-firm sales that cover virtually the universe of firm-to-firm sales.[2]

First, we establish that firms working with banks with higher ex-ante reliance on global liquidity –i.e., firms that are ex-ante more exposed to the sudden stop through the credit supply channel- reduce their fixed capital investments more after the sudden stop. Formally, we estimate the following equation:

$$\Delta K_{f,2009} = \beta \; Exposure \; to \; the \; Credit \; Supply \; Shock_{f,2008} + X_{f,2008} + \vartheta_{i.c} + \varepsilon_{f,2009}. \qquad (1)$$

$\Delta K_{f,2009}$ stands for the log-change in fixed assets of firm f from the end-of-2008 to the end-of-2009, $Exposure \; to \; the \; Credit \; Supply \; Shock_{f,2008}$ is the weighted average reliance on global liquidity (non-core foreign-currency liability-to-total liabilities ratio) of banks that firm f was working with prior to the sudden stop (September 2008), and $X_{f,2008}$ stands for firm controls.[3] $\vartheta_{i.c}$ denotes the industry (NACE-2) x city fixed effects.

The effect that we identify, β, shows whether firms with different degrees of ex-ante reliance on global-liquidity-reliant banks differ in their investments after the sudden stop (among firms within the same industry and city). "Industry x city" fixed effects mitigate the role of other potential channels that may be at work (e.g., trade channel), and thereby help better identify the effect of credit supply channel on investment.

Second, motivated by the possibility that firms may be exposed to a (sudden stop-driven) credit supply shock not only directly but also through their suppliers, we augment equation (1) as below:

$$\Delta K_{f,2009} = \beta_1 \; Exposure \; to \; the \; Credit \; Supply \; Shock_{f,2008} +$$
$$\beta_2 \; Indirect \; Exposure \; to \; the \; Credit \; Supply \; Shock_{f,2008} + X_{f,2008} + \vartheta_{i.c} + \varepsilon_{f,2009}. \qquad (2)$$

---

[1] Inflation Report 2018-II, Box 5.2. "Global Liquidity Conditions, Domestic Credit Supply, and Firms' Access to Credit".

[2] Further details can be found at Fendoğlu and Ongena (2020).

[3] Firm controls are log (total assets), equity-to-total assets ratio, exports-to-total sales ratio, and short-term debt-to-total debt ratio.

where *Indirect Exposure to the Credit Supply Shock*$_{f,2008}$ is the weighted average *Exposure to the Credit Supply Shock* of firms that supply goods and services to firm f, multiplied by how much firm f relies on purchases from its suppliers for production (i.e., the share of supplier purchases in total cost of sales).

The effect we identify here, β_2, shows, on average, whether working with suppliers with greater difficulty in accessing credit has a bearing on the firm's fixed capital investment. We expect firms working more with such suppliers to be able to invest less, i.e., a negative estimated value for β_2.

Finally, to shed light on the mechanism driving equation (2), we study whether suppliers with greater difficulty in accessing credit reduce their sales of inputs to their downstream firms. Formally, we estimate

$$\Delta S_{fs,2009} = \beta_1 \, Exposure \ to \ the \ Credit \ Supply \ Shock_{s,2008} + X_{s,2008} + \vartheta_{f,is.cs} + \varepsilon_{fs,2009}.$$

where $\Delta S_{fs,2009}$ is the log-change in the total sales of supplier s to firm f from January 2008-September 2008 to January 2009-September2009, *Exposure to the Credit Supply Shock*$_{s,2008}$ is the weighted average degree of reliance on global liquidity of banks that the supplier s was working with prior to the sudden stop (September 2008). $X_{s,2008}$ denotes the set of firm controls for supplier s. $\vartheta_{f,is.cs}$ denotes "buyer firm x supplier firm's industry (NACE 2) x supplier firm's city" fixed effects.[4] With this empirical strategy, we measure whether suppliers within the same industry and city but with different degrees of credit constraints differ in their supply of "similar" inputs to the same downstream firm (henceforth, we absorb demand side effects and focus on the supply side).

Table 1: Empirical Results

Dependent Variable:	(1)	(2)	(3)
	$\Delta K_{f,2009}$ (Log-change in Total Fixed Assets)	$\Delta K_{f,2009}$ (Log-change in Total Fixed Assets)	$\Delta S_{fs,2009}$ (Log-change in Firm-to-Firm Sales)
Exposure to the Credit Supply Shock	-0.662*** (0,034)	-0.074*** (0,004)	-0.385*** (0,097)
Indirect Exposure to the Credit Supply Shock	--	-0.048*** (0,022)	--
Firm Controls included?	Yes	Yes	--
Industry x City Fixed Effects	Yes	Yes	--
Buyer firm x Supplier Firm's Industry x Supplier Firm's City Fixed Effects	--	--	Yes
Number of Observations	234,957	234,957	282,272
R^2	0.021	0.021	0.399

Note: Standard errors are reported in parentheses below the coefficients, and are double-clustered at the industry and city level in columns (1) and (2), and at the buyer firm and supplier firm level in column (3). *** significant at 1%.

---

[4] The results are also significant when only buyer fixed effects are included in the model.

The results are summarized in Table 1. Column (1) shows that firms that experience a greater adverse credit supply shock reduce their investments more. Column (2) further shows that firms working more with bank-credit-constrained suppliers reduce their investments as well, amplifying the direct effect that we report in column (1). Column (3) then identifies the mechanism. Suppliers that experience greater adverse credit supply shocks reduce their sales (inputs) to their downstream firms.[5] These effects are not only statistically significant but also of relevant economic magnitude.

A firm at the 3rd quartile of exposure to the credit supply shock reduces its investment by 3% more compared to a firm at the first quartile (column (1)). Via a similar calculation using related interquartile ranges, firms working more with bank-credit-constrained suppliers reduce their investments by about 0.3% more (column (2)). This result implies that the indirect effect is about one-tenth of the direct effect.[6] Lastly, and shedding light on the mechanism, among suppliers that supply similar inputs to a downstream firm with similar transportation costs, the supplier at the 3rd quartile of exposure to the credit supply shock reduces its sales by 2.2% more compared to the supplier at the first quartile (column (3)). In quantifying these effects, we multiply the estimated coefficient with the interquartile range of the variable in question.[7]

To sum up, the results show that an adverse credit supply shock not only affects a firm that is directly hit and leads to a lower investment by that firm but also propagates within the economy through buyer-supplier linkages, and leads to a greater reduction in overall investments via this channel. In this regard, the results underline that changes in the bank credit supply affect investments beyond their direct (first-order) effects.

References

Fendoğlu, S. and Ongena, S. (2020). Tracing the Impact of a Sudden Stop: The Role of Bank Rollover Risks, Expectations, and Domestic Production Networks. Under review (for the previous version, see CBRT Working Papers No. 18/18).

---

[5] Note that here we focus on downstream effects. We find that upstream effects are much weaker than the downstream effects (see Fendoğlu and Ongena, 2020).

[6] Note that indirect effects can become stronger due to various alternative channels. For instance, if a buyer is working in relatively concentrated supplier markets, the indirect effect can get significantly higher (see Fendoğlu and Ongena, 2020).

[7] For interquartile ranges, see Fendoğlu and Ongena (2020).