

# The Downstream Channel of Financial Constraints and the Amplification of Aggregate Downturns

**Sergio H. Rocha**

University of Illinois Urbana-Champaign

**Gustavo S. Cortes**

University of Florida

**ILLINOIS**

**UF WARRINGTON**  
COLLEGE of BUSINESS

## Abstract

We identify a novel channel through which financial constraints propagate in the production chain. Exploiting recent developments on production network data of US firms, we show that firms experience greater valuation losses during industry downturns when their suppliers are financially constrained. Our baseline downstream amplification effect corresponds to roughly 60% of the horizontal amplification documented in the literature. We find stronger impacts of downturns when: (i) suppliers are more constrained; (ii) firms depend more on specific inputs; and (iii) suppliers are more concentrated. The effects are attenuated or muted at high levels of downstream firms' accounts payable and upstream firms' accounts receivable, suggesting trade credit as a mechanism through which the downstream channel operates. Our findings uncover two network implications of financing constraints: a more severe contagion of negative shocks through supplier-customer links and an amplification of downstream industries' valuation losses. Our results lend support to policies that facilitate trade credit in upstream segments during crises.

## Introduction

Financial constraints can amplify the severity and duration of negative shocks on firms' employment and investment decisions. Moreover, as firms interact along the production chain, the soundness of suppliers may affect their customers' real and financial outcomes, mainly via liquidity provision in the form of trade credit (Garcia-Appendini and Montoriol-Garriga, 2013). Thus, financing constraints can propagate downstream via a constrained firm's lower capacity to assist clients, increasing clients' exposure to downturns and facilitating the downstream contagion of shocks. Despite recent advances in the literature, we still know little about the network implications of financing constraints that can facilitate the vertical transmission of economic distress. These considerations have become critical after the 2020 COVID-19 crisis drew renewed attention to perhaps one of the most severe global supply-chain disruptions in modern history.

In this paper, we estimate the extent to which firms with financially constrained suppliers experience an amplification of the effects of industry downturns. In addition, we test whether these firms are also more exposed to downstream contagion—the transmission of supply chain shocks to clients. To link firms' economic distress to upstream financial distress and exploit cross-supplier variation in financing constraints, we leverage recent advances on production network data by Fresard, Hoberg, and Phillips (2020). Our empirical approach builds upon and expands Carvalho's (2015) which quantifies the net effect of the externalities that financially constrained firms impose on their peers during industry downturns. We augment the empirical model to capture net effects of externalities stemming from upstream financing constraints. This allows us to disentangle and quantify the contribution of both horizontal and vertical production chain relations on firms' exposure to aggregate shocks.

Following Almeida et al. (2012) and others, we use corporate long-term debt structure to gauge plausibly exogenous variation in financing constraints. Our results show that firms experience additional valuation losses during industry downturns when their suppliers have greater shares of their long-term debt due. Our results are stronger when suppliers are more constrained, and when customer's costs of switching suppliers are higher. Further tests suggest that trade credit is the underlying mechanism generating the downstream amplification effects: lower cash flows combined with lower capacity to tap suppliers for liquidity during downturns can undermine a firm's capacity to meet its operational expenses, further eroding its franchise value. Finally, we also show that firms with constrained suppliers are more severely affected by supply-chain shocks.

## Data, Variable Construction & Baseline Specification

Data sources:

- Firm balance sheets: Compustat Fundamentals Annual and Quarterly
- Stock returns: Center for Research in Security Prices (CRSP)
- Text-based horizontal and vertical relatedness data: Fresard–Hoberg–Phillips Data Library. Identifies a unique group of industry peers and suppliers for each Compustat firm.

Financial constraint: Large proportion of long-term debt maturing in a given year, as predicted one year before. We build an indicator  $FC_{i,t}^f$  that equals one if firm  $i$  is in the top tercile of year  $t$ 's distribution of proportion of long-term debt due.

We combine this variable with our network structure to build  $FC_{i,t}^{ind}$  and  $FC_{i,t}^{sup}$ , firm-quarter measures of financial constraints among industry peers and suppliers, respectively. These indicators equal one when a firm has above-median proportion of peers and suppliers classified as constrained according to  $FC^f$ .

Industry Downturns:  $D_{i,t}^{ind}$  is a firm-quarter indicator that equals one when firm  $i$ 's peers experience negative median quarterly returns and an abnormally low quarterly median revenue growth (Opler and Titman, 1994).

Our main outcome of interest is  $AbnRet_{i,t}$ : Quarterly DGTW-abnormal returns (in p.p.), i.e., stock returns in excess of a portfolio matched on size, book-to-market, and past-quarter returns (Daniel et al., 1997).

The final sample covers 263,502 firm-quarter observation between 1996 and 2017.

We estimate the following regression model via OLS.

$$AbnRet_{i,t} = \alpha_0 \cdot FC_{i,t}^f + \alpha_1 \cdot FC_{i,t}^{ind} + \alpha_2 \cdot FC_{i,t}^{sup} + \beta_0 \cdot [FC_{i,t}^f \times D_{i,t}^{ind}] + \beta_1 \cdot [FC_{i,t}^{ind} \times D_{i,t}^{ind}] + \beta_2 \cdot [FC_{i,t}^{sup} \times D_{i,t}^{ind}] + \delta_0' \cdot X_{i,t} + \delta_1' \cdot [X_{i,t} \times D_{i,t}^{ind}] + \sum_i \mu_i + \sum_t \mu_t + \epsilon_{i,t}$$

- $\beta_0$ : Direct amplification of financial constraints (Almeida et al., 2012).
- $\beta_1$ : Intra-Industry (horizontal) amplification effect (Carvalho, 2015).
- **Coefficient of interest ( $\beta_2$ )**: Downstream amplification effect.
- Firm and Downturn-quarter fixed effects.
- Controls:
  - Firm: Tobin's  $Q$ , Cash flow, Cash, Size, leverage,  $1(Rated)$ ,  $1(InvestmentGrade)$ .
  - Industry (firm-level): HHI Index, Asset Maturity, Lagged Revenue Growth (lags 1,2, and 3), leverage.
- Interaction of downturns with controls allows for heterogeneous effects of downturns conditional on firms' observables
- Standard errors clustered at the firm level

## Results

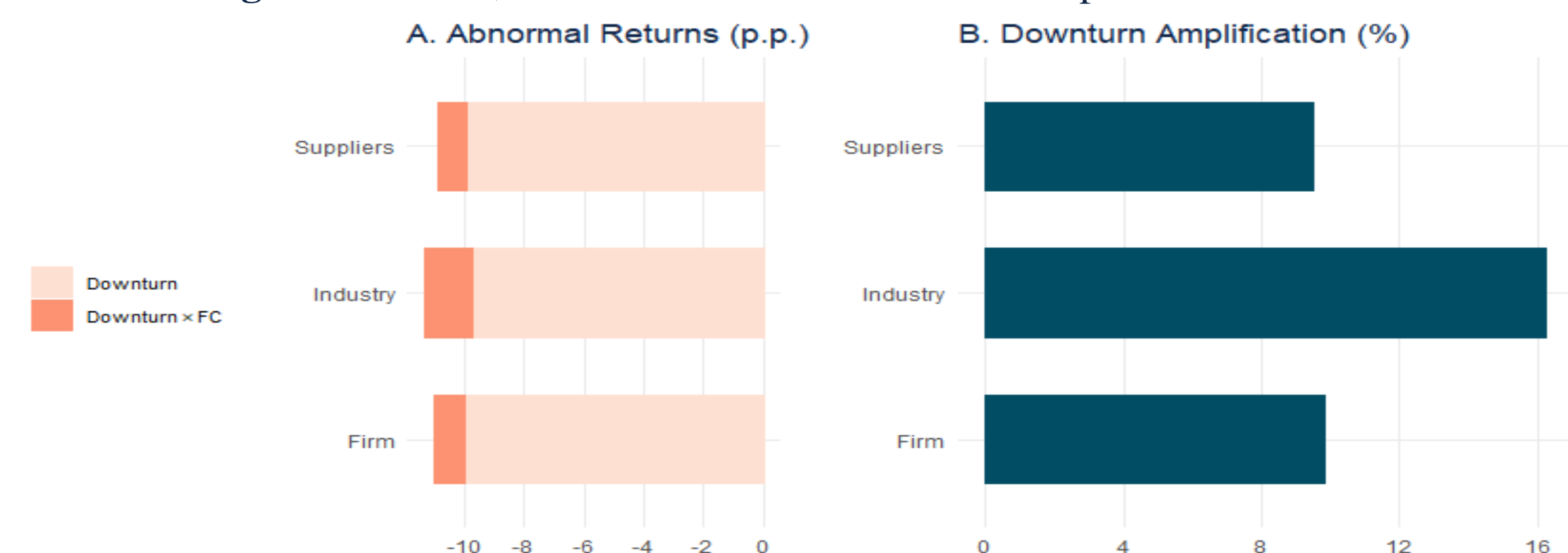
**Table 1:** Direct, Horizontal and Downstream Amplification Effects

	Abnormal return		Amplification (%)
	$D^{ind}(FC=0)$	$FC \times D^{ind}$	
$FC^f$	-10.014***	-0.985**	9.8
$FC^{ind}$	-9.754***	-1.585***	16.2
$FC^{sup}$	-9.944***	-0.940***	9.5

Standard Errors clustered at firm level. \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

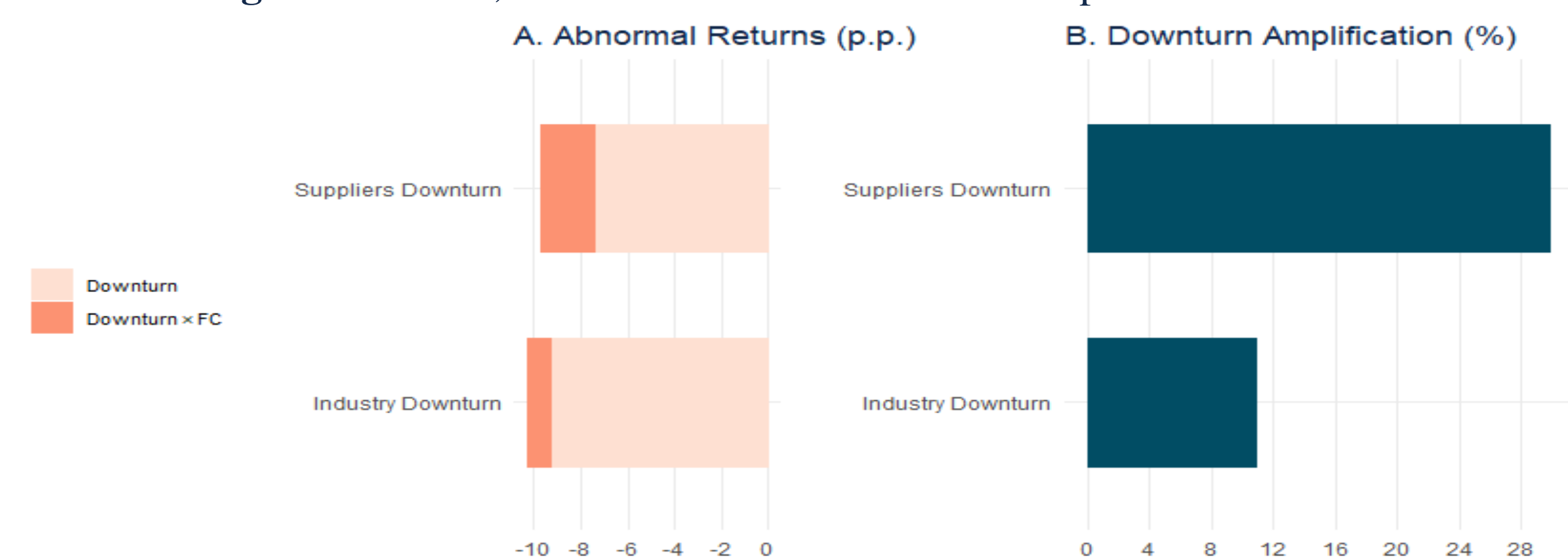
The first column of Table 1 reports the total effect of an industry downturn when the financial constraint specified in the row is not binding. The second column reports the additional valuation loss that firms experience due to each financing constraints, i.e., the estimates of  $\beta_0$ ,  $\beta_1$ , and  $\beta_2$ , respectively. The third column reports the correspondent amplification effects. As one can see in the third row, firms with financially constrained suppliers experience 0.940 p.p. lower abnormal returns than firms with unconstrained suppliers during downturns, which corresponds to a 9.5% amplification of the total devaluation due to the industry shock. This amplification effect corresponds to roughly 60% of the horizontal amplification effect documented by Carvalho (2015) that we replicate in Table 1. These results are summarized in figure 1.

**Figure 1:** Direct, Horizontal and Downstream Amplification Effects



Next, we show that upstream financial constraints are also associated with a stronger downstream contagion of supply-chain shocks. To do this, we build an indicator of suppliers' downturns,  $D^{sup}$ , similar to our industry downturn variable. We include this variable in our baseline specification where the coefficient of its interaction with  $FC^{sup}$  estimates differential downstream effects of shocks to suppliers when these are constrained. To control for overlaps between industry and supplier downturn events, we also interact  $D^{sup}$  with  $D^{ind}$  and  $FC^{sup} \times D^{sup}$ . The results are summarized at Table 2, where we compare the downstream contagion of supply-chain shocks to the amplification of downstream industries downturns. Two results are worthy of note. First, industry downturns impose overall larger devaluation than supply-chain shocks. Second, upstream financial constraints amplify supply-chain shocks by much more than industry downturns (29.8% versus 10.9%, respectively).

**Figure 2:** Direct, Horizontal and Downstream Amplification Effects



## Heterogeneity Analysis & Mechanism Inspection

We investigate firms' observable characteristics driving our baseline amplification results. To do this, we construct several variables and include them in our main specification interacting with  $FC^{sup}$ ,  $D^{ind}$  and  $FC^{sup} \times D^{sup}$ . Hence, the coefficient of the triple interaction estimates the sensitivity of our baseline result to the variable of interest. We summarize the variables used and the results obtained below.

- $FCHP_{i,t}^{sup}$  is the proportion of a firm's constrained suppliers for which long-term debt represent at least 5% of total assets (Almeida et al., 2012). These are the suppliers more likely to be constrained as per our financial constraint measure. We estimate that a one standard deviation (s.d.) increase in  $FCHP^{sup}$  leads to 0.491 p.p. lower abnormal returns due to the downstream amplification effect.
- $FCRD_{i,t}^{sup}$  is the proportion of a firm's constrained suppliers that are R&D intensive. This measure proxies for a firm's dependency on specific inputs provided by constrained suppliers. We estimate that an increase of one s.d in  $FCRD^{sup}$  leads to 0.936 lower abnormal returns via downstream amplification.
- $HHI_{i,t}^{sup}$  is a sales-based Herfindahl–Hirschman index computed across firm  $i$ 's suppliers at quarter  $t$ , thus measuring upstream concentration for each firm. We estimate that an increase of one s.d in  $HHI_{i,t}^{sup}$  is associated with 0.888 p.p. lower abnormal returns via downstream amplification.
- $Pay_{i,t}^f$  and  $Rec_{i,t}^{sup}$  are firm  $i$ 's accounts payable and its constrained suppliers' accounts receivable, respectively. These variables measure the use of trade credit from the downstream and upstream perspectives. Our estimates show that that the downstream amplification effect is significantly attenuated at high levels of trade credit via both proxies. In particular, our results imply that the amplification effect is muted at the top 2.5% and 14% of the overall distribution of  $Pay_{i,t}^f$  and  $Rec_{i,t}^{sup}$ , respectively.

## Conclusions

- Upstream financial constraints increase firms' exposure to industry downturns and supply-chain shocks in the form of greater valuation losses.
- The effects are more prevalent when suppliers are more constrained and when downstream firms incur higher costs of switching constrained suppliers.
- Our evidence suggests that trade credit is the mechanism through which financial constraints propagate downstream amplifying industry downturns. Constrained firms' limited capacity to extend trade credit to their clients translates into customers' lower liquidity available to allocate with discretion, increasing their sensitivity to aggregate shocks.

## References

- Almeida, Heitor, Murillo Campello, Bruno Laranjeira, and Scott Weisbender, 2012, Corporate debt maturity and the real effects of the 2007 credit crisis, *Critical Finance Review* 1, 3–58.
- Carvalho, Daniel, 2015, Financing constraints and the amplification of aggregate downturns, *Review of Financial Studies* 28, 2463–2501.
- Daniel, Kent, Mark Grinblatt, Sheridan Titman, and Russ Wermers, 1997, Measuring mutual fund performance with characteristic-based benchmarks, *Journal of Finance* 52, 1035–1058.
- Fresard, Laurent, Gerard Hoberg, and Gordon M. Phillips, 2020, Innovation activities and integration through vertical acquisitions, *Review of Financial Studies* 33, 2937–2976.
- Garcia-Appendini, Emilia, and Judit Montoriol-Garriga, 2013, Firms as liquidity providers: Evidence from the 2007–2008 financial crisis, *Journal of Financial Economics* 109, 272–291.
- Opler, Tim C., and Sheridan Titman, 1994, Financial distress and corporate performance, *Journal of Finance* 49, 1015–1040.