Supply Chain Shortages, Large Firms' Market Power, and Inflation

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Abstract

We propose and test a theoretical mechanism for why supply chain shortages decrease industry competition. We show empirically that when supply chain shortages affect an industry, "superstar" firms experience smaller increases in costs and consequently are able to increase their market share and profitability. Supply chain shortages are also associated with an increase in markups and higher stock returns for superstar firms relative to other firms in the same industry. Consistent with our theoretical framework and the firm level evidence, when supply chain shortages occur, concentration increases and price hikes are larger in ex ante more concentrated industries. Specifically, ex ante differences in industrial structure and the large increase in supply chain backlogs during the COVID-19 pandemic recovery can explain about 25% of cross-sectional differences in inflation between industries in the US. Economic magnitudes are comparable in the international sample.

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1 Introduction

Over the decades since globalization took off, companies have developed complex value chains, which, for a long time, have decreased costs and generated higher profits (Antràs and Chor, 2022). More recently, geopolitical tensions and the COVID-19 pandemic have attracted policymakers' attention to the risks underlying this global economic network and the severe repercussions that supply chain shortages and disruptions can have on economic activity. However, despite the growing evidence on the importance of supply chain shocks, we know rather little about how firms respond to supply chain shortages and the implications of individual firm behavior for industry structure and macroeconomic outcomes. Specifically, how the competitive position of a firm in its industry affects its ability to navigate supply chain shortages remains an understudied question.

This paper investigates the impact of supply chain shortages on firm performance and industrial structure. We conjecture that supply chain shortages increase production costs because firms cannot utilize the optimal mix of production inputs. The largest firms in an industry, which we label superstars in line with prior literature (Autor, Dorn, Katz, Patterson, and Van Reenen, 2020, Gutiérrez and Philippon, 2019), could suffer less from supply chain shortages because they have more resilient supply chains and more bargaining power to obtain preferential deliveries from their suppliers. If this is the case, supply chain shortages could lead to a larger increase in production costs for relatively smaller firms and can decrease competition, especially in industries that are ex ante more concentrated due to the presence of a few superstar companies.

We show that, consistent with our theoretical conjecture, when upstream industries experience backlogs, the largest firms in the industry acquire market share and increase their profitability and markups. These findings are robust when we consider cost shocks and heterogeneity in pass-through rates between firms with different market power. Further analysis of the supply chain structure supports the mechanism behind our hypotheses. First, when supply chain shocks occur large firms experience smaller increases in production costs. Moreover, superstars firms' increase in market shares and profitability appear to be associated with an increase in markups. Second, the profitability and sales of superstar firms suffer less than those of other companies associated with the same suppliers, when these suppliers experience operating difficulties. Since we hold constant the intensity of the shock experienced by a firm's supplier, this finding suggests that firms tend to favor their most important customers. Third, superstar firms' suppliers are often very large themselves and are consequently less negatively affected by supply chain shortages.

Our findings suggest that supply chain shortages can decrease competition and lead to an increase in market share and profits for large firms, providing an economic channel for the highly disputed assertion that firms' pricing policies in response to supply chain bottlenecks have fostered the recent inflation pressures, a notion often referred to as 'greedflation' in the media. Claims that firms' increased profit margins are associated with high inflation have been recurring in the press and policy circles but tend to be rejected by macroeconomists because higher prices may simply reflect higher costs – the so-called pass-through effect. It is also unclear why firms' market power would have increased. We show that supply chain shortages have hindered smaller firms and improved the competitive position of superstar firms, allowing them to gain market share and increase their profit margins.

At the aggregate level, the increase in market power of superstar firms could help explain the inflationary impact of supply chain shortages. We expect that the extent of supply chain shortages in an industry should result in higher prices and inflation in industries that have experienced larger increases in concentration because of supply chain shortages. We find that indeed industries that are ex ante more concentrated experience larger increases in concentration when supply chain shortages occur. In turn, these industries experienced higher inflation. We show that the mechanism we propose can explain about 25% of the inflation during the COVID-19 pandemic recovery in the US and across the world.

We contribute to several strands of the literature. First, a growing body of work highlights an increase in market power driven by the largest firms (De Loecker and Eeckhout, 2018). It is heatedly debated whether these firms, often labelled superstars, are more efficient (Autor, Dorn, Katz, Patterson, and Van Reenen, 2020) or enjoy oligopolistic rents (Gutiérrez and Philippon, 2021, Grullon, Larkin, and Michaely, 2019). It is also unclear whether the outperformance of superstar firms is driven by the mismeasurement of intangible capital (Ayyagari, Demirguc-Kunt, and Maksimovic, 2023). Existing studies have mostly documented secular trends and their effects on the labor market and wage growth (Autor, Dorn, Katz, Patterson, and Van Reenen, 2020). We study the effects of supply chain shortages on superstar firms and their competitors. Since we are interested in superstars' response to relatively short-lived shocks, we are agnostic on the determinants of their superstar status.

Second, we contribute to a growing literature studying the channels through which microeconomic frictions can affect aggregate supply and inflation. Most of the literature highlights different channels through which monetary and real shocks affect firms' costs and consequently prices (Barth and Ramey, 2001). Chevalier and Scharfstein (1996) propose that binding financial constraints lead firms to reduce capacity and increase prices during recessions and following monetary policy tightening (see also Antoun de Almeida, 2015, for empirical evidence). Drechsler, Savov, and Schnabl (2023) show how a severe credit crunch caused by regulation led to a negative supply shock, which can explain stagflation in the seventies. Acharya, Crosignani, Eisert, and Eufinger (2023b) highlight how zombie lending contributes to excess capacity and deflation. We contribute to this literature by highlighting the interplay of market structure, production networks, and supply chain shortages.

More closely related to us, contemporaneous work by Acharya, Crosignani, Eisert, and Eufinger (2023a) shows that heightened household inflation expectations allowed firms to pass cost shocks to prices and that the effect was particularly strong for high market power firms. We provide a complementary channel and show that when supply chain shortages occur, the market power of the largest firms in an industry increases. As a consequence, during the COVID-19 pandemic recovery, inflation has increased in concentrated industries, which are those in which supply chain shortages affect firms more differently.

Finally, we contribute to the literature showing how shocks propagate over production networks and affect economic outcomes (Acemoglu, Carvalho, Ozdaglar, and Tahbaz-Salehi, 2012, Barrot and Sauvagnat, 2016, Carvalho, Nirei, Saito, and Tahbaz-Salehi, 2021). Macro studies in this line of research highlight that import price increases and supply chain disruptions constrained the COVID-19 pandemic recovery and fostered inflation (e.g., Kemp, Portillo, and Santoro, 2023, Hansen, Toscani, and Zhou, 2023, Di Giovanni, Kalemli-Özcan, Silva, and Yildirim, 2023). Evidence on the extent to which marginal cost pass-through increased firms' markups is mixed (Gagliardone, Gertler, Lenzu, and Tielens, 2023). Differently from these studies, we highlight how changes in firms' competitive environments contributed to the inflation spiral.

The paper proceeds as follows. Section 2 delineates the conjectured economic channel. Section 3 describes the data that are used for the empirical analysis. Section 4 contains the main empirical results on the relationship between supply chain backlogs, firm size, and firm-level outcomes . Section 5 studies the underlying channel using data on the customer-supplier relationships. Section 6 entertains other potential explanations of the main results. Section 7 studies the industry-level relationship between supply chain backlogs, industry structure, and inflation. Finally, Section 8 concludes.

2 Theoretical Framework

Following the COVID-19 pandemic, policymakers aiming to restart the economy injected massive economic stimulus via expansive monetary and fiscal policies, which increased aggregate demand. Furthermore, the unexpected shifts in demand composition from services to goods as a consequence of the lockdowns led many industries to experience supply chain shortages, which accompanied by increases in energy prices and other commodities, contributed to raising costs. The natural outcome of higher demand and higher costs is a market equilibrium with higher prices. This account of the events removes legitimacy from casual claims that firms exploited the pandemic to raise prices and markups, the so-called 'greedflation' theory. The dominant narrative gives no reason to believe that firms' market power has increased.

In what follows, we propose and test a plausible economic channel for an increase in market power resulting from supply chain disruptions, which, in turn, may have led to higher inflation in ex ante more concentrated industries. We conjecture that supply chain shortages have a heterogeneous impact on firms within an industry and may advantage superstar firms for the following reasons. First, the larger firms within an industry tend to have more bargaining power vis-à-vis their suppliers, which consequently grant them preferential treatment in case of production backlogs. Second, the larger firms are also more likely to have the scale to internalize some upstream activities or have suppliers that are themselves superstars and are therefore less negatively affected by supply chain shocks. All these mechanisms contribute to partly insulate large firms from negative events along the supply chain. Consequently, superstar companies are more likely to be able to operate close to the optimal mix of production than their rivals following supply chain shortages and, as a result, they experience lower increases in production costs.

We illustrate how superstar firms' advantage when supply chain shortages occur affects the industry equilibrium with the help of a stylized model. We consider an industry populated by n firms producing perfect substitute products. The firms are oligopolists following Cournot competition. Thus, each firm maximizes its profit taking into account the price impact of its output q_i. The firms face constant return to scale with marginal cost c_i. To capture supply chain shortages and their asymmetric effects, we let

$$c_i = \delta_i c \tag{1}$$

where $\delta_i > 0$ and $\sum_{j=1}^{n} \delta_j = 1$, without loss of generality. The parameter c captures aggregate factors affecting costs in an industry and δ_j firm j's exposure to these factors. Under our parametrization, if $\delta_j = 1/n$ for all j, then all firms have equal costs; to capture that superstar firms are more efficient and less exposed to aggregate shocks originating from supply chains, we assume that $\delta_j < 1/n$ for superstar firms.

Importantly, an increase in the parameter c, capturing supply chain shortages, leads to increased dispersion in the costs of the firms within the industry.

For simplicity, we assume the aggregate demand for the product to be linear

$$p\left(Q\right) = b - Q, \tag{2}$$

where $Q = \sum_{j=1}^{n} q_j$.[1]

Solving the firm profit maximization and for the industry equilibrium, we obtain firms' market shares. All proofs are presented in the Appendix. It follows readily from our assumptions that superstar firms, having lower costs, have higher market shares. Importantly, as established in Lemma 1 below, their advantage increases when supply chain shortages increase c.

Lemma 1. ***Supply Shortages and Firms' Market Shares*** *In equilibrium, firm i's market share and markup increase when supply chain shortages increase marginal costs for all firms if and only if $\delta_i < 1/n$.*

The following proposition follows readily from Lemma 1.

Proposition 1. *Supply chain shortages, captured by an increase in c, lead to an increase in the dispersion of market shares across firms and, therefore, to an increase in the Herfindahl–Hirschman Index (HHI) for the industry which is defined as*

$$HHI = \sum_{j=1}^{n} s_j^2.$$

Importantly, an increase in supply chain shortages captured by the parameter c leads to an increase in the average markup in the industry because the latter increases in the industry's HHI. This can be easily seen by taking the market-share-weighted average of the firm-level markups

$$\sum_{j=1}^{n} s_j \frac{p - c_j}{p},$$

[1]To obtain positive aggregate production in equilibrium, we assume that $nb - c > 0$ and, to have positive equilibrium output for each firm, we let $b + c - (1+n)\,c_i > 0$.

which can be rewritten as

$$\sum_{j=1}^{n} s_j \frac{p - c_j}{p} = \frac{1}{|\varepsilon|} \sum_{j=1}^{n} s_j^2 = \frac{1}{|\varepsilon|} HHI. \tag{3}$$

Our simple framework illustrates how supply chain shortages may lead to higher market power. Supply chain shortages accentuate small firms cost disadvantage. Consequently, a larger fraction of the product will be provided by the largest firms, which facing less competitive pressure benefit from an increase in their market power. Thus, the main testable conjecture that we bring to the data is that superstar firms in an industry will be able to increase their market share, profits and markups when their suppliers experience backlogs.

Importantly, supply chain shortages have larger effects on industries that are ex ante more concentrated, as stated in the following proposition.

Proposition 2. *The increase in industry concentration following a generalized increase in costs, keeping other parameters constant, is higher when the industry starts from higher levels of HHI.*

The latter result motivates the second part of our empirical analysis. An implication of the asymmetric effects of supply chain shortages across firms in an industry is that we expect heterogeneous price increases depending on the industries' ex-ante competitive structure. Not only do we test that supply chain shortages are associated with a more pronounced increase in concentration in industries starting from higher levels of concentration, but we also expect that the effect of supply chain disruptions on prices hikes and inflation is stronger in more concentrated industries.

3 Data

Our analysis relies on a variety of firm-level and macro data that we combine to gauge firm performance and behavior, supply chain shortages, and industry-level inflation. Below we describe our data sources in turn.

Firms and their supply chains. We obtain firm-level financial information from Worldscope. Our sample covers 18,969 firms in 83 countries across 62 2-digit SIC industries. We construct measures of firms' market shares, profitability, and markups, which we introduce in the empirical analysis. Our sample period is 2003-2021, constrained by the availability of the customer and supplier links, described below. Table 1 provides detailed variable definitions, while Table 2 presents summary statistics.

Since our analysis relies on Worldscope, we observe only listed companies which tend to be the largest in the economy. Thus, the companies in our sample are more homogeneous than the population of firms in a country, which makes it harder to find a differential effect of supply chain shortages between large and relatively smaller firms, the relationship that we intend to study.

We obtain the main customers and suppliers of the firms in our sample from Factset Revere, similar to Adelino, Ferreira, Giannetti, and Pires (2023). For our sample firms, we observe a total of 14,754 suppliers and 18,932 customers, which is equivalent to an average of 6.89 suppliers and 4.05 customers per firm.

Supply chain shortages. We measure supply chain shortages using data from the Survey of Purchasing Managers, which is the foundation for the construction of the Purchasing Manager Indexes (PMI), compiled by S&P Global for more than forty economies worldwide.[2] Each national PMI dataset is collected from questionnaire responses from senior purchasing executives (or similar) at around 400 companies around the world. To ensure the survey data are as representative as possible, according to S&P, in each country the panel of companies is selected to accurately represent the true structure of the chosen sector of the economy as determined by official data. PMI data are aggregated at the sector-region level for 37 sectors in three regions – Europe, Asia, and the US.[3]

[2] https://www.spglobal.com/marketintelligence/en/mi/products/pmi.html.

[3] The sector coverage varies by geographical areas. We map sectors to SIC codes using the industry code in the British classification system provided by S&P after manually matching the British codes to the US SIC codes. Overall, the 37 sectors are: Basic Materials; Chemicals; Resources; Forestry and Paper Products; Metals and Mining; Consumer Goods; Automobiles and Auto Parts; Beverages and Food; Food; Beverages; Household and Personal Use Products; Consumer Services; Media; Tourism and Recreation; Consumer Cyclicals; Consumer Non-cyclicals; Financials; Banks; Insurance; Other Financials; Real Estate; Healthcare; Healthcare Services; Pharmaceuticals and Biotechnology; Industrials; Industrial Goods;

Participants' survey responses are weighted according to their workforce size. The survey panels, therefore, are assembled to replicate the structure of the sector being monitored.

The responses to the questionnaires allow the construction of indexes covering different drivers of economic performance at the sector-region level. In our empirical analysis, we focus on two indexes: suppliers' delivery times, our primary measure of supply chain shortages, and backlogs of work, which we use as an alternate measure.[4]

The suppliers' delivery times index is based on survey participants' responses on whether it is taking the firm's suppliers more or less time to provide inputs on average.[5] The percentage of companies reporting an improvement, deterioration, or no change in delivery times are weighted to derive an index as follows:

$$\begin{aligned} INDEX = &\% \, percentage \, of \, survey \, panel \, responding \text{ “}Faster\text{”} \\ &+ 0.5 \times \% \, of \, survey \, panel \, responding \text{ “}same\text{”} \end{aligned}$$

Thus, readings of the index of 50 indicate no change in delivery times relative to the prior month, readings above 50 indicate that delivery times have improved (i.e., become shorter), and readings below 50 indicate that delivery times have deteriorated (i.e., become slower). The index is also seasonally adjusted. For ease of interpretation, in our analyses, we change the sign of the suppliers' delivery times so that an increase in this variable captures a deterioration of supply chain conditions. In addition, while the index is available at monthly frequency, we consider the average over the previous twelve months for two reasons. First, our firm level data are yearly. Second, even if as we explain below, our inflation data are monthly, we do not expect the effects of supply chain shortages to

Machinery and Equipment; Construction Materials; Industrial Services; Commercial and Professional Services; General Industrials; Construction and Engineering; Transportation; Technology; Technology Equipment; Software and Services; Telecommunication Services.

[4] https://www.spglobal.com/marketintelligence/en/mi/research-analysis/understanding--pmi-suppliers-delivery-times-a-widely-used-indicator-of-supply-delays-capacity-constra html.

[5] The precise question wording is: *"Are your suppliers' delivery times slower, faster or unchanged on average than one month ago?"*

be immediate.

Since the suppliers' delivery time index is available at the sector-region level, it appears in our analysis as an industry-level variable, capturing the shortages that the firms in an industry are facing.

We also construct a firm level proxy proxy for supply chain shortages, which takes into account that firms in the same broad industry aggregate may purchase different inputs. This alternative proxy is based on the backlogs of work index, which according to S&P, "captures the volume of orders that a company has received but has yet to either start work on or complete."[6] The index is intended as a gauge of the challenges that companies face in managing demand. For this reason, it is often used by practitioners as a predictor of emerging inflation patterns. Purchasing managers participating in the PMI business surveys are asked how the volume of uncompleted work has changed compared to the prior month on average. Then, the index is constructed as follows

$$\begin{aligned} INDEX = &\% \, of \, survey \, panel \, responding \text{ “}higher\text{”} \\ &+ 0.5 \times \% \, of \, panel \, responding \text{ “}no \, change\text{”} \end{aligned}$$

Hence, when the index is at 50, it means that there is no change in backlogs of work relative to the prior month, readings above 50 indicate an increase in backlog, and readings below 50 indicate a decline. The index is also seasonally adjusted to remove typical variations in workloads within the year.

We use the backlogs of work index at the sector-region level and also in this case we consider the average over the previous twelve months. To construct a firm-level measure of supply chain shortages, we use information on a firm's suppliers during a year from FactSet as well as the region and sector to which the suppliers belong. Then, for each

[6] https://www.spglobal.com/marketintelligence/en/mi/research-analysis/understanding-pmi-backlogs-of-work-aug21.html. The precise question wording is: *"Are your backlogs of work higher, lower or unchanged on average than one month ago? This refers to the amount of work (in units) that has been ordered but has not as yet been completed or commenced, i.e. the amount of work in-hand or outstanding."*

supplier, we take the average of the sector-region level backlogs of work indexes in the previous 12 months. Finally, we average this figure across all the suppliers of a given firm to obtain a firm-level measure, which we label *Backlog*.

Our measure captures the constraints that a firm's suppliers face in providing full and timely delivery of the necessary production inputs and relies on the customer-supplier relationships that we observe through Factset. In this way, we account for the fact that firms in the same 2-digit industry may have different business models (Hoberg and Phillips, 2016) and use different inputs or source inputs from suppliers in countries differently affected by supply chain shortages. This measure, however, has the disadvantage that it depends on information on a firm's suppliers, which may be incompletely reported in Factset.

In Figure 1, we plot the time series of the average of our proxies for supply chain disruption across industries and countries. We note that the two measures are highly correlated and spike at similar points in time, notably in 2006 and 2021, at the end of the sample. During the COVID-19 pandemic, not only an increasing number of companies report supply chain shortages over the previous month, but also this happens for several months in a row, indicating a build up in bottlenecks, which, as we argue, may have fostered inflation.

Inflation data We obtain inflation data at the industry-country level from Bloomberg, which in turn reports the series from the relevant statistical authorities. Different countries display different levels of industry aggregation, with the United States having the most granular level of aggregation.[7] Bloomberg does not provide an industry identification code. Therefore, we conduct a manual reconciliation of the industries in the inflation data set with the industries in the rest of our analysis.

[7] For example, in the U.S., the group of non-alcoholic beverages is disaggregated into Juices and Non-alcoholic Drinks – which in turn comprises Carbonated Drinks, Frozen Noncarbonated Juices and Drinks, Nonfrozen noncarbonated Juices and Drinks – Beverage Materials including Coffee and Tea – which in turn is comprised of Coffee, Roasted coffee, Instant & Freeze Dried Coffee, Other Beverage Materials Including Tea. In the UK, the group of non-alcoholic beverages contains the two subcategories Coffee, Tea and Cocoa, and Mineral Water, Soft Drinks and Fruit and Vegetable Juices. Finally, in Switzerland, non-alcoholic beverages are in the same category with food: Food and Nonalcoholic Beverages.

The monthly inflation series consists of the annual change in the monthly consumer price index for the relevant industry.[8] We prefer the seasonally adjusted series whenever they are available.

4 Supply Chain Shortages and Firm-Level Outcomes

4.1 Main Findings

We test whether superstar firms are better equipped to withstand supply chain disruptions and, therefore, improve their competitive standing relative to smaller firms in the same industry using our sample of international firms. We start considering firms' market shares and profitability. We compute market share as the fraction of a firm's sales over the total sales of firms in the same two-digit SIC-code industry (labeled *% of industry sales*). Similar to De Loecker, Eeckhout, and Unger (2020), we measure profitability with the return on assets (*ROA*), defined as sales minus cost of goods sold (COGS), selling, general, and administrative expenses (SG&A), and opportunity cost of capital, obtained by multiplying property, plant, and equipment by a measure of the real interest rate.

Figure 2 illustrates our main finding distinguishing between changes in market share and profitability of superstar firms and their competitors in periods with high and low supply chain shortages. It appears that superstar firms gain market share and experience larger increment in profitability relative to their competitors only in periods with supply chain bottlenecks. Their advantage is if anything slightly reversed in other periods.

Table 3 considers the continuous version of the supply chain shortages proxy and reports the estimates from regressing the outcome variables on the interaction of *Delivery time* and an indicator for superstar firms, *Star*. Superstar firms are defined as those ranking in the top 10% of the sales distribution within a 2-digit SIC-code industry in the prior year for the universe of international firms. We include industry-by-country-by-year fixed effects to capture industry- and country-specific shocks and cluster standard errors

[8] Our dataset includes Canada, China, Denmark, Eurozone, Hong Kong, India, Israel, Japan, Norway, Singapore, South Korea, Switzerland, United Kingdom, and the United States. For Norway, we use the index of producer prices because no other series is available in Bloomberg.

at the firm level.

Table 3 considers the entire sample period (2003-2021) as well as the period around the Covid-19 pandemics.[9] In column (1) and (2), we observe that superstar firms experience an increase in market share following a deterioration of the supply chain conditions as measured by the suppliers' delivery times. Moreover, in column (3) and (4), we observe that superstar firms' profitability increases.[10] The effect is robust whether we consider the whole sample period or we focus on the period around the COVID-19 pandemics. Importantly, the estimates are not only statistically, but also economically significant. For example, the coefficient in column (1) implies that a one-standard-deviation increase in *Delivery Time* increases the market share of star firms by 3.6% of a standard deviation, which is equivalent to around 10% of the average market share. This figure goes up to 40% of the average value when we consider ROA in column (3)[11]. Table A1 confirms these using our alternative measure of supply chain disruption, the firm's backlog. These results suggest that larger firms are more resilient when bottlenecks emerge and consequently better able to satisfy market demand. Importantly, supply chain disruptions appear different from shocks that increase competition in an industry, such as those explored by Ayyagari, Demirguc-Kunt, and Maksimovic (2023), which have been shown to affect all firms in an industry to the same extent.

For robustness, in Table 4, we take as dependent variables the first differences of the outcome variables of interest. This allows us to control for the fact that not only star firms have by definition higher market shares and are more profitable, but also that they may be on a trajectory of acquiring larger market shares while enhancing their overall performance. The estimates are consistent with the prior findings and suggest that, on average, superstar firms increase their market shares and improve their profitability in comparison to other firms facing backlogs. Also for these specifications, the effects are

[9] We let the COVID sample start in 2019 to have a year before the start of the pandemic that we can use as benchmark.

[10] The direct effect of our proxy for supply chain shortages variable is absorbed by the industry-by-country-by-year fixed effects.

[11] As shown in Table 2, the average of the variable % industry sales is 0.336 and the standard deviation 0.916. Thus, 3.6% of a standard deviation corresponds to 0.033(=0.036×0.916). Similar calculations apply to the coefficient for ROA.

stronger in the COVID subsample.

Importantly, the changes in market share we highlight appear to be permanent. In Figure 3, we estimate the dynamics of the effects of an increase in delivery times for star firms using local projections. We plot the estimated effect of a one-standard-deviation change in delivery times on the change in market share of a superstar firm over time (Panel A). It appears that supply chain shortages translate in an increase in market share for superstar firms during the following year, while subsequent changes are not statistically different from zero, indicating the the changes in market structure are persistent. We find however that a similar shock is followed by only a temporary increase in superstar firms' profitability (Panel B), suggesting that when supply chain shortages subside, potential entrants erode superstar firms' market power.

4.2 Placebo: Other Cost Shocks

As our simple framework makes clear, we think of supply chain shortages as cost shocks that due to suppliers' preferential treatment of larger customers have an asymmetric effects on firms within an industry. To construct a placebo, we consider a shock that is likely to affect similarly all firms in an industry. Energy price shocks are likely to satisfy this condition because for given price, firms should be able to satisfy their demand, irrespective of their size.

We thus do not expect that energy price increases are associated with increases in market share and profitability for superstar firms. Table **??** perfom this test. Besides inclduding the double interaction between the energy price change and the superstar firm dummy, we also consider that different industries exhibit different dependence on energy, which we capture using the average emission in an industry. When energy shocks occur, superstar firms and superstar firms in more energy intensive industries do not appear to experience increase in market share and profitability ....

4.3 Markups and Pass-Through

The evidence that market shares and profitability increase for large firms relative to the smaller ones suggests that the former are taking advantage of an improvement in their competitive position. However, it does not necessarily imply that large firms have more market power: Their profitability can increase if they are able to produce more than other firms and increase sales when backlogs are high (Syverson, 2019), their costs may also increase, reducing or holding constant markups. Thus, a higher market share and improved profitability may not necessarily imply more market power because they may arise by an increase in unit sold even if profit margins are decreasing.

To evaluate whether superstar firms' market power increases thanks to easier access to inputs, we investigate whether the markups of superstar firms increase relative to other firms in the same industry and country. In the absence of information on product prices and marginal costs, we follow existing literature and define markups as sales divided variable costs which we construct as operating expenses minus R&D expenses and 30% of Selling, General and Administrative Expenses (SG&A) expenses, following Ayyagari, Demirguc-Kunt, and Maksimovic (2023).

In Table A3, we show that our results are qualitatively invariant if we alter the definition of markup using different definitions of costs in the denominator. Specifically following De Loecker, Eeckhout, and Unger (2020), we add SG&A to the cost of goods sold and an estimate of the user cost of capital. We also consider an alternative definition that only considers the costs of goods sold at the denominator.

Table 5 explores the association between supply chain shortages and firms' markups distinguishing between superstar firms and other firms. The estimates show that consistent with previous literature superstar firms always have higher markups. More importantly, superstar firms' markups increase relative to other firms in the same industry when supply chain shortages occur. This results are not only statistically significant, but their economic magnitude is sizable. For example, in column (1), a one-standard-deviation increase in *Delivery Time* leads to 7.8% of a standard deviation increase in the markups for star firms, which corresponds to 27% of the average logarithmic markups in the sample.[12]

Some have noted that firms with high markups have been better able to pass through cost shocks (Bräuning, Fillat, and Joaquim, 2022, Konczal and Lusiani, 2022). One may wonder whether our proxies for supply chain shocks simply capture costs shocks, which superstar firms may pass through on prices to a larger extent thanks to their market power. To measure firm level changes in costs, we use the contemporaneous percentage change in the cost of good sold. We include this proxy for cost shock in the regression and interact it with the superstar firm indicator. We observe mixed evidence on whether superstar firms' pass-through level is larger than for other firms as this seems to be the case when we consider the markup in levels as dependent variable, but we obtain the opposite sign when we consider the change in markup. More importantly, we continue to observe that when supply chain shortages occur, superstar firms are able to increase markups to a larger extent, indicating that the channel we highlight is distinct and robust.

Overall, it appears that supply chain shortages increase superstar firms' pricing power. We also test that the mechanism we proposed based on a differential effect of the supply chain bottlenecks of firms within an industry is at play. In Table 7, the dependent variable is the change in cost of goods sold of a firm. We test whether indeed in periods of more pronounced supply chain shortages, superstar firms experiences lower increases in costs than other firms within an industry. This is precisely what we find. The coefficient of -0.022 in column (1) suggests that when *Delivery Time* increases by one standard deviation, star firms experience a decrease in costs of goods sold of 2.2% of a standard deviation relative to other firms. This is equivalent to drop of around 9.1bps, or 10% of the average value.[13]

[12]As shown in Table 2, the average logarithmic markups is 0.121 and the standard deviation 0.426. Thus, 2% of a standard deviation corresponds to 0.033(=0.078×0.426).

[13]As shown in Table 2, the average change in COGS is 0.091 and the standard deviation 0.415. Thus, 2.2% of a standard deviation corresponds to 0.0091(=0.022×0.415).

4.4 The Cross-Section of Stock Returns

The period subsequent to the COVID-19 pandemics has been characterized by strong stock market performance for large firms. We test whether the mechanisms we highlight can contribute to explain the outperformance of large firms. Table 8 tests whether superstar firms' monthly abnormal returns, defined as the firm's monthly returns minus the MSCI index monthly return, are systematically higher when their industry's experience delivery delays. This is precisely what we find both in the whole sample period and when we focus on the period around the COVID-19 pandemics.

In the next section, we provide evidence that the comparative advantage of superstar firms in periods of input shortages derives from being the most important customers of their suppliers and from having more reliable suppliers than their competitors.

5 Studying the Channel: Preferential Treatment and Assortative Matching

The competitive position of the largest firms in an industry may be enhanced by supply chain shortages through two non-mutually-exclusive mechanisms.

First, as highlighted by a large body of literature, firms tend to favor their large customers (see e.g., Klein, Crawford, and Alchian, 1978, Williamson, 1979, Draganska, Klapper, and Villas-Boas, 2010, Giannetti, Serrano-Velarde, and Tarantino, 2021). Thus, we would expect that when firms are slow in satisfying their orders, they favor their large, more important customers. Table 9 provides evidence consistent with this conjecture. We consider customer-supplier relationships in a given year and test whether large customers of a given firm have better performance in terms of sales and profitability when the supplier's industry experiences backlogs. To compare customers of the same firm, we include the interaction of firm and year fixed effects. Since each customer may appear several times in the dataset because we observe multiple supplier relationships, we cluster at the customer-year level.

The estimates support our hypothesis that for a given backlog experienced by a given supplier, the large customers that we classify as superstars experience a disproportionate increase in sales and profitability. Results are consistent both when we consider the dependent variable in levels and first differences.

The second mechanism posits that there is assortative matching along the supply chain so that large firms tend to have larger suppliers. The advantage conferred by size in periods of input shortages may thus be compounded and amplified at different stages of production. Table 10 provides evidence that indeed, firms that we classify as superstar are likely to be associated with customers that we also classify as superstars. To the extent that superstar suppliers are less likely to have experienced backlogs, superstar firms' operations are less negatively affected by backlogs. Superstar firms can therefore increase their market share and improve their competitive position, thus increasing their prices.

6 Alternative Mechanisms

6.1 Financial Constraints

Markups have been shown to vary over the business cycle: During recessions, financial frictions can constrain firm scale leading firms to optimally increase prices (Chevalier and Scharfstein, 1996). Such a mechanism would imply higher markups for the more constrained small firms that are less likely to be able to produce at capacity. This mechanism contrasts with the evidence we present which indicates an improvement of the competitive position for the largest firms in an industry. In addition, supply chain shortages are likely to be higher during expansions and do not have to coincide with periods in which financial frictions are more pronounced. Moreover, during the COVID-19 pandemic, government interventions contributed to significantly decrease firms' cost of capital.

Even though we view our mechanism as distinct from financial constraints and, more generally, financial resilience, we evaluate to what extent financial frictions can contribute to explain our findings. We use the average interest rate firms pay on their outstanding liabilities as a proxy for the cost of external finance. Specifically, we consider as financially constrained the firms for which average interest rate is in the top tercile of the country during the year. In Table 11, we interact this dummy capturing the most financially constrained firms at $t-1$ with *Delivery Time* and run a horse race. While we find only weak evidence that financial constraints tend to decrease firms' sales and profitability in periods with high supply chain shortages, the coefficient on the interaction between *Star* and *Backlog* remains positive and significant suggesting that the extent to which firms are exposed to financial frictions does not drive our findings. Estimates continue to be equally supportive of our mechanism in Table 12, where we consider as more financially flexible firms that are in the top tercile for cash-holdings relative to total assets within their country.

6.2 Operational Resilience

We also consider that some firms may have been better able to withstand supply chain shocks because they had invested in operational resilience. Table 13 explores whether the better performance of superstar firms depends on the fact that superstar firms are in a better position to face supply chain shortages thanks to larger inventories. We thus interact our proxy for supply chain shortages with the ratio of a firm's inventory to sales during the previous year. We do not find much evidence that larger inventories help firms to acquire market shares and preserve profits when supply chain shortages occur. More importantly, we continue to find that superstar firms acquire market shares and improve their profitability relative to firms experiencing similar supply chain shocks.

Overall, these tests confirm our interpretation of the empirical evidence that firms with dominant positions can take advantage of supply chain shortages to further enhance their market power.

7 Supply Chain Shortages and Industry Level Outcomes

7.1 Industry concentration

Based on our findings that large firms tend to enhance their competitive position during periods of supply chain shortages, we expect that industries that are characterized by the presence of large companies should become even more concentrated when supply chain disruptions occur. In what follows, our main proxy for concentration is an industry's Herfindahl-Hirschman index (HHI), which is the sum of firms' squared market shares within the country, computed using sales. This measure has the advantage to be directly related to an industry level of markups within a Cournot model.

While concentration can be associated with more or less market power (Syverson, 2019), we aim to capture the presence of large companies that may not suffer as much as their smaller competitors and potential entrants from supply chain shortages, and may consequently experience an increase in their market power. In principle, the HHI could be high in industry with very few equally large firms. While we would not expect supply chain shortages to have a different effect on the costs of firms with similar size, our data include only listed companies. Market power can increase for the largest companies not only because their smaller listed competitors have a harder time securing the necessary inputs, but also because unlisted companies that are not included in our data and potential entrants are deterred by the input shortages. Thus, the HHI may indeed capture the effects of supply chain shortages that we theorize.

To make sure that the ex ante HHI indeed captures the mechanism behind our theoretical framework, we test whether an industry's HHI increases following years in which the industry experienced an increase in the suppliers' delivery time and whether the effect is driven by industries that were ex ante more concentrated, as captured by a higher HHI at the beginning of the sample period. Table 14 presents the results. In the most restrictive specification with country-by-year and industry-by-year fixed effects (column

4), we find that a one-standard-deviation increase in *Delivery Time* is associated with a 3.3% of a standard deviation increase in HHI for industries with an ex-ante HHI that is a one-standard-deviation above the mean.

7.2 Inflation

Since highly concentrated industries become even more concentrated when supply chain shortages occur, we expect prices and consequently inflation to increase more. To test this conjecture, we regress industry-level annual price changes (CPI) at the monthly frequency on the industry HHI interacted with our main measure of supply chain shortages. For this analysis, industries are defined at the country level as we conjecture that local companies have local price-setting power and consequently determine country-level inflation.

We run the following regression model for CPI in industry i, country c and month t:

$$CPI_{i,c,t} = \alpha_{i,c,t} + \beta_1 Delivery\ Time_{i,c,t}^{t-1,t-12} + Delivery\ Time_{i,c,t}^{t-1,t-12} \times Concentration_{i,c} + \varepsilon_{i,c,t} \tag{4}$$

where, $\alpha_{i,c,t}$ represents our different combinations of fixed effects, namely, industry-country-year and year-month. $Delivery\ Time_{i,c,t}^{t-1,t-12}$ is measured in the 12-month interval $[t-1, t-12]$ for industry i in country c. $Concentration_{i,c}$ is either the HHI or one of the alternative proxies for concentration that we introduce below, all defined at the beginning of the sample for industry i in country c to limit reverse causality problems. Standard errors are clustered at the year-month level and adjusted for eleven lags of autocorrelation.

Our hypothesis implies that for given input shortages, inflation should be higher in ex ante more concentrated industries because there are more large firms that are poised to benefit disproportionately from input shortages. Since we control for the direct effect of the supply chain shortages on industry inflation, our tests do not merely test for an increase in prices after supply chain disruptions, which can result from the pass-through effect even in a perfectly competitive market. Rather, holding constant the extent of supply chain shortages, we investigate whether the price increases are stronger in industries and countries in which large firms are more likely to experience an increase in market power at the expenses of smaller firms following supply chain disruptions.

Table 15 presents the estimates. The coefficient on the variable *Delivery Time* is positive and significant both for the whole sample and for the COVID-19 period, suggesting that this variable can indeed capture increases in input costs associated with shortages. More importantly, consistent with our conjecture, we find that more concentrated industries experience more significant price increases at times of supply chain disruptions. The effect appears particularly large during the COVID period.

We also consider whether our findings may indicate that cost shocks are transferred on prices to a larger extent in high concentration industries. While such an explanation would be inconsistent with the firm level evidence (Table 6), we still take into account the possibility that differences in pass-through may help explaining differences in inflation. In columns 3 and 4 of Table 15, we measure industry level cost shocks summing the cost of goods sold for all firms in an industry during a year and computing the year on year percentage change. We observe that industries with higher increases in costs experience higher inflation. While the pass-through of cost increases appears to be higher in more concentrated industries when we consider the whole sample, in the COVID-19 period subsample we do not observe that the increase in costs translates in higher inflation in more concentrated industries. In contrast, our finding that supply chain shortages translate into higher inflationary pressure in industries with higher concentration is unchanged across specifications.

Table 16 consider alternative proxies for industry ex ante concentration. In column 1 and 2, the estimates appear qualitatively and quantitatively unchanged if we measure concentration using the market share of the top four firms in an industry. Also, if one abstracts from potential entrants, our conjecture hinges on the existence of an unequal distribution of firm size, so that the larger firms can subtract market share from smaller firms when the input shortages occur. In the rest of Table 16, we capture this considering the presence of superstar firms in a country and industry. Specifically, in columns 3 and 4, we consider the superstar firms' percentage of sales in the industry and country and in columns 5 and 6, a dummy variable denoting the presence of a superstar in the industry and country, both measured at $t-1$ as in our firm level analysis. Consistent with our earlier findings we observe higher inflation in industries and countries with more pronounced presence of superstar firms.

Table 17 provides a geographic breakdown of the effect identified in the prior two tables. In particular, we note that the interaction of *Delivery Time* and the proxy for the likelihood that large firms increase their market power is by and large positive and significant in the US, and Europe. The economic magnitude of the estimates is not only statistically, but also economically significant. For instance, the coefficient of 1.148 in column 2 of Table 17 implies that in the US during the COVID-19 pandemic, the CPI increased by 1.148 percentage points in industries with a one-standard-deviation-above-the-mean delivery time and a one-standard-deviation-above-the-mean HHI. The average CPI in the US during the COVID-19 pandemic was 4.56%. Thus, the mechanism we propose can explain about 25% (=1.148%/4.56%) of the inflation realized during the COVID-19 period in the US.

Overall, the evidence points to a shift in market share towards superstar firms following supply chain shortages, which led to an increase in the market power of the largest firms. Thus, industries characterized by the presence of superstar firms experienced more significant price spikes. This finding is consistent with the evidence that the pandemic-era inflation was initiated by developments that directly raised prices rather than wages, following supply chain shortages (see, e.g., Bernanke and Blanchard, 2023).

8 Conclusions

We contribute to the debate on the determinants of inflation during the pandemic. To the best of our knowledge, this is the first paper to propose a mechanism through which supply chain shortages have increased market power and led to price hikes. In particular, we argue that large firms may acquire market power following supply chain shortages because they are better equipped to withstand the disruptions. Consistent with this conjecture, we show that large firms increase their market shares and experience higher profit margins and markups when supply chain shortages occur. Moreover, we find that industries in which superstar firms are present and the firm size distribution is more asymmetric experience higher inflation following supply chain backlogs.

To the extent that monetary policy contractions lead to a decrease in sales by small firms (Gertler and Gilchrist, 1994), financial frictions may further reduce competition. In this light, the channel that we highlight can trigger inflation that persists even after the supply chain shortages have subsided.

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A Proof of Proposition 1

Proof. A firm's profit maximization problem is

$$\underset{q_i}{Max}\pi_i = p\left(Q\right)q_i - c_i q_i$$

with first order condition

$$p\left(Q\right) + \frac{\partial p}{\partial Q}q_i - c_i = 0. \tag{5}$$

Using the demand function in Equation (2), the first order condition becomes

$$b - \sum_{j=1}^{n} q_j - q_i - c_i = 0. \tag{6}$$

To find the solution, we first sum Equation (6) across all n firms to obtain

$$\sum_{j=1}^{n} q_j = \frac{nb - c}{1 + n}. \tag{7}$$

Then, we replace Equation (7) into Equation (6) and obtain

$$q_i = \frac{b + c - \left(1 + n\right)\delta_i c}{1 + n}. \tag{8}$$

Using the aggregate equilibrium quantity, Equation (7), and the demand function, Equation (2), we can compute the equilbrium price

$$p = \frac{b + c}{1 + n}. \tag{9}$$

From Equation (9), it is evident that prices in the industry increase following an increase in aggregate costs.

Using Equations (8) and (7), we can now compute the market share of firm i as

$$s_i = \frac{q_i}{\sum\limits_{j=1}^{n} q_j} = \frac{b + c - \left(1 + n\right)\delta_i c}{nb - c}. \tag{10}$$

We are now in the position to prove that an increase in the marginal costs for all producers leads to an increase in market share for low-cost firms and a decrease in market share for high-cost firms.

We take the first order derivative of the market share in Equation (10) with respect to c

$$\frac{\partial s_i}{\partial c} = \frac{nb - (1+n)\, nb\delta_i + b}{(nb-c)^2}.$$

Then, we have that

$$\frac{\partial s_i}{\partial c} > 0 \quad \text{iff} \quad \delta_i < \frac{1}{n}.$$

In other words, firm i experiences an increase in market share when marginal costs increase for all firms if and only if the marginal cost of firm i is below the average marginal cost in the industry (remember that $\sum_{j=1}^{n} c_j = 1$).

Following an increase in industry costs, firms that benefit from an increase in market share – i.e. low-cost firms – will experience higher markups. To verify this claim, it is sufficient to define the markup as

$$\frac{p - c_i}{p}$$

and to use the first order condition in Equation (5) to show that

$$\frac{p - c_i}{p} = \frac{s_i}{|\varepsilon|}, \tag{11}$$

where $\varepsilon = \frac{\partial p}{\partial Q}\frac{Q}{p}$ is the inverse elasticity of demand. □

B Proof of Proposition 2

Proof. To this purpose, it is enough to show that the second derivative of the market share of each firm with respect to c is positive.

$$\frac{\partial^2 s_i}{\partial^2 c} = 2\frac{nb - (1+n)\, nb\delta_i + b}{(nb-c)^3},$$

which is positive under the parametric assumptions that we have made to obtain positive individual firms' output and aggregate output (see footnote 1).

Based on the sign of this second derivative, an increase in costs will have a higher impact on the dispersion in market shares the higher the starting level of the cost dispersion, as captured by c. Thus, for higher levels of HHI, which correspond to a higher dispersion of the δ_i the impact of a cost increase on the industry concentration is higher. □

Tables

Table 1
Variables Description

Panel A	*Firm-level variables*
Variable	Description
% Industry Sales	Market share of a 2-digit SIC industry sales held by a firm at the end of the year.
Markup	Sales/Variable Input, where Operating Expenses* (OPEX*) is used as a variable input. OPEX* is defined as operative expenses (ITEM1249) - R&D (ITEM1201) - R&D Amortization (ITEM1152) - 0.3*Net SG&A (ITEM1101-ITEM1201). Missing values of R&D, R&D Amortization and SG&A are set to zero. Note: Ayyagari, et al., 2023 subtract in-process R&D (rdip in Compustat), however this variable is not available in Worldscope and we replace it with R&D Amortization.
ROA	Π_{it}/A_{it}, where Π_{it} is profit defined as $(S_{it} - P^V_{it} V_{it} - r_t K_{it} - P^X_t X_{it})$. S_{it} represents sales (ITEM7240); A_t is total assets (ITEM7230); $P^X_t X_{it}$ is SG&A (ITEM1101); $P^V_{it} V_{it}$ is variable input measured using COGS (ITEM1051); $r_t K_{it}$ is the user cost of capital multiplied by the capital stock (PPEGT, ITEM2301). User cost is defined as nominal interest rate minus inflation rate minus depreciation rate. Nominal interest rate is the fed funds rate, inflation rate is the percentage change in CPI and depreciation rate is set to 12% as in De Loecker, Eeckhout, and Unger (2020). We drop observations with non-positive sales and total assets. All variables are in USD and deflated using the US GDP deflator at 2009 prices.
Financing Constraints	Dummy equal to 1 if the firm's average interest rate (Worldscope's item 08356) is in the top tercile of the country-level distribution in year t-1 (computed in the full Worldscope sample).
Cash Available	Dummy equal to 1 if the firm's cash and short term investments (Worldscope's item 02001) divided by total assets is in the top tercile of the country-level distribution in year t-1 (computed in the full Worldscope sample).

Table 1
Variables Description (continued)

Inventory	Ratio of inventories (Worldscope's item 02101) to sales in year t-1.
Delta COGS	Year-to-year percentage change in COGS (ITEM1051).
Star	Dummy equal to 1 if the firm is in top 10% of sales distribution within a 2-digit sic industry in year t-1. Computed for the entire universe of Worldscope firms.
Mean Backlog	Mean across suppliers of backlog of work for a firm at the beginning of a fiscal year. For each supplier, backlog is the previous 12-month average. The index is defined as (percentage of survey panel responding "Higher") + (percentage responding "No change"*0.5). Readings of 50 indicate no change in backlogs of work on the prior month, readings above 50 indicate an increase and readings below 50 indicate a decline.
Delivery Time	Previous 12-month average supplier delivery time. The index is defined as (percentage of survey panel responding "Faster") + (percentage responding "Same"*0.5). Readings of 50 indicate no change in delivery times on the prior month, readings above 50 indicate that delivery times have improved (become shorter, or faster) and readings below 50 indicate that delivery times have deteriorated (become longer, or slower). We multiply this variable by -1 to keep the interpretation equal to that of Mean Backlog.

Table 1
Variables Description (continued)

Panel B	*Industry-level variables*
Variable	Description
Industry CPI (% YoY, monthly freq.)	Annual change in the monthly consumer price index for the relevant industry in a country.
CR4 (Sales)	Fraction of a 2-digit SIC industry held by the top 4 firms (defined at the beginning of the sample for each country).
HHI (Sales)	Herfindahl-Hirschman Index of sales for a 2-digit SIC industry (defined at the beginning of the sample for each country).
% Sales of Stars	Percentage of the total sales in a 2-digit SIC industry-country-year attributable to star firms.
Dummy Has Star	Indicator equal to 1 if a country-industry-year has at least one star firm.
Delta COGS	Year-to-year percentage change in total COGS (ITEM1051) in an industry-country pair.

Table 2
Summary Statistics

See Table 1 for variables definitions. All variables are winsorized at the 1% and 99%.

Panel A	Firm-level variables							
	No. obs	Mean	Std	Min	p25	Median	p75	Max
% Industry Sales	103,269	0.336	0.916	0.000	0.008	0.039	0.195	6.587
Change in % Industry Sales	102,867	0.002	0.085	-0.436	-0.003	0.000	0.004	0.470
Log Markups (Ayyagari, et al., 2023)	102,335	0.121	0.426	-2.834	0.065	0.142	0.255	1.014
Markups	102,374	1.198	0.343	0.054	1.067	1.153	1.291	2.757
Change in Markups	101,426	0.001	0.155	-0.688	-0.030	0.001	0.031	0.753
ROA	95,999	3.140	15.710	-81.353	-1.515	4.089	10.007	45.888
Change in ROA	94,011	-0.019	8.321	-37.459	-2.313	0.003	2.269	38.136
Financing Constraints	88,021	0.265	0.441	0.000	0.000	0.000	1.000	1.000
Cash Available	102,807	0.287	0.452	0.000	0.000	0.000	1.000	1.000
Inventory	86,395	15.953	24.944	0.000	2.930	10.806	18.705	187.670
Delta COGS	100,217	0.091	0.415	-0.814	-0.075	0.037	0.168	2.798
Star	103,269	0.277	0.448	0.000	0.000	0.000	1.000	1.000
Mean Backlog	103,269	50.225	2.234	42.979	49.132	50.238	51.544	56.750
Delivery Time	67,506	-46.403	4.778	-51.481	-48.997	-47.631	-45.703	-22.848
Panel B	**Industry-level variables**							
	No. obs	Mean	Std	Min	p25	Median	p75	Max
Industry CPI (% YoY, monthly frequency)	91,873	1.646	6.858	-53.600	-0.400	1.300	3.400	193.700
CR4 (Sales)	91,873	0.905	0.180	0.430	0.912	1.000	1.000	1.000
HHI (Sales)	91,873	0.649	0.365	0.076	0.268	0.716	1.000	1.000
% Sales of Stars	86,841	70.798	36.247	0.000	60.413	89.061	95.852	100.000
Dummy Has Star	86,841	0.818	0.386	0.000	1.000	1.000	1.000	1.000
Delivery Time	52,843	-47.108	3.297	-56.502	-49.078	-47.985	-46.273	-16.858
Delta COGS	86,745	0.086	0.119	-0.254	0.023	0.074	0.135	0.557

Table 3
Superstar Firms' Market Share and Profitability

Star is a dummy equal to 1 if a firm is above the 90th percentile of the sales distribution at the beginning of a given year within a 2-digit sic industry. Industry is based on 2-digit sic codes. A definition of all variables can be found in Table 1. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	% Industry Sales		ROA (%)	
	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)
Star × Delivery Time	0.036***	0.040***	0.078***	0.073***
	(0.009)	(0.009)	(0.009)	(0.009)
Star	0.713***	0.672***	0.359***	0.324***
	(0.025)	(0.024)	(0.018)	(0.018)
Industry-Country-Year FE	Yes	Yes	Yes	Yes
Obs.	79,401	28,051	72,938	25,725
Adj. R2	0.487	0.462	0.167	0.173

Table 4
Changes in Superstar Firms' Market Share and Profitability

Star is a dummy equal to 1 if a firm is above the 90th percentile of the sales distribution at the beginning of a given year within a 2-digit sic industry. Industry is based on 2-digit sic codes. The dependent variables are defined as year-on-year changes. A definition of all variables can be found in Table 1. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation.. Standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	% Industry Sales		ROA (%)	
	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)
Star × Delivery Time	0.039***	0.048***	0.020**	0.029***
	(0.011)	(0.014)	(0.009)	(0.011)
Star	-0.002	0.024	-0.003	-0.028**
	(0.012)	(0.020)	(0.006)	(0.012)
Industry-Country-Year FE	Yes	Yes	Yes	Yes
Obs.	79,111	28,012	71,289	24,973
Adj. R2	0.205	0.168	0.084	0.147

Table 5
Supply Chain Shortages and Firms' Markups

We define markups as in Ayyagari, Demirguc-Kunt, and Maksimovic (2023). See Table 1 for a detailed definition. In column (1)-(2) we take the logarithm of the markup, while columns (3)-(4) and (5)-(6) use the level and the first difference of markup, respectively. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Markup			
Dep. var. definition.	Log		Levels	
	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)
Star × Delivery Time	0.078***	0.062***	0.083***	0.065***
	(0.010)	(0.010)	(0.010)	(0.010)
Star	0.311***	0.316***	0.242***	0.251***
	(0.017)	(0.021)	(0.019)	(0.020)
Industry-Country-Year FE	Yes	Yes	Yes	Yes
Obs.	78,272	28,015	78,295	28,024
Adj. R2	0.164	0.198	0.116	0.130

Table 6
Cross-sectional Differences in Cost Pass-through

Delta COGS is defined as the year-on-year percentage change in COGS (ITEM1051). All continuous variables are standardized by subtracting the mean and dividing by the standard deviation. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Markup					
Dep. var. definition.	Log		Levels		Changes	
	Full sample	2019-2021	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)	(5)	(6)
Star × Delivery Time	0.058***	0.042***	0.068***	0.053***	0.023***	0.027**
	(0.009)	(0.009)	(0.010)	(0.010)	(0.009)	(0.011)
Star × Delta COGS	0.036**	0.031	0.048***	0.023	-0.228***	-0.248***
	(0.014)	(0.027)	(0.018)	(0.032)	(0.019)	(0.034)
Delta COGS	0.003	0.018	0.015**	0.032***	0.099***	0.134***
	(0.009)	(0.015)	(0.007)	(0.012)	(0.010)	(0.015)
Star	0.265***	0.285***	0.230***	0.242***	-0.035***	-0.029**
	(0.015)	(0.020)	(0.018)	(0.021)	(0.006)	(0.013)
Industry-Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	76,446	27,516	76,465	27,523	75,873	27,521
Adj. R2	0.176	0.197	0.141	0.143	0.100	0.133

Table 7
Percentage Change in COGS

This table repeats the main firm-level analysis using as dependent variable the year-on-year percentage change in COGS. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Delta COGS	
	Full Sample	2019-2021
	(1)	(2)
Star × Delivery Time	-0.022**	-0.021**
	(0.008)	(0.010)
Star	-0.150***	-0.114***
	(0.008)	(0.013)
Industry-Country-Year FE	Yes	Yes
Obs.	77,546	27,546
Adj. R2	0.082	0.100

Table 8
Stock Returns

The dependent variable is a firm's monthly abnormal return expressed in basis points (bps). Stock returns are from Datastream. Abnormal returns are computed by subtracting the monthly return on the MSCI Developed index from a firm's monthly stock return. In columns (1)-(4) we consider the full sample (2004-2021), while in columns (5)-(8) we focus on the period 2019-2021. We report in parentheses standard errors clustered at the stock and calendar month level (columns (1)-(4)) and at the stock level only (columns (5)-(8)). The single clustering in columns (5)-(8) is justified by the small size of the time dimension which accounts for 36 months only. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Abnormal returns (bps)							
Benchmark	Full sample				2019-2021			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Star × Delivery Time	5.753***	5.587**	5.783**	6.288**	7.069***	7.355***	8.174***	8.987***
	(2.175)	(2.717)	(2.513)	(2.589)	(1.040)	(1.159)	(1.091)	(1.283)
Star	284.003***	280.535**	286.865**	309.645**	342.425***	358.476***	387.446***	421.167***
	(99.714)	(127.109)	(117.155)	(120.482)	(46.941)	(52.330)	(49.285)	(58.344)
Delivery Time	-4.447	4.015	1.043		-4.443***	12.245***	5.854**	
	(4.075)	(2.924)	(2.583)		(0.855)	(1.799)	(2.872)	
Industry-Month FE	Yes	No	Yes	No	Yes	No	Yes	No
Country-Month FE	No	Yes	Yes	No	No	Yes	Yes	No
Industry-Country-Month FE	No	No	No	Yes	No	No	No	Yes
Obs.	694,094	693,175	692,403	640,075	258,541	258,223	258,199	243,675
Adj. R2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 9
Within Supplier Analysis

Industry is based on 2-digit sic codes. A definition of all variables can be found in Table 1. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors are clustered at the customer-by-year level and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	% Industry Sales	ROA
	(1)	(2)
Star × Delivery Time	0.060***	0.040***
	(0.016)	(0.015)
Star	0.511***	0.350***
	(0.011)	(0.013)
Supplier-Year FE	Yes	Yes
Firm's Country-Industry-Year FE	Yes	Yes
Obs.	652,660	628,975
Adj. R2	0.723	0.433

Table 10
Assortative Matching

Star is a dummy equal to 1 if a firm is in the top decile of the sales distribution. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. The regressions include combinations of different customer-by-supplier (CS) firm fixed effects, as well as industry, country, and year fixed effects (FE), and all standard errors reported in parentheses are clustered at the customer-by-year level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	$Star^S$			
	(1)	(2)	(3)	(4)
$Star^C$	0.005***	0.008***	0.008***	0.006***
	(0.001)	(0.002)	(0.002)	(0.002)
$Size^C$				0.005**
				(0.002)
$Size^S$				0.195***
				(0.003)
Year FE	Yes	Yes	Yes	Yes
CS-Firm FE	Yes	Yes	Yes	Yes
CS-Industry FE	No	Yes	Yes	Yes
CS-Country FE	No	No	Yes	Yes
Obs.	1,212,121	845,443	845,443	768,206
Adj. R2	0.921	0.920	0.920	0.928

Table 11
Financing Constraints

Financing Constraints is a dummy equal to 1 if the firm's average interest rate is in the top tercile of the country-level distribution in year t-1. The variable is defined as Interest Rate on Debt/(Short Term Debt & Current Portion of Long Term Debt+Long Term Debt)*100. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	% Industry Sales		ROA (%)	
	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)
Star × Delivery Time	0.029***	0.035***	0.060***	0.062***
	(0.009)	(0.009)	(0.009)	(0.009)
Financing Constr. × Delivery Time	-0.016***	-0.015**	-0.056***	-0.046***
	(0.006)	(0.006)	(0.011)	(0.012)
Financing Constr.	-0.065***	-0.041***	-0.182***	-0.165***
	(0.010)	(0.010)	(0.013)	(0.015)
Star	0.702***	0.663***	0.295***	0.254***
	(0.025)	(0.024)	(0.016)	(0.016)
Industry-Country-Year FE	Yes	Yes	Yes	Yes
Obs.	67,850	24,938	63,144	23,102
Adj. R2	0.492	0.470	0.172	0.176

Table 12
Cash Available

Cash Available is a dummy equal to 1 if the firm's cash-to-asset ratio is in the top tercile of the country-level distribution in year t-1. Cash is measured as cash and short term investment (ITEM2001). All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	% Industry Sales		ROA (%)	
	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)
Star × Delivery Time	0.036***	0.042***	0.049***	0.044***
	(0.010)	(0.009)	(0.008)	(0.008)
Cash Available × Delivery Time	0.004	0.007	-0.158***	-0.156***
	(0.005)	(0.005)	(0.014)	(0.015)
Cash Available	-0.008	-0.007	-0.110***	-0.038*
	(0.009)	(0.008)	(0.018)	(0.020)
Star	0.712***	0.672***	0.341***	0.317***
	(0.025)	(0.024)	(0.017)	(0.017)
Industry-Country-Year FE	Yes	Yes	Yes	Yes
Obs.	79,050	27,994	72,673	25,692
Adj. R2	0.487	0.462	0.173	0.184

Table 13
Firms' Operational Resilience and Inventories

Inventory is the ratio of inventories to sales in year t-1. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	% Industry Sales		ROA (%)	
	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)
Star × Delivery Time	0.035***	0.041***	0.063***	0.065***
	(0.009)	(0.009)	(0.009)	(0.009)
Inventory × Delivery Time	0.002	0.003	-0.009	-0.005
	(0.002)	(0.002)	(0.008)	(0.009)
Inventory	-0.016***	-0.013***	-0.159***	-0.139***
	(0.004)	(0.004)	(0.013)	(0.015)
Star	0.716***	0.665***	0.338***	0.293***
	(0.026)	(0.024)	(0.019)	(0.018)
Industry-Country-Year FE	Yes	Yes	Yes	Yes
Obs.	64,524	24,889	59,673	22,954
Adj. R2	0.489	0.459	0.180	0.189

Table 14
Delta HHI

The dependent variable is the first difference of sales HHI constructed for each industry-country-year between t and $t+1$ and is regressed on the HHI at the beginning of the sample. Industry is based on 2-digit SIC codes. A definition of all other variables can be found in Table 1. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Delta HHI			
	(1)	(2)	(3)	(4)
Delivery Time × Ex-Ante HHI	0.026***	0.021***	0.021***	0.033***
	(0.006)	(0.007)	(0.007)	(0.008)
Delivery Time	0.017	-0.025	-0.023	-0.023
	(0.011)	(0.016)	(0.016)	(0.017)
Ex-Ante HHI	-0.100***	-0.105***	-0.111***	
	(0.006)	(0.008)	(0.008)	
Year FE	Yes	Yes	Yes	Yes
Country FE	No	Yes	Yes	No
Country-Industry FE	No	No	No	Yes
Obs.	9,215	9,213	9,213	9,138
Adj. R2	0.011	0.009	0.009	0.001

Table 15
Supply Chain Shortages and Industry Concentration

HHI is computed for each country and 2-digit SIC code at the beginning of the sample at the country-industry level. Delta COGS is defined as the year-to-year percentage change in total COGS in an industry-country pair. All continuous independent variables are standardized by subtracting the mean and dividing for the standard deviation. Industry is proxied by 2-digit sic codes. A definition of all variables can be found in Table 1. Standard errors are adjusted for clusters at the year-month level and 11 lags of autocorrelation and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Industry CPI (% YoY, monthly frequency)			
	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)
Delivery Time × Ex-Ante HHI	0.589**	1.162***	0.855***	1.348***
	(0.282)	(0.305)	(0.320)	(0.209)
Delivery Time	1.253*	2.600***	2.483***	3.763***
	(0.688)	(0.648)	(0.831)	(0.510)
Delta COGS × Ex-Ante HHI			0.344***	0.994
			(0.128)	(0.697)
Delta COGS			1.812***	4.550**
			(0.463)	(2.008)
Country-Industry-Year FE	Yes	Yes	No	No
Year-Month FE	Yes	Yes	Yes	Yes
Country-Industry FE	No	No	Yes	Yes
Obs.	72,478	19,700	52,320	13,997
Adj. R2	0.579	0.631	0.220	0.221

Table 16
Supply Chain Shortages and Industry Concentration: Robustness

CR4 is computed for each country and 2-digit SIC code at the beginning of the sample at the country-industry level. The variables in columns (3)-(6) are defined at the country-industry-year in year t-1. All continuous independent variables are standardized by subtracting the mean and dividing for the standard deviation. Industry is proxied by 2-digit sic codes. A definition of all variables can be found in Table 1. Standard errors are adjusted for clusters at the year-month level and 11 lags of autocorrelation and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Industry CPI (% YoY, monthly frequency)					
Industry variable	CR4 Sales		% Sales of Stars		Dummy Has Star	
	Full sample	2019-2021	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)	(5)	(6)
Delivery Time × Industry Structure	0.407**	0.763***	0.912***	1.034***	2.123***	2.320**
	(0.197)	(0.188)	(0.284)	(0.380)	(0.704)	(0.974)
Delivery Time	1.176*	2.381***	1.015***	1.288***	-0.572	-0.427
	(0.651)	(0.586)	(0.327)	(0.385)	(0.660)	(0.995)
Country-Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	72,478	19,700	57,289	18,702	57,289	18,702
Adj. R2	0.579	0.630	0.605	0.635	0.605	0.635

Table 17
Inflation, Supply Chain Shortages, and Concentration: Geographical Differences

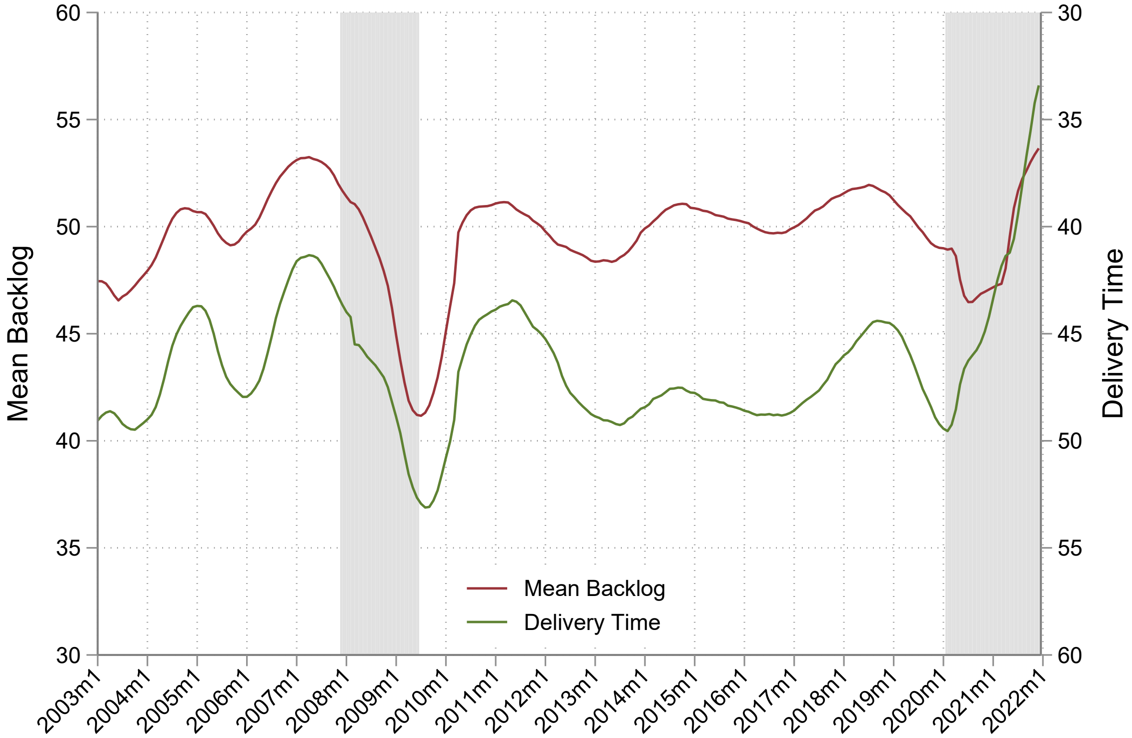
This table repeats the analysis of Table 15 for the subsamples of industries in the United States, and Europe. Europe comprises the Euro-area plus Denmark, Norway, Switzerland and the United Kingdom. Standard errors are adjusted for clusters at the year-month level and 11 lags of autocorrelation and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

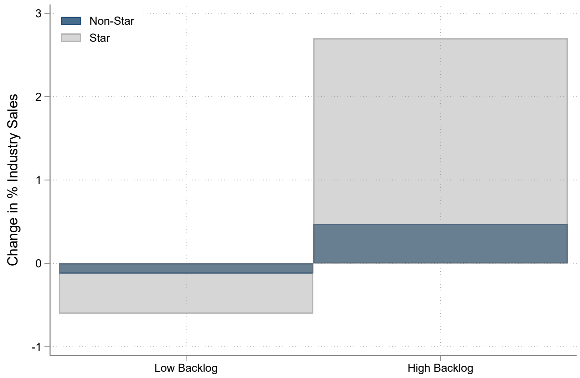
Dependent variable	Industry CPI (% YoY, monthly frequency)			
	US		Europe	
	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)
Delivery Time × Ex-Ante HHI	0.965***	1.148***	1.121**	1.342**
	(0.346)	(0.323)	(0.449)	(0.616)
Delivery Time	3.106	4.466	1.928	5.986***
	(5.316)	(8.888)	(1.245)	(2.103)
Country-Industry-Year FE	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes
Obs.	11,627	3,715	29,640	5,688
Adj. R2	0.551	0.530	0.683	0.738

Figures

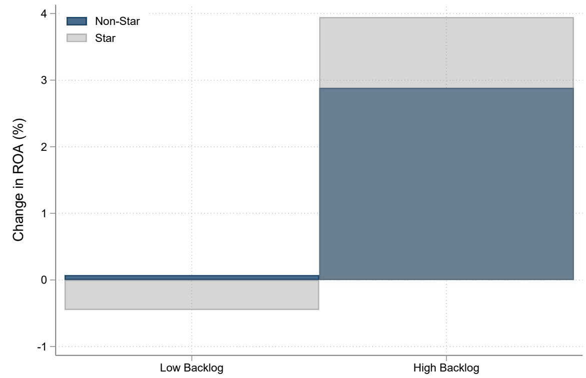
Figure 1
The Time-Series of Supply Chain Shortages

This figure plots the time-series of the average of our proxies for supply chain disruption across industries and and geographical areas. We report mean backlog on the left y-axis and delivery time on the right y-axis.

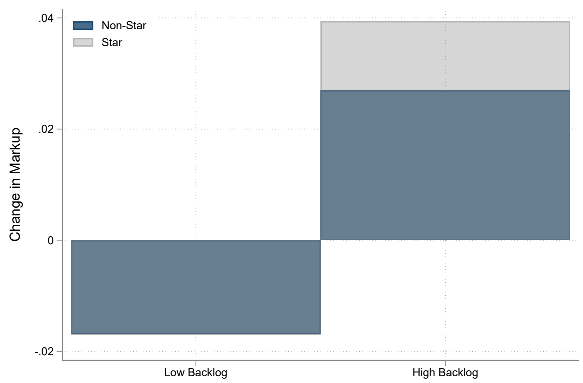




(a) *Change in % Industry Sales*



(b) *Change in ROA (%)*



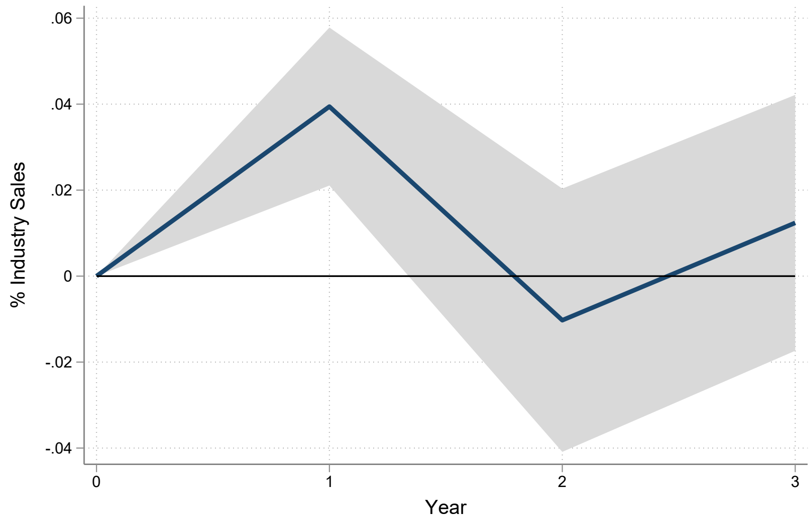
(c) *Change in Markup*

Figure 2
Marginal Effects

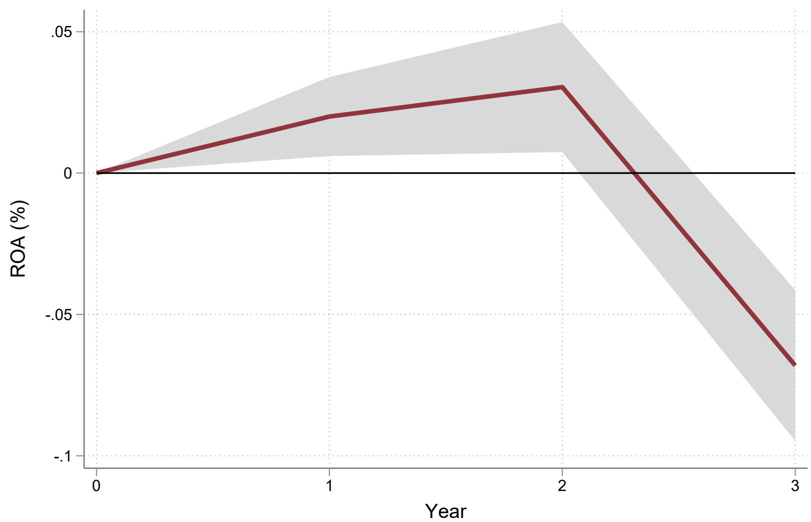
This figure plots the marginal effects of the following regression:

$$y_{i,t} = \alpha + \beta_1 Star_{i,t} \times HighBacklog_{i,t-1} + \beta_2 Star_{i,t} + \beta_3 HighBacklog_{i,t-1} + \varepsilon_{i,t},$$

where y is either the change in % industry sales or the change in ROA, or the change in markup. High Backlog is a dummy equal to 1 if the across-supplier average backlog for customer i in the previous 12 months was above 50. *Star* is a dummy equal to one if the firm is in the top decile of the sales distribution in year $t-1$. The sample spans the period 2019-2021.



(a) *Change in % Industry Sales*



(b) *Change in ROA (%)*

Figure 3
Dynamic Effects

This figure plots the β_1 for the following regression run for $h = 1, 2, 3$:

$$dy_{i,[t+h,t+h-1]} = \alpha_{j,c,t} + \beta_1 Delivery\ Time_{j,t} \times Star_{i,t} + \beta_2 Star_{i,t} + \varepsilon_{i,t},$$

where $dy_{i,[t+h,t+h-1]}$ is either the change in % industry sales or the change in ROA, defined between year $t+h$ and $t+h-1$. $DeliveryTime$ is defined in the 12 months before the end of year t for industry j to which firm i belongs. $\alpha_{j,c,t}$ represent industry-by-country-by-year fixed effects. The levels of $DeliverTime$ are subsumed by the fixed effects. The shaded area represents the 95% confidence interval for standard errors clustered at the firm level.

Internet Appendix

Table A1
Superstar Firms' Market Share and Profitability using Backlog

Star is a dummy equal to 1 if a firm is above the 90th percentile of the sales distribution at the beginning of a given year within a 2-digit sic industry. Industry is based on 2-digit sic codes. The dependent variables are defined as year-on-year changes. A definition of all variables can be found in Table 1. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation.. Standard errors are clustered at the firm level and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	% Industry Sales				ROA (%)			
Dep. var. definition.	Levels		Changes		Levels		Changes	
	Full sample	2019-2021	Full sample	2019-2021	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Star × Backlog	0.016**	0.010	0.076***	0.099***	0.031***	0.058***	0.054***	0.081***
	(0.007)	(0.007)	(0.010)	(0.015)	(0.006)	(0.007)	(0.007)	(0.011)
Star	0.799***	0.732***	0.001	0.051***	0.397***	0.386***	-0.009*	-0.015
	(0.024)	(0.021)	(0.013)	(0.018)	(0.015)	(0.017)	(0.005)	(0.011)
Backlog	-0.004	-0.001	0.011***	0.011**	0.005	-0.004	0.001	0.011
	(0.003)	(0.003)	(0.004)	(0.005)	(0.006)	(0.007)	(0.006)	(0.009)
Industry-Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	103,269	36,527	102,837	36,470	95,488	33,625	93,371	32,725
Adj. R2	0.492	0.469	0.222	0.203	0.171	0.195	0.067	0.124

Table A2
Firms' Markups and Backlogs

This table reruns the analysis of Table 5 using Backlog instead of Delivery Time. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	Markup			
Dep. var. definition.	Log		Levels	
	Full sample	2019-2021	Full sample	2019-2021
	(1)	(2)	(3)	(4)
Star × Backlog	0.013**	0.031***	0.011*	0.034***
	(0.006)	(0.008)	(0.007)	(0.008)
Star	0.285***	0.333***	0.236***	0.281***
	(0.013)	(0.017)	(0.017)	(0.019)
Backlog	-0.003	-0.011	0.001	0.008
	(0.006)	(0.008)	(0.006)	(0.007)
Industry-Country-Year FE	Yes	Yes	Yes	Yes
Obs.	102,223	36,468	102,265	36,482
Adj. R2	0.138	0.180	0.109	0.126

Table A3
Alternative Measures of Firms' Markups

Different from Table 5, this table defines markups by scaling sales by total costs (COGS+SG&A+KEPX) as in De Loecker, Eeckhout, and Unger (2020) (columns (1)-(4)), or by OPEX not adjusted for SG&A and R&D (columns (5)-(8)). Panel A reports the results on the full sample, while we focus on the period 2019-2021 in Panel B. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors reported in parentheses are clustered at the firm level. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A	Full sample							
Dependent variable	Markups (De Loecker, et al., 2020)				Markups (OPEX)			
Dep. var. definition.	Log		Levels		Log		Levels	
Shortages	Mean Backlog	Delivery Time	Mean Backlog	Delivery Time	Mean Backlog	Delivery Time	Mean Backlog	Delivery Time
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Star × Shortages	0.019***	0.089***	0.023***	0.094***	0.007***	0.022***	0.015***	0.057***
	(0.006)	(0.010)	(0.007)	(0.010)	(0.002)	(0.003)	(0.003)	(0.005)
Star	0.372***	0.369***	0.359***	0.330***	0.088***	0.088***	0.174***	0.157***
	(0.014)	(0.017)	(0.016)	(0.017)	(0.004)	(0.005)	(0.008)	(0.009)
Shortages	-0.001		0.001		-0.003*		-0.002	
	(0.006)		(0.006)		(0.002)		(0.003)	
Industry-Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	93,489	71,976	93,499	71,981	102,242	78,282	102,261	78,292
Adj. R2	0.156	0.156	0.172	0.169	0.941	0.938	0.851	0.844

Table A3
Alternative Measures of Firms' Markups (continued)

Panel B	2019-2021							
Dependent variable	Markups (De Loecker, et al., 2020)				Markups (OPEX)			
Dep. var. definition.	Log		Levels		Log		Levels	
Shortages	Mean Backlog	Delivery Time	Mean Backlog	Delivery Time	Mean Backlog	Delivery Time	Mean Backlog	Delivery Time
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Star × Shock	0.045***	0.078***	0.055***	0.088***	0.011***	0.019***	0.023***	0.052***
	(0.009)	(0.010)	(0.009)	(0.010)	(0.002)	(0.003)	(0.004)	(0.005)
Star	0.405***	0.367***	0.377***	0.326***	0.102***	0.087***	0.180***	0.136***
	(0.018)	(0.020)	(0.019)	(0.019)	(0.005)	(0.006)	(0.009)	(0.009)
Shock	-0.013		-0.003		-0.009***		-0.008**	
	(0.009)		(0.008)		(0.002)		(0.003)	
Industry-Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	32,864	25,436	32,867	25,438	36,476	28,021	36,481	28,023
Adj. R2	0.188	0.165	0.187	0.172	0.936	0.936	0.840	0.832

Table A4
Within Supplier Analysis using Backlog

Industry is based on 2-digit sic codes. A definition of all variables can be found in Table 1. All continuous variables are standardized by subtracting the mean and dividing for the standard deviation. Standard errors are clustered at the customer-by-year level and reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Dependent variable	% Industry Sales	ROA
	(1)	(2)
Star × Backlog	0.017**	0.019***
	(0.008)	(0.007)
Star	0.581***	0.347***
	(0.011)	(0.011)
Backlog	-0.017*	0.003
	(0.009)	(0.009)
Supplier-Year FE	Yes	Yes
Firm's Country-Industry-Year FE	Yes	Yes
Obs.	740,757	711,300
Adj. R2	0.683	0.401