WORKING paper

BANQUE DE FRANCE
EUROSYSTÈME

# R(a)ising Prices While Struggling: Firms' Financial Constraints and Price Setting

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March 2024, WP #942

## ABSTRACT

This paper investigates the interaction between financial constraints faced by firms and their price setting behaviour. We find systematic differences in the frequencies of price increases and decreases between financially constrained and unconstrained firms, consistently across several alternative proxies. Financial constraints affect price adjustments asymmetrically. When firms are financially struggling, they are more likely to increase their prices, while simultaneously exhibiting greater rigidity in lowering prices.

Keywords: Producer Price Setting, Firm Financial Constraints, Customer Market

JEL classification: E31, G30

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The author would like to thank Anne Duquerroy, Clément Mazet-Sonilhac, Eric Jondeau, Stefano Ungaro, Vincent Guegan, Patrick Sevestre, and my colleagues at Companies Observatory. I am extremely grateful to participants at the Panel Data and AFFI conferences, and at internal Banque de France seminars. The views expressed in this article are those of the author and do not necessarily reflect those of her institution.

# NON-TECHNICAL SUMMARY

Firms' price setting is a classic but elusive object of economic investigation. In Ben Bernanke's words, a better understanding of the factors that determine pricing behaviour of "price setters themselves, namely businesses, is one of the major unresolved issues for monetary policymakers". In the recent context of soaring prices and firms having financial difficulties, the relation between firms' financial situation and how they decide to adjust their prices is again attracting attention.

While these rises had several determinants, among which in particular the sharp rises in the cost of raw materials, this paper focuses on the consistent role played by firms' financial constraints in their price setting. In particular, we investigate the relationship between the financial situation of French manufacturing firms and their price adjustments at the extensive margin (i.e., the frequency of price increases and decreases) over a long and recent period of time, including the post pandemic years of rising prices. Our analysis is mainly based, on the one hand, on Banque de France monthly business survey data to assess price increases and decreases decided by firms and, on the other, on their balance sheets to approximate their financial constraints, for the period 2010-2022.

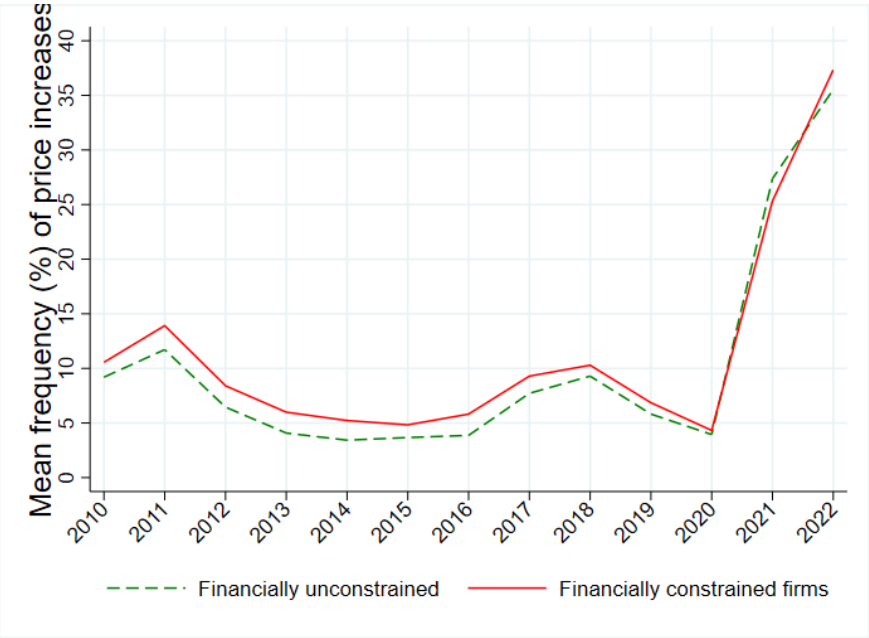
We find systematic differences in the frequencies of price increases and decreases between financially constrained and unconstrained firms. When firms are financially struggling, they are more likely to increase their prices. Moreover, there is evidence that financial constraints affect price adjustments in an asymmetric way: when firms have financing difficulties, they exhibit greater upward flexibility, but at the same time, their price setting is more rigid downward. This price setting behaviour is robust to a wide range of alternative proxies for financial constraints and different time periods.

The quantitative impact of financial constraints on the frequency of price increases and decreases is significant. In terms of interquartile shift, a firm with a lagged operating cash flow ratio (our preferred proxy for financial constraints) in the lower half of the distribution of operating cash flow ratio would decide each month 0.6 percentage point (p.p.) more price increases and 0.4 p.p. less price decreases than the same one in the upper half of the distribution. Put in other words, when facing a negative shock of two standard deviations of its operating cash flow, a firm chooses on average 1.4 p.p. more price increases and 0.9 p.p. less price decreases, which correspond to 13 and -24% of the average monthly frequencies of price increases and decreases, respectively.

Beyond proving the asymmetric impact of a firm's financial constraints on its price setting robust to many alternative ways of approximating financial difficulties, we test robustness of our findings to concerns about the potential endogeneity between price adjustment and financial constraints with an instrumental variable approach, as well as a difference in differences one. We also test their robustness to an alternative definition of the dependent variable and to the estimation of alternatives econometric models. Finally, we explore the role played by several dimensions of firm heterogeneity in the impact of financial constraints on price adjustment decisions, such as investment shocks, market power, age, and sector of activity.

While our analysis includes the pandemic and post pandemic years and shows that firms' behaviour in terms of price dynamics when facing financial constraint holds even then, further research is left to investigate more specifically this exceptional period, ideally based on higher frequency data. Indeed, Ge (2022) suggests that financial constraints may affect price setting through multiple mechanisms possibly with different time horizons (e.g., short run fire sale of inventories).

**Figure 1. Annual average percentage of monthly price increases depending on firms' financial constraints.**




Note: The annual average percentage of monthly price increases is higher for firms financially constrained (solid red line) than for unconstrained ones (dashed green line), defined by lagged OCF ratio in the first and last quartile of the distribution, respectively.
Source: Banque de France manufacturing business survey and FIBEN.

# Prix plus hauts face aux difficultés : contraintes financières et ajustement des prix des entreprises


## RÉSUMÉ

Cet article étudie l'interaction entre les contraintes financières auxquelles sont confrontées les entreprises et leur comportement en matière de fixation des prix. Nous constatons des différences systématiques dans la fréquence des augmentations et des baisses de prix entre les entreprises soumises à des contraintes financières et celles qui ne le sont pas, et ce de manière cohérente pour plusieurs indicateurs alternatifs. Les contraintes financières affectent les ajustements de prix de manière asymétrique : lorsque les entreprises sont en difficulté financière, elles sont plus susceptibles d'augmenter leurs prix, tout en faisant preuve d'une plus grande rigidité à la baisse de ceux-ci.



Mots-clés : fixation des prix à la production, contraintes financières de l'entreprise

# 1 Introduction

Understanding when and how prices adjust is a classic object of investigation in economics. The setting of producer prices, notably, has been elusive, due to data scarcity. However, investigating firms' price setting is of the utmost importance. In Ben Bernanke's words, a better understanding of the factors that determine pricing behavior of "price setters themselves, namely businesses, is one of the major unresolved issues for monetary policymakers".[1] In the recent context of soaring prices and firms struggling, the relation between firms' financial situation and how they decide to adjust their prices is again attracting attention.

From a theoretical standpoint, the financial situation of firms could play a role in price setting for several reasons, potentially affecting upward and/or downward price adjustments. In the first instance, financially constrained firms may choose to adjust their prices upwards in order to pass on increasing costs to customers, or even boost their mark-up in customer markets (see Gilchrist et al. [2017]). In the case of downward price adjustments, Balleer et al. [2017] argued that the impact is ambiguous. When a firm is financially constrained, either it could decide more price decreases, because the inaction region becomes narrower, or it could choose price cuts less often, not being able to engage in market-share capture strategies via price cuts, because it does not have the resources to accordingly increase their production capacity.

From an empirical point of view, the relation between firms' financial situation and their price setting has been explored during the last decade in the context of the 'missing disinflation' in the aftermath of the financial crisis. Gilchrist et al. [2017] investigated price setting for large US firms between 2005 and 2012 and showed that the financial situation (and in particular, the liquidity) of US firms before the 2008 crisis had a significant impact on their pricing strategy during the financial crisis: when firms were more financially constrained they resorted to price increases, despite the decline in aggregate demand, in order to preserve their liquidity. In Europe, Antoun de Almeida [2015] uncovered the existence of a positive relationship between financial

[1] June 2008 speech on "Outstanding issues in the analysis of inflation".

constraints and sectoral inflation for PIGS countries of the Euro Area. At the micro level, Renkin and Züllig [2023] found that Danish manufacturing firms increased their prices to raise cash in the short-run when other sources of liquidity dried up during the financial crisis, consistently with Gilchrist et al. [2017]' results for the US. However, Kim [2021] reached the conclusion that US firms decreased their prices in the months following a negative credit supply shock. Balleer et al. [2017] found that financially constrained firms adjusted their prices, both upward and downward, more often than unconstrained firms in Germany between 2002 and 2014.

Ge [2022] suggested that these seemingly contradictory results on how financial constraints affect price adjustment can be reconciled. Indeed, the direction in which a firm changes its prices depends on their short-term impact on firms' financial resources. On one hand, financially constrained firms increase prices for products for which customers pay after firms incur marginal production costs. On the other hand, they could lower prices to sell more in a shorter time period and gain more immediate liquidity in the case of inventories that have already been produced.

In this paper, we investigate the relationship between the financial situation of French manufacturing firms and their price adjustments at the extensive margin (i.e., the frequency of price increases and decreases) over a long and recent period of time, including the post pandemic years of rising prices. Our analysis is mainly based, on the one hand, on Banque de France monthly business survey data to gauge price setting of firms and, on the other, on their balance sheet information to assess their financial constraints, for the period 2010-2022.

We find systematic differences in the frequencies of price increases and decreases between financially constrained and unconstrained firms. When firms are financially struggling, they are significantly more likely to increase their prices. Moreover, there is evidence that financial constraints affect price adjustments in an asymmetric way: when firms have financing difficulties, they exhibit greater upward flexibility, but at the same time their price setting is more rigid downward than otherwise. This price setting behavior is robust to a wide range of alternative proxies for financial constraints and

different time periods.

The quantitative impact of financial constraints on the frequency of price increases and decreases is significant. When facing a negative shock of two standard deviations of its operating cash flow, our preferred proxy for financial constraints, a firm chooses on average 1.4 percentage points more price increases and 0.9 less price decreases, which correspond to 13 and -24% of the average monthly frequencies of price increases and decreases, respectively.

One concern could be the endogeneity between price adjustment and financial constraints. In particular, an omitted variable could be correlated with financial constraints and separately affect price adjustment decisions. Beyond including firm fixed effects, as well as sector[2] combined with time fixed effects, we implement two approaches, to reduce potential concern about endogeneity. First, we estimate a 2SLS specification, where the main instrument is the mean financial constraints of all the other firms in a given class of sector and year. An additional instrument, namely the capital to assets ratio of the banks with whom a firm has loans, allows testing the joint validity of these instruments. The exclusion restrictions seem reasonable, as the financial constraints of other firms and the capital ratio of banks providing credit to a firm should not have a direct impact on the price setting of that firm. Second, we estimate a difference-in-differences specification that exploits the fact that firms with loans at variable interest rate have been more exposed to the recent hike in interest rates than firms with loans at fixed rates.

Our findings are consistent with the general equilibrium model proposed by Gilchrist et al. [2017] in which agent preferences allow for the formation of a customer base à la Ravn et al. [2006] and monopolistically competitive firms face costly price adjustment à la Rotemberg [1982], as well as costly external finance. With customer markets, a trade-off arises between firms' current profits and the longer run maximization of their market share. Firm heterogeneity in their availability of internal resources results in an asymmetric price adjustment behavior. Firms may raise their current prices to avoid costly external financing, if their current internal liquidity position is

[2]In our data, firms belong to 215 different classes of sectors at the NACE (that is, the Statistical Classification of Economic Activities in the European Community) level 4.

weak enough relative to their future one, while financially healthy firms may instead cut their prices to drive out financially constrained firms.

Section 2 describes firms' price setting, their financial situation, and descriptively explores systematic differences in price increases and decreases between financially constrained and unconstrained firms. Section 3 econometrically investigates more in depth how the existence of financial constraints interacts with price setting, controlling for firm fixed effects, as well as for sectoral classes (corresponding to NACE level 4) combined with year fixed effects. Several alternative proxies for financial constraints are tested. In section 4, we asses the robustness of our main findings to concerns about the potential endogeneity between price adjustment and financial constraints with an instrumental variable approach, as well as a difference-in-differences one. We also check the robustness to an alternative definition of the dependent variable and the estimation of alternatives econometric models. Section 5 explores the role played by several dimensions of firm heterogeneity, such as investment shocks, market power, age, and sector of activity. Finally, section 6 concludes the paper.

# 2 Price adjustment behavior of firms and their financial situation

## 2.1 Banque of France business survey data and producer price adjustment behavior of firms

To gauge producer prices, we exploit the monthly business survey conducted by the Banque de France and explore pricing behavior of individual firms. The manufacturing sector survey[3] is conducted by Banque de France's local branches to company managers and questions mostly have multiple choice qualitative answers.[4]

Our analysis of price adjustment behavior is based on firms' response

[3] *Enquête mensuelle de Conjoncture dans l'Industrie* in French.

[4] The possible answers are given on a seven-point Likert scale, distinguishing no change, and different intensities of increases and decreases.

about the price variation of their most representative finished product (defined at the level of 4-digit NACE code), with respect to the previous month.[5] Based on companies' qualitative answer, we build a monthly indicator variable *price increase*, which is equal to 0, for a given month and firm, if the latter declares that there has been no price increase, and to 1 otherwise. Similarly, we generate the indicator variable *price decrease* equal to 0 if the firm declares that the price was stable or increasing, and 1 if it decreased. Based on this monthly information, for each firm we calculate averages of each of these two variables each year, to get each firm in a given year the monthly average frequency of price increases and decreases.

We focus on price adjustments of an almost balanced sample[6] of about 4 thousand firms[7] in the manufacturing sector. Over the whole 2010-2022 period, each month on average 11.1% of firms increased the price of their most representative product (see first column of Table 1).[8] Over the same period, each month, 3.8% of firms raised their prices, on average. The preponderance of price increases over decreases is a stylized fact typical of microeconomic producer, as well as consumer, price dynamics.[9]

Figure 1 shows the evolution of the monthly frequency of price increases

[5]See Loupias and Sevestre [2013] for more details. We also exploit qualitative information about the monthly evolution of orders received and of raw material prices. These are aggregated by firm and year, calculating opinion balances.

[6]We limit our reference sample to firms in the manufacturing sector for which we have price change responses for at least 9 months in a year between 2010 and 2022, as well as balance sheets. While this choice limits the number of firms in the sample, it is crucial to limit compositional effects. We also restricted the sample to firms with a 12-month balance sheet (98% of the firms for which balance sheet data are available), typically January to end of December.

[7]A firm is defined here as a legal unit, identified by a SIREN code.

[8]The frequency of overall price changes (i.e., both increases and decreases) characterizing the period 2010-2022, 14.9%, is between the one calculated by Gautier [2008] between 1994 and 2005 on the basis of INSEE producer price data (13%) and the one calculated by Loupias and Sevestre [2013] between 1998 and 2005 on the basis of the Banque de France business survey (18%). Based on a survey, Fabiani et al. [2006] obtain that in France 66% of firms report changing their price at most once a year. For comparison, for the United States Nakamura and Steinsson [2008] computed a median frequency of 10.8% for prices of finished goods and 13.3% for intermediate goods between 1998 and 2005. The one calculated by Dedola et al. [2019] for Denmark was 10%.

[9]See, for example, Gautier [2008] for producer prices and Berardi et al. [2015] for consumer prices in France.

| | 2010-22 | 2010-12 | 2013-16 | 2017-2019 | 2020 | 2021-22 |
|---|---|---|---|---|---|---|
| Mean frequency (%) of: | | | | | | |
| price increases | 11.1 | 10.4 | 4.9 | 8.6 | 4.6 | 31.6 |
| | (17.3) | (14.3) | (9.4) | (13.2) | (9.3) | (25.0) |
| price decreases | 3.8 | 4.3 | 5.6 | 2.9 | 3.4 | 1.4 |
| | (9.6) | (9.8) | (11.7) | (8.1) | (8.8) | (5.3) |
| N.firms | 3,922 | 2,676 | 3,051 | 2,879 | 2,542 | 2,581 |
| N.panel obs. | 32,230 | 7,262 | 9,800 | 7,665 | 2,542 | 4,961 |

Table 1: Average monthly frequency of firms' price increases and decreases by period between 2010 and 2022.
*Notes:* Standard deviations in parentheses.
*Source: Banque de France manufacturing business survey.*

averaged across firms each year between 2010 and 2022 (red solid line), as well as of price decreases (blue dashed line). Between 2010 and 2012, a period characterized by the sovereign debt crisis in the Eurozone, manufacturing firms frequently increased their prices. Indeed, 10.4% of prices rose each month, while 4.3% decreased (see the second column of Table 1). After that came a period, 2013-2016, with few price increases: only 4.9% of manufacturing firms raised their prices monthly. The third column of Table 1, in addition, shows that between 2013 and 2016 price cuts were more frequent than increases on average (5.6% versus 4.9%).[10] This fact is atypical in the literature on microeconomic price dynamics,[11] but consistent with the results of Berardi et al. [2015] in periods of low inflation.[12] After 2016 and till the Covid outbreak, the frequency of price increases rose to 8.6%, before plunging to 4.6% in 2020, the lowest level over the whole period. The frequency of price decreases remained rather stable since 2016, only slightly increasing in

[10]The overall frequency of price changes was, thus, 10.5%, which is rather low. This echoes the results available for France for consumer prices, showing that the frequency of changes decreases with the level of inflation (Berardi et al. [2015]).

[11]Fabiani et al. [2006], for example, report that in France, Portugal and the Netherlands price increases account for about 70% of price changes by firms.

[12]Berardi et al. [2015] show that the decline in the frequency of consumer price changes when the inflation level was below 1% was mainly due to a drop in the frequency of increases coupled with a more modest rise in the frequency of decreases in France. Moreover, they find that, compared to previous episodes of inflation below 1%, the 2013-2014 period of low inflation was characterized by significantly more frequent individual price cuts.

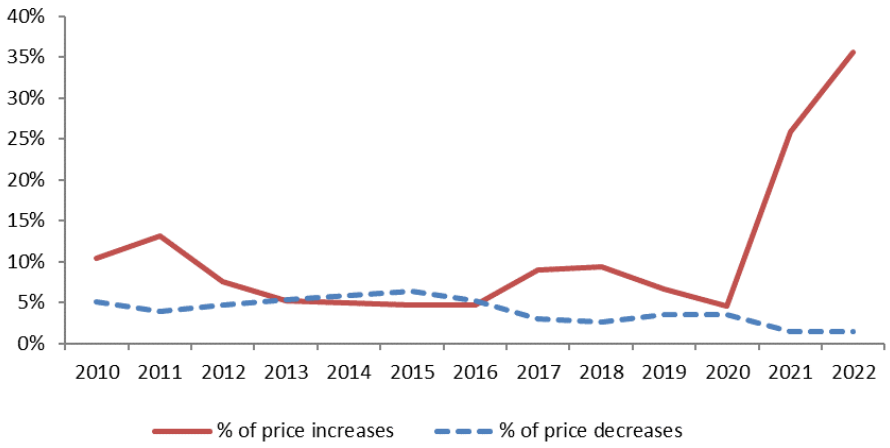



Figure 1: Annual average of the monthly frequency of price increases (red solid line) and decreases (blue dashed line).
*Source: Banque de France manufacturing business survey.*

2020, from 2.9% to 3.4% (see fourth and fifth column of Table 1). However, in 2021 and 2022 it plummeted to only 1.4%, while price increases skyrocketed to 31.5% (see last column of Table 1).[13]

## 2.2 Balance sheet data and financial constraints of firms

We now turn to describing the characteristics of firms and, in particular, their financial situation, mainly based on their balance sheets.[14] Balance sheet information is enriched with some variables obtained from Banque de France's manufacturing business survey, which are opinion balances based on qualitative answers. Moreover, we exploit information about trade bills payment defaults and credit ratings of Banque de France.

[13]These dynamics are in line with the evolution of the PPI index produced by the French National Statistical Office (INSEE), which aggregates all price changes of individual firms. The business survey data do not allow us to quantitatively analyze the size of price increases and decreases, which contribute with the frequency of these adjustments to determine aggregate inflation. Nevertheless, Berardi et al. [2013] show that time variations in inflation come more from variations in the frequency of price changes than from variations in the size of price changes.

[14]The data source is FIBEN (*'FIchier Bancaire des ENtreprises'* in French). It is based on fiscal documents, including annual balance sheet for firms with sales at least equal to 750 thousand euros. We winsorize all financial variables at the first and last centile.

The average characteristics of firms are reported in the first column of Table 2.[15] Over the period 2010-2022, firms had on average total assets of about 56 million euros and yearly revenues of 72 million euros.[16] The cost of raw materials was, on average, 29 millions euros and that of purchased merchandise about one sixth. The average (log) growth rate of sales was 2%, similarly to that of the cost of raw materials and purchased merchandise. The mean operating cash flow (OCF) ratio was 8%, the gross profit margin 4%, the current ratio 1.83, and the leverage ratio 22%. The index of external financing constraints proposed by Whited and Wu [2006] was on average 51%. The statistics for balances of opinions, which concern the evolution of orders received and that of prices of raw material used as inputs and are based on firms' answers to the business survey of Banque of France (marked with a dagger in Table 2 and following ones), suggest an increase, on average, over the period. The credit rating grade, that is built from Banque of France's categorical rating for the short-term credit risk of firms, is relatively high on average, reflecting the fact that the business survey sample does not include very small firms.[17] Consistently, 70% of panel observations have a credit rate eligible to collateral.[18] Finally, 32% of observations were characterized by at least a trade bill payment default over a year.

Although no perfect variable capturing firms' financial constraints is available, several ones in the last part of Table 2 could serve as proxy. In order to get a sense of their usefulness, we rely on the analysis of their variation with respect to Banque of France's credit rating, a comprehensive qualitative assessment of firms' financial health. Table 3 divides the original qualitative

[15]The definition and source of each variable is reported in Table 17 in the appendix.

[16]Both median total assets and revenues are much lower than their average, about 14 and 20 million euros, respectively (see the third column of Table 2). Indeed, the distribution of assets and revenues across firms is very right-skewed, as there are fewer large companies than small firms in our sample.

[17]It ranks the qualitative categories of the original rating scale, from 0 to 20 (the latter being attributed to firms with the lower credit risk). The latter is produced by Banque of France for firms with sales at least equal to 750 thousand euros.

[18]Bank credit given to firms with a good rating is an asset accepted as collateral by the Eurosystem for banks' refinancing operations. It is based on firm fundamentals and private information held by the Banque de France's analysts. For more details, see Cahn et al. [2023].

| | Mean | Q1 | Q2 | Q3 | SD | N.panel obs. |
|---|---|---|---|---|---|---|
| total assets (k€) | 55,858 | 5,027 | 13,976 | 42,851 | 130,715 | 32,230 |
| sales (k€) | 71,661 | 7,371 | 20,170 | 59,964 | 155,614 | 32,230 |
| Δ ln sales | 0.02 | -0.06 | 0.02 | 0.10 | 0.16 | 32,230 |
| cost of raw materials (k€) | 28,833 | 1,891 | 6,384 | 22,771 | 65,263 | 32,230 |
| Δ ln cost of raw materials | 0.02 | -0.08 | 0.02 | 0.14 | 0.24 | 32,230 |
| cost of merchandise purch. (k€) | 4,736 | 0 | 2 | 1,109 | 17,257 | 32,230 |
| Δ ln cost of merchandise purch. | 0.03 | 0.00 | 0.00 | 0.04 | 1.02 | 32,230 |
| Δ orders † | 0.08 | -0.08 | 0.08 | 0.25 | 0.26 | 32,230 |
| Δ price raw materials † | 0.12 | 0.00 | 0.08 | 0.25 | 0.25 | 32,230 |
| operating cash flow ratio | 0.08 | 0.04 | 0.08 | 0.13 | 0.10 | 32,230 |
| credit rating grade | 14.75 | 10.00 | 17.00 | 18.00 | 4.40 | 31,845 |
| gross profit margin | 0.04 | -0.00 | 0.04 | 0.09 | 0.10 | 32,228 |
| current ratio | 1.83 | 1.11 | 1.54 | 2.21 | 1.14 | 32,102 |
| leverage ratio | 0.22 | 0.06 | 0.18 | 0.33 | 0.20 | 32,230 |
| Whited-Wu index | 0.51 | 0.45 | 0.51 | 0.57 | 0.09 | 29,827 |
| eligible to collateral | 0.70 | 0.00 | 1.00 | 1.00 | 0.46 | 32,230 |
| trade bill payment default | 0.32 | 0.00 | 0.00 | 1.00 | 0.47 | 32,230 |

Table 2: Descriptive statistics of manufacturing firms' characteristics.
*Notes:* Descriptive statistics of variables marked with a dagger (†) are balances of opinion resulting from firm qualitative answers to the business survey about variations of received orders and raw material prices.
*Source: Banque de France manufacturing business survey and FIBEN.*

scale of this rating into three categories (compromised, intermediate, and good), plus a residual category for firms in the sample but without a credit rating, and reports the mean values of several quantitative proxies. The OCF ratio ranges from negative (-5%) for firms whose capacity to reimburse loans is compromised, to 3% and 10%, respectively, for firms characterized by intermediate and good credit rating. The current ratio and gross profit margin are, on average, also monotonically increasing with firms' credit rating categories. Consistently, the incidence of payment defaults, the leverage ratio,[19] and the Whited-Wu index of external financing constraints are monotonically decreasing, since in the case of these variables lower levels correspond to better financial health. Figure 2 visually conveys the same message: all these quantitative variables are related to some extent with firms' financial

[19]We adopt the same measure of leverage ratio as Auer et al. [2021], who argue that this definition can be interpreted as a measure of the degree of indebtedness, as well as of the degree of capitalization. For more details, see Table 17 in the appendix.

| | rating grade | OCF ratio | current ratio | gross profit margin | payment default | leverage ratio | Whited-Wu index |
|---|---|---|---|---|---|---|---|
| credit rating categories: | | | | | | | |
| compromised | 3.43 | -0.05 | 1.21 | -0.06 | 0.36 | 0.39 | 0.57 |
| intermediate | 9.51 | 0.03 | 1.45 | -0.00 | 0.34 | 0.30 | 0.54 |
| good | 17.12 | 0.10 | 2.00 | 0.06 | 0.32 | 0.19 | 0.49 |
| none | . | 0.05 | 1.82 | 0.02 | 0.27 | 0.25 | 0.53 |
| N.obs. | 31,845 | 32,230 | 32,102 | 32,228 | 32,230 | 32,230 | 29,828 |

Table 3: Mean financial constraint proxies by credit rating category.
*Source: Banque de France credit rating and FIBEN.*

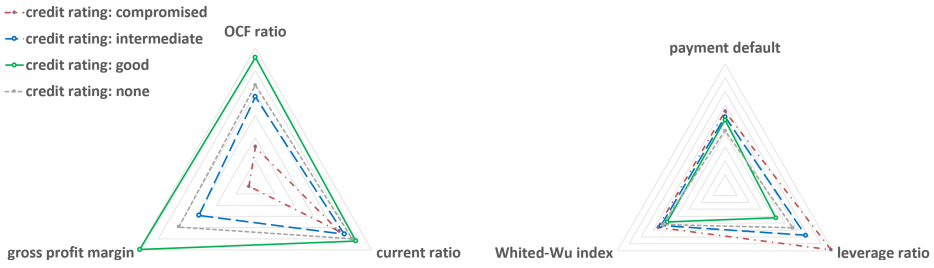



Figure 2: Financial constraint proxies by credit rating category.
*Notes:* Normalized means of variables positively related to financial health (and, thus, negatively to financial constraints) in the left panel, and variables positively related to financial constraints in the right panel, by credit rating as grouped into the categories compromised (red dash-dotted), intermediate (blue dashed), good (solid green), and no credit rating (grey dotted).
*Source: Banque de France credit rating and FIBEN.*

health and could thus be candidate to approximate financial constraints.

Moreover, Figure 3 shows that these quantitative variables are sensibly worse in the event of firm bankruptcy (in orange). In particular, it suggests that a low level of OCF ratio is not only a proxy of financial constraints, but also a strong signal of firm financial distress.[20]

Among the quantitative variables that may proxy financial constraints, the OCF ratio is also the most correlated to firms' credit rating grade.[21] In this paper, we thus consider the OCF ratio as the best quantitative candidate

[20]See Kim and Park [2015] for a comparison of financial constraint and distress measures.
[21]See Figure 6 in the appendix.

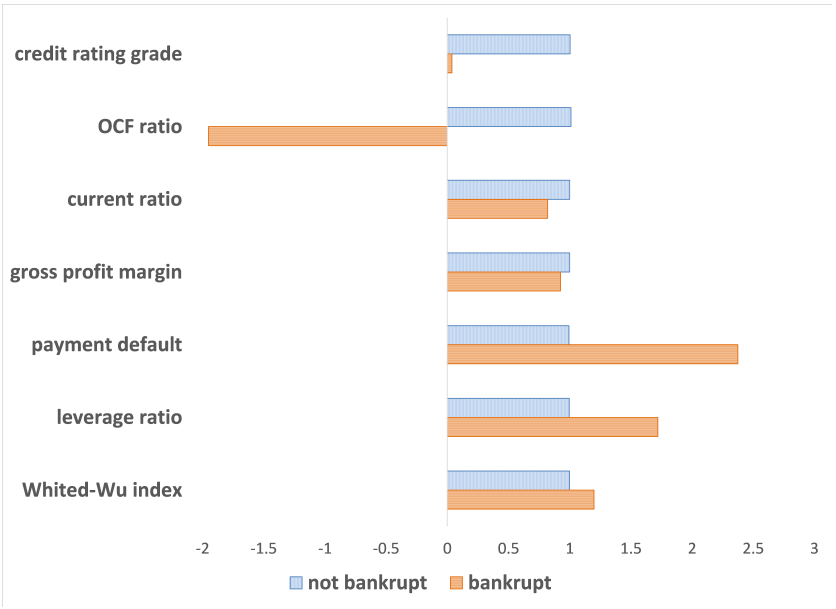



Figure 3: Financial constraint proxies by bankruptcy status.
*Notes:* Normalized mean of financial constraint proxies for bankrupt firms (horizontal pattern in orange) and non-bankrupt firms (vertical pattern in pale blue).
*Source: Banque de France business bankruptcy and FIBEN.*

that can be computed based on balance sheet information to approximate financial constraint. Indeed, a firm's operating cash flow is an indicator of the availability of internal resources, to invest in its productive capital, to pay dividends, and to repay its debts. The lower a firm's self-financing capacity, the more financially constrained it is. While there exist other ways to finance expenses than exploiting internal resources, self-financing is the most widespread financing resource for the large majority of companies.

Another complementary variable proxying rather external financial constraints is the Whited-Wu index, which exhibits a strong (negative) correlation with a firm's credit rating grade. Among the other candidate indicators of financial constraints, there is also indebtedness, measured by the leverage ratio. Indeed, the most indebted firms are likely to be financially constrained, as the marginal cost of external financing increases with debt ratio and high debt reduces access to additional external financing. In section 3.3 we will

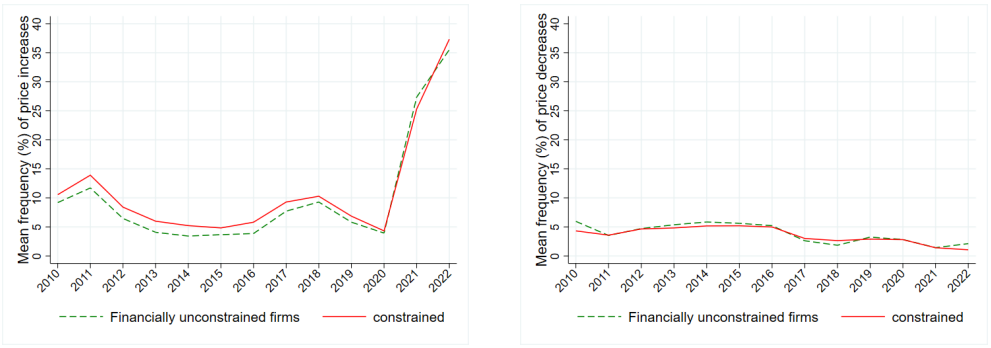
show that the main findings of this paper are robust to alternative proxies of financial constraints.

## 2.3 Descriptive evidence of the relation between financial constraints and price adjustment

Based on the microeconomic data described in the previous sections, we now turn to investigating the interaction between firms' financial situation and their price setting behavior. We descriptively explore systematic differences in price adjustment for firms financially constrained and not in two different ways.

First, we define firms' financial constraints in a simple way: firms characterized by an OCF ratio in the upper quartile of the distribution during the previous year are labelled as financially unconstrained in a given year, while those in the lower quartile are labelled as constrained. Though this definition of financial constraints is oversimplistic, some differences in pricing behavior between financially constrained and unconstrained firms already emerge, at least as far as price increases are concerned. Figure 4 plots over time the average percentage of price increases (left panel) and decreases (right panel) for financially constrained and unconstrained firms (solid red line and dashed green line, respectively) and reveals that constrained firms adjust their prices upward more frequently than unconstrained firms.

Second, we explore the relationship between lagged OCF ratio and price adjustment within each firm. The binned scatterplots of Figure 5 represent the effect of financial constraints on the percentage of firms' price increases (left panel) and decreases (right panel) over the whole period. For each bin of lagged OCF ratio, a dot represents its mean percentage of price increases and decreases, respectively, controlling for firm fixed effects. The red line visually represents the population regression line of these simple regressions of bins averages. The main message is that the effect of financial constraints on price increases (left panel) and decreases (right panel) is asymmetric. Indeed, when firms are more financially constrained (that is, have low lagged OCF ratio), they are more likely to increase prices with respect to when they




(a) % of price increases (b) % of price decreases

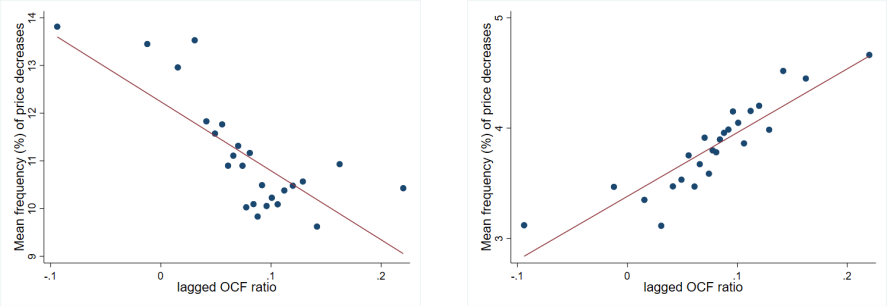
Figure 4: Annual average of the monthly frequency of price increases (left panel) and decreases (right panel) for financially constrained (solid red line) and unconstrained (dashed green line) firms.
*Notes:* In this figure firms are defined as financially constrained when their lagged OCF ratio belonged to the first quartile of the OCF ratio distribution, and financially unconstrained when their lagged OCF ratio belonged to the last quartile.
*Source: Banque de France manufacturing business survey and FIBEN.*

are less financially constrained, and appear less likely to decrease them.

The suggestive evidence conveyed by Figure 4 and 5 is strengthened in the following section through an econometric analysis on panel data, controlling for several time-varying firm characteristics, as well as a wider set of fixed effects. Moreover, while descriptively we only focused on one proxy for the degree of firms' financial constraints, in section 3.3, we test the robustness of the results to different time periods and consider other dimensions related to a firm's ability to access resources.

# 3 Impact of financial constraints on price adjustment

In order to strengthen and refine the descriptive evidence presented in section 2.3 suggesting an asymmetric relationship between firms' financial constraints and their decisions of upward and downward price adjustment, we turn to an econometric analysis. The empirical approach is described in section 3.1,




(a) % of price increases (b) % of price decreases

Figure 5: Binned scatterplots of lagged OCF ratio and percentage of price increases (left panel) and decreases (right panel), respectively, absorbing firm fixed effects.
*Source: Banque de France manufacturing business survey and FIBEN.*

while our benchmark results are presented in section 3.2. Section 3.3 tests that our baseline findings are robust to a wide range of alternative proxies for financial constraints.

## 3.1 Empirical approach

The dependent variables are the yearly average of monthly frequencies of price increases, on one hand, and decreases, on the other hand, that are decided by a firm over a year.

Separately for the frequencies of price increases and decreases, we start by estimating, the role played by a firm's financial situation, as captured by the categories of its credit rating:

$$\Delta p^{\pm}_{i,t} = \alpha + \beta \; credit \; rating_{i,t} + \gamma X_{i,t-1} + \zeta Z_{i,t} + FE_i + FE_{s,t} + \epsilon_{i,t} \quad (1)$$

We control for several firm's time-varying lagged balance sheet characteristics ($X_{i,t-1}$), namely the lagged natural logarithm of total assets and sales, plus the latter's lagged log growth rate, the lagged log growth rate of the cost of raw materials and purchased merchandise, and the inventory to sales ratio. $X_{i,t-1}$ also includes some qualitative variables from the business survey, based on yearly balances of opinion, namely the lagged variation of received orders

and of raw material prices, as well as its variation with respect to the previous year ($Z_{i,t}$).[22] The spirit of our specification is very similar to Gilchrist et al. [2017], where the growth of sales and cost of goods sold controls for the cyclical changes in demand and direct costs attributable to the production of goods sold by the firm, and the inventory-sales ratio captures precautionary liquidity demand. Since price setting varies greatly from one product to another, we also filter out sector $s$ effects at an extremely fine level (NACE level 4 sectoral class) within the manufacturing industry. Moreover, sectoral fixed effects are combined with year fixed effects ($FE_{s,t}$).[23] Therefore, all determinants of price adjustments that are time-varying at the sectoral level, like for instance sectoral inflation are controlled for. Finally, we incorporate firm fixed effects ($FE_i$) in an effort to absorb any time invariant differences across firms.[24] Standard errors are robust and clustered at the firm level.

Columns (Ia) and (Ib) in Table 4 report the estimated coefficients (and SE, in parentheses) for the frequency of price increases and decreases, respectively. We find significant heterogeneity in price adjustment behavior according to the financial situation of firms and an asymmetry in upward and downward price adjustment behavior. Indeed, when firms have a compromised credit rating, they appear to choose significantly more often to increase their prices than when their credit rating is good (the reference category). Firms with a compromised credit rating increase 1 p.p. more often their prices than when their credit rating is good, and 0.9 p.p. when it is intermediate. The estimated coefficients in column (Ib) for price decreases suggest the opposite behavior, in that the better the credit rating category the more a firm decides to decrease its prices, but they are not statistically significant. Notice that this heterogeneity in price adjustment behavior ac-

[22]Detailed information about the variables included in the regressions are reported in Table 17 in the appendix.

[23]Antoun de Almeida [2015] provides an example of the importance of time varying factors affecting sectors, by taking into account the interaction between sectors and oil prices. Indeed, sectors that depend on oil as an input may have higher cash holdings to hedge against oil price fluctuations, and when oil prices rise, these sectors are more likely to increase prices due to higher input costs.

[24]Tables 21 and 22 in the appendix show that the main results are robust to many different specifications of fixed effects.

cording to a firm's financial situation emerges even within the same sector and controlling for time-invariant and several time-varying firm characteristics that affect price setting, notably the cost of inputs. The estimated coefficients for the control variables are in line with the intuition that firms increase their prices when demand is stronger, as proxied by the variation of sales and orders, and decrease them when demand is weak. As expected, manufacturing firms also raise prices following an increase of their input costs, in particular of the raw materials that they use in production. Consistently, prices decreases follow reductions of raw materials' costs.

The same conclusion is suggested by the estimated coefficients reported in columns (IIa) and (IIb) of Table 4, respectively for the frequencies of price increases and decreases, where credit rating categories are replaced by a quantitative approximation of a credit rating grade[25]: firms decide to increase their prices significantly more and to decrease them less often, when their credit rating gets worse.

However, on one hand, credit rating categories put firms into rather wide groups and a firm seldom changes group. On the other hand, unfortunately, the transformation into a quantitative variable imprecisely translates their financial situation, as these grades do not capture the heterogeneity of jumps among different credit ratings. Therefore, we now turn to quantitative measures approximating financial constraints based on balance sheet data, which are more time variable and strongly correlate with credit rating (as shown in section 2.2).

## 3.2 Baseline results

Our benchmark specification is as follow:

$$\Delta p^{\pm}_{i,t} = \alpha + \beta OCF_{i,t-1} + \gamma X_{i,t-1} + \zeta Z_{i,t} + FE_{s,t} + FE_i + \epsilon_{i,t} \qquad (2)$$

where the dependent variables, $\Delta p^{\pm}_{i,t}$, are the extensive margin of price adjustment, i.e., the yearly average monthly frequency of price increases and

[25]See section 2.2 for details on this variable.

decreases of firm $i$ in year $t$, as in section 3.1. The main variable of interest is $OCF_{i,t-1}$, which captures the lagged[26] operating cash flow ratio of firm $i$ and represents our preferred proxy for financial constraints. The other regressors and fixed effects are the same described in section 3.1.

The estimated coefficients for price increases and decreases (columns (Ia) and (Ib) of Table 5, respectively) confirm a marked asymmetry in firms' upward and downward price adjustment behavior depending on their financial constraints.[27] This is consistent with the intuition that, when firms are financially constrained, they adjust their prices to generate short-term liquidity, as shown by Gilchrist et al. [2017]. Note that also Renkin and Züllig [2023] found that firms with less pre-crisis cash holdings responded more to the credit supply shock during the financial crisis, consistently with a liquidity-generating motive for price increases.

While this finding had already visually emerged from the binned scatterplots represented in Figure 5, the econometric specification (2) estimated in Table 5 ensures that the result is more general, by looking for each firm at the relation between their mean monthly price adjustment decisions over the year and their financial constraints. Moreover, in addition to firm fixed effects, which were already absorbed in the binned scatterplots, here many time-varying firm controls are also included, together with sectoral classes combined with year fixed effects.

Quantitatively, if the lagged OCF ratio diminishes by 1 percentage point, from its mean 8% to 7%, the frequency of price increases rises by 6.8 basis points, from its mean of 11.1% to about 11.17%. In terms of interquartile shift (corresponding to 9 percentage points, accordingly to Table 2), a firm with a lagged OCF ratio in the lower half of the distribution would decide 0.6 percentage points more price increases than the same one in the upper half of the distribution (11.7% monthly frequency of price increases versus

[26]Financial constraints relate to the previous period with respect to price adjustment, in order to reduce concerns about reverse causality, in a spirit similar to Gilchrist et al. [2017], who consider a firm's liquidity position in 2006 to study the price-setting behavior during the financial crisis.

[27]This asymmetry contrasts with the empirical results of Balleer et al. [2017], who show in Germany that financially constrained firms adjust their prices both upward and downward more frequently than unconstrained firms.

the average 11.1%). Asymmetrically, if the lagged OCF ratio diminishes by 1 percentage point, the frequency of price decreases declines by 4.5 basis points, from its mean of 3.8% to about 3.75%. As for an interquartile shift, a firm with a lagged OCF ratio in the lower half of the distribution would decide 0.4 percentage points less price decreases than the same one in the upper half of the distribution (3.4% monthly frequency of price decreases versus the average 3.8%).

These effects may seem limited, but they can actually prove sizeable when a firm is hit by a shock. For instance, when facing a negative shock of two standard deviations of its OCF ratio (corresponding to 20 percentage points, accordingly to Table 2), a firm on average chooses 1.4 percentage points more price increases and 0.9 less price decreases, which correspond to 13 and -24% of the average monthly frequencies of price increases and decreases, respectively.

In order to make sure that the results are not driven by extreme values in the distribution of the OCF ratio, we re-estimate the same regressions, replacing the actual value of the lagged OCF ratio with a categorical variable that distinguishes firms in the bottom quartile, in the interquartile range (the reference category), and in the upper quartile of its distribution.[28] Consistently with previous results, the estimated coefficients, reported in columns (IIa) and (IIb) of Table 5 suggest that when a firm has little OCF, it decides more prices increases than when it is intermediate, while price increases become less common when abundant internal resources are available. Asymmetrically, when a firm has little OCF, it decides less prices decreases than when it is intermediate, while price decreases become more common when abundant internal resources are available.[29] In conclusion, when firms are more financially constrained, as proxied by their lagged OCF ratio, they decide more price increases and less decreases.

This asymmetric relationship between financial constraints and frequency

[28]We also checked the robustness of the results to extreme values of operating cash flow ratio by replacing its actual value with a simple ranking and to non-linearity by including a squared term. The results are reported in Table 19 in the appendix.

[29]Table 18 in the appendix shows that the conclusion are the same whether we compute the quartiles within sector or within sector and year level.

of price increases and decreases is not specific to a given period. In particular, columns (Ia) and (Ib) of Table 6 show that the role played by the lagged OCF ratio on price adjustment in the period between 2013 and 2020 is similar to the one estimated for the overall period and was not significantly different during the sovereign debt crisis (2010-2012), nor in recent years, 2021-22, characterized by skyrocketing price increases (see Figure 1). Consistently, the estimated coefficients are very similar if we exclude the last three years of data and restrict to the period 2010-2019 (see column (IIa) and (IIb) of Table 6).

Finally, Table 20 in the appendix shows that the conclusion is the same and the estimated coefficients even larger in absolute value, if we restrict to a strongly balanced sample (which halves our sample size, however).

## 3.3 Alternative proxies of financial constraints

To test the robustness of the results to different possible definitions of financial difficulties, we modify specification (2) by replacing the OCF ratio with a battery of alternative measures proxying firms' financial constraints, while keeping the same controls and fixed effects as before. The estimated results, reported in Table 7, suggest that the main conclusion is robust to a wide range of proxies for financial constraints. Column (Ia) of panel A suggests that when a firm's loans become assets accepted as collateral by the Eurosystem for banks' refinancing operations, which may ease a firm's financial constraints, price increases decline. An asymmetric, though not significant, result is reported in column (Ib) of panel B for decreases. Columns (IIa) and (IIIa), similarly suggest that an improvement in current ratio and gross profit margin, respectively, diminishes price increases. Again, the opposite seems true for price decreases, as suggested by column (IIb) and (IIIb). Finally, columns (IVa) and (IVb) report the estimated coefficients when all these proxies of a firm's financial constraints are included in the regression and reveal that the role of the OCF ratio in price adjustment decisions remains strong and significant even then.

In the same spirit, Table 8 reports the estimated coefficients of another

group of alternative measures proxying firms' financial constraints, while keeping the same controls and fixed effects as before. Column (Ia) of panel A suggests that when a firm has a trade bill payment default, which may be a sign of financial distress, price increases rise. More indebted firms are also significantly more likely to increase their prices (column IIa). The same is true when firms have more external financing constraints, as measured by the Whited-Wu index (column IIIa).[30] Asymmetric, though not significant, results are reported in panel B for price decreases. Again, the role of the OCF ratio in price adjustment decisions remains strong and significant even in the presence of other proxies for firms' financial difficulties.

The coefficients for the standardized variables of some financial constraints' proxies are reported in Table 9. Standardizing the regressors allows to easily compare the relative importance of independent variables. In particular, columns (Va) and (Vb) suggest that lagged OCF ratio is the most important factor for both price increases (panel A) and decreases (panel B): firms with little OCF relatively to their assets, thus likely to be financially constrained, decide fewer price increases and more price decreases. Quantitatively, a 1 standard deviation decline of the OCF ratio is followed roughly by a 0.4 standard deviation rise in price increases and drop in price decreases, respectively.

# 4 Robustness

In the previous section, a consistent relation between financial constraints and price adjustment has emerged, that is asymmetric for price increases

[30]Other common indexes in the literature to approximate financial constraints are Kaplan and Zingales [1997] KZ and Hadlock and Pierce [2010] SA indexes. These proxies for financial constraints have the expected sign in our estimations, but are not significant. We do not report these results (available upon request) because the KZ index was designed for large listed firms and, moreover, has found little support as a useful proxy of financial constraints by many authors, among which Hadlock and Pierce [2010]. The index proposed by the latter authors, the size-age (SA) index, which was also designed for listed firms, is a relatively static proxy for financial constraints and may be more useful in cross-sectional data than in detecting time-series variation of financial constraints in a panel dataset like ours.

and decreases. In particular, a firm is more likely to decide to increase its prices and less to decrease them when it is more financially constrained in terms of exiguity of OCF. This asymmetric impact of a firm's financial constraints on its price setting proved robust to many alternative ways of proxying financial difficulties. In this section, we test the robustness of our main findings to concerns about the potential endogeneity between price adjustment and financial constraints with an instrumental variable approach, as well as a difference-in-differences one. Finally, we test the robustness to an alternative dependent variable and to estimating alternative econometric models.

## 4.1 Endogeneity

One concern may be potential endogeneity between price adjustment and financial constraints, as measured by OCF ratio based on balance sheets data. While section 3.3 showed that the relationship is robust to many different proxies for firms' financial constraints, the causal effect from an omitted variable could be tangled up in the coefficient of the variables proxying firm financial constraints. In other words, an omitted variable could be correlated with financial constraints and separately affect price adjustment decisions.[31]

One way to reduce potential concerns about endogeneity is implementing an instrumental variable approach. A possible instrument, that could be both valid and relevant for the OCF of a firm, is the average one of other firms in the same sector and year. Therefore, we instrument the lagged OCF ratio of a firm with the lagged mean of the OCF ratios, computed among all firms in a given sector (215 classes, corresponding to NACE level 4) and year, excluding the firm itself. We argue that the exclusion restriction is reasonable, as the average OCF ratio of the other firms populating the environment where a firm operates should not have a direct impact on the price setting of that firm. Moreover, by construction, the OCF ratio of that firm is excluded from

[31]Endogeneity could also result from reverse causality. However, in our specification the relationship studied is between a firm's financial constraints in the previous period and its price setting, in a spirit similar to Gilchrist et al. [2017], who consider a firm's liquidity position in 2006 to study the price-setting behavior during the financial crisis.

the instrument. Finally, this instrument is relevant. In the first stage, the average OCF ratio of a firm's environment is a positive and very significant determinant of the OCF ratio of the firm itself.[32]

Table 10 reports the second stage estimates of the 2SLS regression in columns (IIa) and (IIb). In the second stage, the estimated coefficients for the lagged OCF ratio are larger in absolute terms than in our benchmark results (columns (Ia) and (Ib) in Table 5), especially for price increases. Thus, this instrumental variable estimates suggests that the baseline coefficients may actually underestimate the causal impact of firms' financial constraints on their price increases. Notice that we don't include sector combined with year fixed effects in this specification, as the instrument is a variable mainly defined by sector and year. However, we do include separately sector and year fixed effects. The baseline estimates under this specification are reported in column (Ia) and (Ib) and are very similar to those with sector*year fixed effects.[33]

While we argued that we can validly exclude from the second stage the average OCF ratio of the other firms populating the environment where a firm operates, no test is possible with only one instrument. Therefore, we include, as additional instrument, the capital to assets ratio of the banks with whom a firm has loans.[34] We claim that this second exclusion restriction is also reasonable, as the capital ratio of banks providing credit to a firm should not have a direct impact on the price setting of that firm. Moreover, the OCF ratio of a firm is unlikely to affect the capital ratio of a bank.[35] This instrument is relevant. Indeed, there exists a negative relationship between

[32]Estimates available upon request.

[33]Tables 21 and 22 in the appendix provide estimates under various combinations of fixed effects.

[34]To construct the capital to assets ratios, we mobilized balance sheet data at the Bank Identifier Code (BIC) level (SITUATION database). We first computed the annual capital to assets ratio for the BICs corresponding to loans of our sample firms, as reported in the French credit register (SCR database), which is subject to a declaration threshold of 15 thousand euros. Then, for firms that have loans with several BICs, we compute the average capital ratio weighted by loan amounts. Because it can't be computed for firms with no credit registered, the inclusion of this instrument reduces our sample size. Moreover, we can only exploit the SITUATION database since 2010, which further shrinks our sample size.

[35]The spirit of this instrument is similar to Duca et al. [2017].

the capitalization of a bank and the OCF ratio of the firms to which it provides credit.

Table 10 reports the second stage estimates of the 2SLS regression with two instruments in column (IIIa) and (IIIb). The estimated coefficients for the lagged OCF ratio are larger in absolute terms than those in columns (Ia) and (Ib), and even (IIa) and (IIb). This strengthens the finding that the role of financial constraints on price adjustment may be stronger once potential endogeneity is taken into account.

Because in this specification there are two instruments and only one endogenous variable, we can perform a J-test for over-identifying restrictions. This tests whether all instruments are exogenous, assuming that at least one of them is exogenous. This over-identification test fails to reject the null hypothesis of instruments validity at standard significance levels.

An alternative approach to reduce potential concerns about endogeneity is a difference-in-differences estimation. In order to implement this identification strategy, we exploit the fact that some firms have loans at fixed rates, while others at variable rates, and that the latter one have sharply increased in 2022.[36] Intuitively, firms with loans at variable interest rate are more exposed to the hike in interest rate and become arguably more financially constrained as they are hit by an exogenous credit shock. Thus, the treatment time is 2022, while the treatment group comprises firms that have mostly loans at variable rates. We expect firms more exposed to the hike

[36]To retrieve the exposure of firms to variable rates, we mobilized a database of contracts census (M-contran or '*Recensement des contrats nouveaux*' in French), available since 2012. In some cases, the duration of loans is not specified. For contracts with missing duration, we assume 17 month duration for loans at fixed rates (corresponding to the mean of fixed rate contrats) and 10 month duration for variable rate loans (which is the mean of variable rate contracts). In the appendix, Table 23 reports results based on a different assumption, namely a 12-month duration (corresponding to the mean of fixed rate contracts, which are the majority in sample with no missing duration) for all contracts with missing duration. Whatever hypothesis chosen for unreported durations, we consistently find that firms that are more exposed to the hike in interest rate (because they have loans at variable interest rate) and, thus, more financially constrained, are more likely to increase their prices and less likely to decrease them. Notice that the sample size shrinks, because firms' exposure to variable rate loans can't be computed for firms with no loans registered in M-contran or when the information about the type of rate is missing. Moreover, we can only exploit the M-contran database since 2012. This further reduces the sample size with respect to our benchmark estimation.

in interest rate (because they have most loans at variable interest rate) and, thus, more financially constrained, to be more likely to increase their prices and less likely to decrease them. Consistently, the estimated coefficients of the interaction terms reported in columns (Ia) and (Ib) of Table 11 have the expected signs for price increases and decreases, and are significant for price increases. We visually verify the parallel trend assumption by plotting year by year the estimated interaction coefficients and their confidence intervals (Figure 7 in the appendix).

To test the robustness of the results to alternative definitions of treated group, we adopt two alternative definitions. The first alternative treatment group is composed by firms that only have variable interest rate loans. The second one in a continuous treatment determined by the share variable interest loans over total loans. Columns (IIa) and (IIb), as well as (IIIa) and (IIIb) of Table 11 consistently support the finding that more financially constrained firms are more likely to decide to increase their prices.

## 4.2 Alternative dependent variable and econometric models

Throughout the paper, the two dependent variables are the annual monthly frequencies of price increases and decreases decided by a firm. We test the robustness of our findings to an alternative dependent categorical variable that distinguishes whether a firm predominantly chose to increase or decrease its prices in a given year.

We then estimate, first, an ordered logit model where the three dependent variable categories are mostly price decreases, no price changes overall, and mostly price increases.[37] Column (I) of Table 12 reports the estimated coefficients of the lagged OCF ratio. The significant and negative coefficient implies that when a firm is more financially constrained, it is more likely to choose price increases.

[37]Errors are clustered as the firm level as everywhere else, while this non-linear model cannot estimate the numerous fixed effects that we had previously included. However, Tables 21 and 22 in the appendix show that our main findings are robust to whatever combination of fixed effects.

Second, we also estimate a multinomial logit, which does not impose an ordering of the categorical dependent variable. The estimated coefficient in column (IIa) corresponds to the effect of a firm's lagged OCF ratio on its decision to mostly increase its prices. The positive and significant coefficient implies that when a firm is more financially constrained, it is more likely to predominantly decide price increases.

Quantitatively, when the lagged OCF ratio decreases by one unit, then the multinomial log-odds for overall predominantly price increases, with respect to no change overall, increases by 1.2. The estimated coefficient in column (IIb) concerns the effect of a firm's lagged OCF ratio on its decision to mostly decrease its prices. The negative and significant coefficient implies that when a firm is more financially constrained, it is less likely to predominantly choose price decreases. In particular, when the lagged OCF ratio decreases by one unit, then the multinomial log-odds for overall predominantly price decreases, with respect to no change overall, decreases by 0.8. In terms of relative risk, when the lagged OCF ratio decreases by one percentage point, overall positive price changes become 0.3 more likely, while negative price changes 2.3 less likely.

In conclusion, the asymmetric impact of a firm's financial constraints on its price setting proves robust to an alternative definition of the dependent variable, as well as to the estimation of different econometric models.

# 5 Heterogeneity

In this section, we explore the role played by several dimensions of firms' heterogeneity in the impact of financial constraints on their price adjustment decisions. The first dimension takes into account idiosyncratic investment shocks and production capacity expansions. The second one explores firms' market power, looking at their market shares and at sectoral concentration. Finally, the role played by financial constraints, as proxied by the OCF ratio, may also be heterogeneous depending on a firm's age and sector of activity.

We start by investigating idiosyncratic investment shocks and production capacity expansions. Indeed, one situation where the OCF ratio may not be a

satisfactory proxy for financial constraints (as several other proxies based on balance sheet information) could be in the case of firms that at some point in time invest a lot. For instance, firms at very high rate of capacity utilization may decide to invest to increase their production capacity. In their case, a low OCF ratio doesn't imply that they are doing bad, though their recent investment does temporarily impose them some financial constraints to the extent that it reduces their internal resources left.

For such firms we find some evidence of an attenuating effect to the impact of the lagged OCF ratio on price changes, though thsi attenuation is only significant (and marginally so) in the case of price decreases. Indeed, the estimated coefficients reported in columns (Ib) and (IIb) of Table 13 imply that, while firms that the previous year were in the top decile of the investment (in terms of gross investment or capex, respectively) growth distribution with respect to their sector (NACE level 4) tend to decrease their prices in general, when their lagged OCF ratio increases they do so less than other firms. Notice also that for the latter ones, the estimated impact of the lagged OCF ratio is quantitatively extremely similar to our benchmark result (reported in columns (Ia) and (Ib) of Table 5), limiting the concerns about the OCF potential shortcomings related to idiosyncratic investment shocks.

Alternatively, it is possible to identify firms investing to increase their production capacity, exploiting the business survey data instead of balance sheet information and looking at the evolution of their capacity utilization rate. In particular, we built a dummy variable that equals one when a firm had used at least at 85% of its production capacity (corresponding to the top quartile of the capacity utilization rate distribution) the previous year, and then decreased its capacity utilization rate. The estimated interaction coefficients reported in column (IIIa) and (IIIb) of Table 13 suggest that the role played by the lagged OCF ratio is not significantly different as far as price increases and decreases, respectively, are concerned.

Beyond the case of firms that may have few internal resources left because they massively invested, one question that may arise is whether the role played by financial constraints on price adjustment may differ for firms with the market power to set prices with respect to firms are price takers.

While defining market power is elusive, we are able to explore the role of market shares computed within years and sectoral classes (4-digit NACE codes) based on the sales of all firms in the manufacturing sector. We computed dummies corresponding to the top decile and quartile, as well as bottom quartile and decile, of the distribution of market shares, and interacted these with the lagged OCF ratio. The estimates, reported in Table 14, overall suggest that market shares do not affect the frequency at which firms decide to raise their prices. Indeed, the coefficients estimated for the dummy variables are never a significant determinant of the frequency of price increases. The estimated dummy coefficients in columns (Ib) and (IIIb) imply instead that firms enjoying top decile market shares are less likely to decrease their prices and those in the bottom quartile are more likely to do so. As far as the interaction between the lagged OCF ratio and market shares is concerned, column (Ib) of Table 14 suggests that when financial constraints diminish (that is, the lagged OCF ratio rises) for a firm enjoying top decile market shares, the company is significantly (though marginally) more likely to decrease its prices than other firms with the same level of financial constraints. The same is true for firms with market shares in the top quartile (column IIb), but the estimated magnitude of the interaction coefficient is smaller than in column (Ib). Consistently, columns (IIIb) and (IVb) suggest that the opposite is true for firms in the bottom quartile and decile of the distribution, respectively. In particular, when financial constraints diminish for a firm with market shares in the bottom quartile, it is significantly less likely to decrease its prices than other firms with the same level of financial constraints. This attenuating effect is even stronger in the case of firms with market shares in the bottom decile of the distribution and, thus, more likely to be price takers in their market.

To gain further insights into potential heterogeneity of the role played by financial constraints on price adjustment depending on the competitiveness of firms' environment, we also explore the role of financial constraints in subsamples of very concentrated sectoral classes. Like Montero and Urtasun [2021], we capture sectoral concentration through the Herfindahl-Hirschman index (HHI), the four-firm concentration ratio (CR4), and the number of

firms. Across all these measures of sectoral concentration, we consistently find that the role played by financial constraints on both price increases and decreases is stronger for firms in the most concentrated sectors. Indeed, the estimated coefficients reported in columns (Ia) and (Ib) of Table 15 (which correspond to the subsample of firms in the top quartile of concentrated sectors, respectively for price increases and decreases) are always larger in absolute value than those for the least concentrated ones reported in columns (IIa) and (IIb) (which correspond to the subsample of firms in the bottom quartile of concentrated sectors), whether based on alternatively the HHI (panel 1), the CR4 (panel 2), or the number of firms (panel 3).

In conclusion, when firms enjoying a stronger position in terms of market shares or operating in highly concentrated sectors (where competition may be weaker) are financially constrained, they appear to be more inclined than other firms. Indeed, these firms may face lower competition and may, thus, be able to do so without loosing too many customers.

A third dimension of heterogeneity across firms could relate to their age. Indeed, young firms may ex ante be more financially constrained, even for the same level of internal resources available, as access to external financing is more difficult for them (e.g., Hadlock and Pierce [2010]). Table 16 reports the coefficients for the lagged OCF ratio estimated in the subsample of firms up to the first centile of the age distribution in our sample, that is, very young firms aged one year (reported for price increases and decreases, respectively, in columns Ia and b), up to the fifth centile (10 years, in columns IIa and b), up to the tenth (14 years, in columns IIIa and b), and below the median age (34 years, in columns IVa and b). Although our sample contains very few young firms, the impact of the lagged OCF ratio on the decision to increase prices (column Ia) and to decrease them (column Ib) appears almost ten times stronger for firms up to one-year-old than in the benchmark estimation (reported in reported in columns (Ia) and (Ib) of Table 5). For firms up to 10-year-old, the coefficient almost doubles (columns IIa and b) and it monotocally decreases in absolute value with the inclusion of more mature firms. Finally, the comparison between the estimated coefficients reported in columns (IVa) and (IVb) and in reported in columns (Ia) and (Ib) of Table 5

suggests that the lagged OCF ratio is a stronger determinant of price setting for firms younger than the sample median than for the whole sample. We conclude that the OCF ratio is likely to be a particularly good proxy for firms' financial constraints in the case of relatively young firms with limited access to external financing.

Finally, we explore the heterogeneity of the role played by financial constraints across sectors of activity within manufacturing.[38] In all sectors, when firms are more financially constrained, as approximated by a lower OCF ratio, they are more likely to increase their prices and less likely to decrease them. However, the magnitude of the impact of financial constraints on price adjustment is heterogeneous across sectors[39] and especially strong in the agro-industry and the wood&paper manufacturing sectors.

# 6 Conclusion

Investigating the interaction between firms' financial constraints and their decision to change prices is an important and still debated topic. Indeed, the existing literature reaches ambiguous conclusions about and the characteristics of this relationship. One reason is that producer price data is scarce and the firms' financial constraints difficult to capture. To address the absence of consensus in the literature about the best approach to approximate financial

[38]We grouped into agro-industry sectoral divisions (corresponding to 2-digit NACE codes) between 10 and 12 (i.e., manufacture of food products, of beverages, and of tobacco products), into wood & paper 2-digit NACE codes between 16 and 18 (i.e., manufacture of wood, of paper and paper products, as well as printing and reproduction of recorded media), into electrical, chemical & pharmaceutical 2-digit NACE codes between 20 and 21, as well as between 26 and 27 (i.e., manufacture of chemicals and chemical products, of pharmaceutical products, of computer, electronic and optical products, of electrical equipment), into plastic & metal 2-digit NACE codes between 22 and 25 (i.e., manufacture of rubber and plastic products, of other non-metallic mineral products, of basic metals, of fabricated metal products, except machinery and equipment), into machinery & transport equipment 2-digit NACE codes between 28 and 30, as well as 33 (i.e., manufacture of machinery and equipment, of motor vehicles, trailers and semi-trailers, of other transport equipment, plus repair and installation of machinery and equipment), into clothing, furniture & other 2-digit NACE codes between 13 and 15, as well as between 31 and 32 (i.e., manufacture of textiles, of wearing apparel, of leather and related products, of furniture and other).

[39]Estimated coefficients are reported in the appendix from Table 24 to 29.

constraints, we exploit a rich micro dataset and test a variety of proxies. We consistently find that firms facing financial constraints have a price adjustment behavior that is asymmetric for price increases and decreases. When a firm is more financially constrained in the previous period, it is more likely to decide to increase its prices and less to decrease them.

Despite the robustness of this finding to a range of possible proxies for financial constraints, the identification of its causality may still be called into question. Beyond controlling for an extensive set of fixed effects that capture all time-invariant factors at the firm level and all time-varying ones at the sectoral level, we implement an instrumental variable approach and a difference-in-differences one, in order to reduce this concern. Though these may fall short of unquestionably proving causality, this paper highlights a structural relationship between firms' financial constraints and their price setting over a long (and recent) period of time, transcending a specific period of macroeconomic turmoil like the financial crisis.

Bridging between the literature on corporate finance and the literature on producer price setting, it singles out a mechanism driving up prices when firms are financially struggling. From a macroeconomic perspective, our findings suggest that financial frictions are likely to contribute to inflation dynamics in France. This implies that, like in Gilchrist et al. [2017], the divine coincidence fails to hold and central banks face a trade-off between inflation and output stabilization. Moreover, in a context of already high inflation like the current one, policymakers should take into account that, if access to financial resources becomes more difficult or more costly, producer prices may rise even more, due to the role played by firms' financial constraints on their price adjustments. However, assessing the extent to which the microeconomic significant interaction between firms' financial constraints and price adjustment translates into sizeable effects at the macroeconomic level would require investigating the consequences of firms' asymmetric pricing behavior, which is left for further research.

| Frequency (%) of: | price increases | | price decreases | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (Ib) | (IIb) |
| credit rating: compromised | 1.001* | | -0.480 | |
| | (0.608) | | (0.428) | |
| credit rating: intermediate | 0.925*** | | -0.246 | |
| | (0.267) | | (0.190) | |
| credit rating: none | 0.395 | | 0.394 | |
| | (0.763) | | (0.514) | |
| credit rating: good (ref.) | | | | |
| credit rating grade | | -0.151*** | | 0.050** |
| | | (0.034) | | (0.025) |
| lagged (ln) total assets | -1.380*** | -1.232** | 0.295 | 0.309 |
| | (0.536) | (0.541) | (0.336) | (0.339) |
| lagged (ln) sales | 0.844 | 0.866 | 1.393*** | 1.336*** |
| | (0.624) | (0.632) | (0.422) | (0.426) |
| lagged Δ ln sales | 1.219** | 1.282** | -0.708* | -0.739* |
| | (0.572) | (0.577) | (0.380) | (0.386) |
| lagged Δ orders † | 0.892*** | 0.912*** | -0.969*** | -0.985*** |
| | (0.313) | (0.315) | (0.204) | (0.206) |
| Δ ln cost of raw materials | 1.043*** | 1.130*** | -0.657*** | -0.711*** |
| | (0.338) | (0.332) | (0.215) | (0.217) |
| Δ ln cost of merchandise purchased | -0.034 | -0.020 | -0.078 | -0.075 |
| | (0.065) | (0.065) | (0.048) | (0.048) |
| Δ price raw materials † | 26.951*** | 27.001*** | -6.687*** | -6.740*** |
| | (0.643) | (0.648) | (0.413) | (0.417) |
| lagged Δ price raw materials † | 5.168*** | 5.104*** | -1.487*** | -1.480*** |
| | (0.489) | (0.489) | (0.341) | (0.344) |
| lagged inventory to sales | 1.288 | 0.444 | 1.243 | 1.494 |
| | (1.753) | (1.745) | (1.139) | (1.167) |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,911 | 3,922 | 3,911 |
| N.obs. | 32,230 | 31,829 | 32,230 | 31,829 |
| Adj.$R^2$ | 0.57 | 0.57 | 0.34 | 0.34 |
| Within $R^2$ | 0.16 | 0.16 | 0.03 | 0.03 |

Table 4: Financial situation and price adjustment.
*Notes:* The financial situation of firms is proxied by credit rating categories in columns (Ia) and (Ib) for the frequency of price increases and decreases, respectively. Controls are defined as in Table 17. In columns (IIa) and (IIb), the financial situation of firms is proxied by the credit ranking grade. The definitions of the variables are detailed in appendix Table 17.
*Source: Banque de France manufacturing business survey and FIBEN.*

| Frequency (%) of: | price increases | | price decreases | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (Ib) | (IIb) |
| lagged operating cash flow ratio | -6.745*** | | 4.600*** | |
| | (1.283) | | (0.934) | |
| lagged OCF ratio: below Q1 | | 0.780*** | | -0.638*** |
| | | (0.238) | | (0.170) |
| lagged OCF ratio: Q1-Q3 (ref.) | | | | |
| lagged OCF ratio: above Q3 | | -0.656*** | | 0.582*** |
| | | (0.238) | | (0.172) |
| lagged (ln) total assets | -1.647*** | -1.700*** | 0.457 | 0.536 |
| | (0.535) | (0.537) | (0.334) | (0.334) |
| lagged (ln) sales | 1.254** | 1.181* | 1.059** | 1.031** |
| | (0.633) | (0.632) | (0.425) | (0.423) |
| lagged Δ ln sales | 1.707*** | 1.508*** | -1.067*** | -0.990** |
| | (0.580) | (0.578) | (0.388) | (0.387) |
| lagged Δ orders † | 0.871*** | 0.890*** | -0.956*** | -0.968*** |
| | (0.312) | (0.312) | (0.204) | (0.204) |
| Δ ln cost of raw materials | 1.028*** | 1.023*** | -0.667*** | -0.668*** |
| | (0.337) | (0.337) | (0.215) | (0.214) |
| Δ ln cost of merchandise purchased | -0.032 | -0.034 | -0.081* | -0.080* |
| | (0.065) | (0.065) | (0.048) | (0.048) |
| Δ price raw materials † | 26.965*** | 26.967*** | -6.700*** | -6.705*** |
| | (0.643) | (0.643) | (0.412) | (0.412) |
| lagged Δ price raw materials † | 5.148*** | 5.151*** | -1.482*** | -1.483*** |
| | (0.489) | (0.489) | (0.340) | (0.340) |
| lagged inventory to sales | 1.109 | 1.196 | 1.508 | 1.516 |
| | (1.746) | (1.749) | (1.133) | (1.136) |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,922 | 3,922 | 3,922 |
| N.obs. | 32,230 | 32,230 | 32,230 | 32,230 |
| Adj.$R^2$ | 0.57 | 0.57 | 0.34 | 0.34 |
| Within $R^2$ | 0.16 | 0.16 | 0.03 | 0.03 |

Table 5: Financial constraints and price adjustment: benchmark results.
*Notes:* Columns (Ia) and (Ib) report our baseline results concerning the asymmetric role on price increases and decreases, respectively, played by financial constraints, as approximated by the lagged operating cash flow (OCF) ratio, our preferred proxy. In columns (IIa) and (IIb) this continuous variable is replaced by a categorical variable that distinguishes firms in the bottom quartile, in the interquartile range (the reference category), and in the upper quartile of the distribution of the OCF ratio. The definitions of the variables are detailed in appendix Table 17.
*Source: Banque de France manufacturing business survey and FIBEN.*

| Frequency (%) of: | price increases | | price decreases | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (Ib) | (IIb) |
| lagged operating cash flow ratio | -6.564*** | -6.480*** | 5.398*** | 4.593*** |
| | (1.365) | (1.243) | (1.032) | (1.097) |
| lagged OCF ratio * period 2010-12 | -1.083 | | -1.831 | |
| | (1.978) | | (1.598) | |
| lagged OCF ratio * period 2021-22 | 0.812 | | -2.104 | |
| | (3.764) | | (1.489) | |
| lagged (ln) total assets | -1.665*** | -1.417*** | 0.462 | 0.098 |
| | (0.536) | (0.517) | (0.334) | (0.430) |
| lagged (ln) sales | 1.215* | 0.630 | 1.051** | 1.626*** |
| | (0.634) | (0.626) | (0.428) | (0.536) |
| lagged Δ ln sales | 1.726*** | 1.188** | -1.043*** | -1.313*** |
| | (0.581) | (0.529) | (0.389) | (0.501) |
| lagged Δ orders † | 0.869*** | 0.895*** | -0.959*** | -1.053*** |
| | (0.312) | (0.298) | (0.204) | (0.260) |
| Δ ln cost of raw materials | 1.019*** | 0.816** | -0.675*** | -0.858*** |
| | (0.338) | (0.328) | (0.215) | (0.262) |
| Δ ln cost of merchandise purchased | -0.032 | 0.072 | -0.082* | -0.089 |
| | (0.065) | (0.061) | (0.048) | (0.057) |
| Δ price raw materials † | 26.966*** | 19.291*** | -6.704*** | -8.645*** |
| | (0.643) | (0.699) | (0.412) | (0.569) |
| lagged Δ price raw materials † | 5.145*** | 4.148*** | -1.486*** | -1.897*** |
| | (0.489) | (0.501) | (0.340) | (0.423) |
| lagged inventory to sales | 1.115 | 2.114 | 1.434 | 2.254 |
| | (1.746) | (1.452) | (1.137) | (1.517) |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| Period | 2010-22 | 2010-19 | 2010-22 | 2010-19 |
| N.firm clusters | 3,922 | 3,588 | 3,922 | 3,588 |
| N.obs. | 32,230 | 24,588 | 32,230 | 24,588 |
| Adj.$R^2$ | 0.57 | 0.44 | 0.34 | 0.36 |
| Within $R^2$ | 0.16 | 0.11 | 0.03 | 0.04 |

Table 6: Robustness to different periods and to 2010-19 subsample.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Panel A: price increases*

| Frequency (%) of price increases | | | | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (IIIa) | (IVa) |
| eligible to collateral | -0.893*** | | | -0.575** |
| | (0.257) | | | (0.267) |
| lagged current ratio | | -0.529*** | | -0.372** |
| | | (0.154) | | (0.159) |
| lagged gross profit margin | | | -5.847*** | -1.680 |
| | | | (1.587) | (1.791) |
| lagged OCF ratio | | | | -4.563*** |
| | | | | (1.485) |
| Controls | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,915 | 3,922 | 3,915 |
| N.obs. | 32,230 | 32,077 | 32,230 | 32,077 |
| Adj.$R^2$ | 0.57 | 0.57 | 0.57 | 0.57 |
| Within $R^2$ | 0.16 | 0.16 | 0.16 | 0.16 |

*Panel B: price decreases*

| Frequency (%) of price decreases | | | | |
|---|---|---|---|---|
| | (Ib) | (IIb) | (IIIb) | (IVb) |
| eligible to collateral | 0.213 | | | -0.029 |
| | (0.181) | | | (0.187) |
| lagged current ratio | | 0.140 | | 0.034 |
| | | (0.089) | | (0.090) |
| lagged gross profit margin | | | 4.073*** | 1.843 |
| | | | (1.028) | (1.178) |
| laggedOCF ratio | | | | 3.752*** |
| | | | | (1.077) |
| Controls | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,915 | 3,922 | 3,915 |
| N.obs. | 32,230 | 32,077 | 32,230 | 32,077 |
| Adj.$R^2$ | 0.34 | 0.34 | 0.34 | 0.34 |
| Within $R^2$ | 0.03 | 0.03 | 0.03 | 0.03 |

Table 7: Robustness to alternative proxies for (the exiguity of) financial constraints.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Panel A: price increases*

| Frequency (%) of price increases | | | | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (IIIa) | (IVa) |
| payment default | 0.376** | | | 0.345* |
| | (0.186) | | | (0.191) |
| lagged leverage ratio | | 2.282*** | | 0.864 |
| | | (0.794) | | (0.860) |
| lagged Whited-Wu index | | | 6.285** | 3.429 |
| | | | (3.185) | (3.193) |
| lagged OCF ratio | | | | -6.750*** |
| | | | | (1.401) |
| Controls | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,922 | 3,773 | 3,773 |
| N.obs. | 32,230 | 32,230 | 29,730 | 29,730 |
| Adj.$R^2$ | 0.57 | 0.57 | 0.58 | 0.58 |
| Within $R^2$ | 0.16 | 0.16 | 0.17 | 0.17 |

*Panel B: price decreases*

| Frequency (%) of price decreases | | | | |
|---|---|---|---|---|
| | (Ib) | (IIb) | (IIIb) | (IVb) |
| payment default | -0.172 | | | -0.215 |
| | (0.131) | | | (0.135) |
| lagged leverage ratio | | -0.813 | | 0.018 |
| | | (0.546) | | (0.637) |
| lagged Whited-Wu index | | | -2.407 | -1.015 |
| | | | (2.038) | (2.061) |
| lagged OCF ratio | | | | 4.744*** |
| | | | | (1.034) |
| Controls | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,922 | 3,773 | 3,773 |
| N.obs. | 32,230 | 32,230 | 29,730 | 29,730 |
| Adj.$R^2$ | 0.34 | 0.34 | 0.34 | 0.34 |
| Within $R^2$ | 0.03 | 0.03 | 0.03 | 0.03 |

Table 8: Robustness to alternative proxies for financial constraints.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Panel A: price increases*

| Frequency (%) of price increases | | | | | |
|---|---|---|---|---|---|
| | (Ia) | (IIa) | (IIIa) | (IVa) | (Va) |
| lagged OCF ratio | -6.745*** | | | | -4.818*** |
| | (1.283) | | | | (1.416) |
| credit rating grade | | -0.151*** | | | -0.093** |
| | | (0.034) | | | (0.037) |
| lagged current ratio | | | -0.529*** | | -0.368** |
| | | | (0.154) | | (0.159) |
| payment default | | | | 0.376** | 0.328* |
| | | | | (0.186) | (0.186) |
| Controls | yes | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,911 | 3,915 | 3,922 | 3,904 |
| N.obs. | 32,230 | 31,829 | 32,077 | 32,230 | 31,698 |
| Adj.$R^2$ | 0.57 | 0.57 | 0.57 | 0.57 | 0.57 |
| Within $R^2$ | 0.16 | 0.16 | 0.16 | 0.16 | 0.16 |

*Panel B: price decreases*

| Frequency (%) of price decreases | | | | | |
|---|---|---|---|---|---|
| | (Ib) | (IIb) | (IIIb) | (IVb) | (Vb) |
| lagged OCF ratio | 4.600*** | | | | 4.260*** |
| | (0.934) | | | | (0.983) |
| credit rating grade | | 0.050** | | | 0.011 |
| | | (0.025) | | | (0.026) |
| lagged current ratio | | | 0.140 | | 0.046 |
| | | | (0.089) | | (0.091) |
| payment default | | | | -0.172 | -0.199 |
| | | | | (0.131) | (0.132) |
| Controls | yes | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,911 | 3,915 | 3,922 | 3,904 |
| N.obs. | 32,230 | 31,829 | 32,077 | 32,230 | 31,698 |
| Adj.$R^2$ | 0.34 | 0.34 | 0.34 | 0.34 | 0.34 |
| Within $R^2$ | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |

Table 9: Financial constraints and price adjustment: standardized variables.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Panel A: price increases*

| Frequency (%) of price increases | | | |
|---|---|---|---|
| | (Ia) | (IIa) | (IIIa) |
| lagged OCF ratio | -6.339*** | -60.382** | -62.240* |
| | (1.246) | (23.458) | (33.144) |
| Controls | yes | yes | yes |
| Firm FE | yes | yes | yes |
| Sector FE | yes | yes | yes |
| Year FE | yes | yes | yes |
| N.firm clusters | 3,922 | 3,876 | 3,567 |
| N.obs. | 32,230 | 31,646 | 26,138 |
| Adj.$R^2$ | 0.54 | 0.13 | 0.14 |
| Within $R^2$ | 0.20 | | |
| Instrument: | | | |
| lagged mean OCF ratio by sector*year | no | yes | yes |
| lagged banks capital ratio | no | no | yes |
| F statistic | | 53 | 16 |
| Cragg-Donald Wald F statistic | | 123 | 36 |
| Hansen J statistic (overidentification test) | | | 0.16 |
| Hansen J statistic p-value | | | 0.69 |

*Panel B: price decreases*

| Frequency (%) of price decreases | | | |
|---|---|---|---|
| | (Ib) | (IIb) | (IIIb) |
| lagged OCF ratio | 4.360*** | 10.679 | 18.727 |
| | (0.905) | (16.254) | (24.970) |
| Firm FE | yes | yes | yes |
| Sector FE | yes | yes | yes |
| Year FE | yes | yes | yes |
| N.firm clusters | 3,922 | 3,876 | 3,567 |
| N.obs. | 32,230 | 31,646 | 26,138 |
| Adj.$R^2$ | 0.31 | 0.03 | 0.03 |
| Within $R^2$ | 0.04 | | |
| Instrument: | | | |
| lagged mean OCF ratio by sector*year | no | yes | yes |
| lagged banks capital ratio | no | no | yes |
| F statistic | | 53 | 16 |
| Cragg-Donald Wald F statistic | | 123 | 36 |
| Hansen J statistic (overidentification test) | | | 0.08 |
| Hansen J statistic p-value | | | 0.76 |

Table 10: Robustness to endogeneity between financial constraints and price adjustment: instrumental variable approach.
*Source: Banque de France manufacturing business survey, FIBEN, SITUATION, and credit register.*

*Panel A: price increases*

| Frequency (%) of price increases | | | |
|---|---|---|---|
| | (Ia) mostly | (IIa) only | (IIIa) share of |
| | variable rate loans | | |
| treatedtime*treatedgroup | 4.721** | 4.082** | 4.758*** |
| | (1.921) | (1.733) | (1.835) |
| Controls | yes | yes | yes |
| Firm FE | yes | yes | yes |
| Sector x Year FE | yes | yes | yes |
| N.firm clusters | 618 | 618 | 618 |
| N.obs. | 2,338 | 2,338 | 2,338 |
| Adj.$R^2$ | 0.64 | 0.64 | 0.64 |
| Within $R^2$ | 0.27 | 0.27 | 0.27 |

*Panel B: price decreases*

| Frequency (%) of price decreases | | | |
|---|---|---|---|
| | (Ib) mostly | (IIb) only | (IIIb) share of |
| | variable rate loans | | |
| treatedtime*treatedgroup | -0.733 | -0.800 | -0.663 |
| | (0.631) | (0.531) | (0.572) |
| Controls | yes | yes | yes |
| Firm FE | yes | yes | yes |
| Sector x Year FE | yes | yes | yes |
| N.firm clusters | 618 | 618 | 618 |
| N.obs. | 2,338 | 2,338 | 2,338 |
| Adj.$R^2$ | 0.29 | 0.29 | 0.29 |
| Within $R^2$ | 0.06 | 0.06 | 0.06 |

Table 11: Robustness to endogeneity between financial constraints and price adjustment: difference-in-differences approach.
*Notes:* Estimates of the interaction between post treatment and treated group reported in columns (Ia) and (Ib) correspond to firms having mostly variable rate loans registered in M-contran, columns (IIa) and (IIb) only variable rate loans, and columns (IIIa) and (IIIb) the share of variable rates, respectively for price increases and decreases.
*Source: Banque de France manufacturing business survey, FIBEN, and M-contran.*

| Logit | ordered | multinomial | |
|---|---|---|---|
| categories: | mostly price decr., no price changes, mostly price incr. | mostly price increases | decreases |
| | (I) | (IIa) | (IIb) |
| lagged OCF ratio | -1.069*** | 0.818*** | -1.162** |
| | (0.170) | (0.279) | (0.214) |
| Controls | yes | yes | yes |
| N.firm clusters | 3,922 | 3,922 | |
| N.obs. | 32,230 | 32,230 | |

Table 12: Robustness to alternative dependent variable and econometric models.

*Notes:* Estimated log-odds of ordered logit (column I), where the categories of the dependent variable are mostly price decreases, no price changes overall, mostly price increases. Estimated log-odds of a multinomial logit (columns IIa and IIb for mostly price increases and decreases, respectively, with respect to overall no price changes).

*Source: Banque de France manufacturing business survey and FIBEN.*

*Panel A: price increases*

| Frequency (%) of price increases | | | |
|---|---|---|---|
| | (Ia) | (IIa) | (IIIa) |
| lagged operating cash flow ratio | -6.783*** | -6.864*** | -6.616*** |
| | (1.296) | (1.302) | (1.318) |
| lagged top decile Δ ln investment | -0.087 | | |
| | (0.339) | | |
| lagged OCF ratio * top decile Δ ln investment | 0.418 | | |
| | (2.750) | | |
| lagged top decile Δ ln capex | | -0.088 | |
| | | (0.333) | |
| lagged OCF ratio * top decile Δ ln capex | | 1.399 | |
| | | (2.678) | |
| lagged CUR above 85% then decrease | | | -0.232 |
| | | | (0.298) |
| lagged OCF ratio * CUR above 85% then decrease | | | -0.684 |
| | | | (2.284) |
| Controls | yes | yes | yes |
| Firm FE | yes | yes | yes |
| Sector x Year FE | yes | yes | yes |
| N.firm clusters | 3,922 | 3,922 | 3,922 |
| N.obs. | 32,230 | 32,230 | 32,230 |
| Adj.$R^2$ | 0.57 | 0.57 | 0.57 |
| Within $R^2$ | 0.16 | 0.16 | 0.16 |

*Panel B: price decreases*

| Frequency (%) of price decreases | | | |
|---|---|---|---|
| | (Ib) | (IIb) | (IIIb) |
| lagged operating cash flow ratio | 4.932*** | 5.066*** | 4.534*** |
| | (0.966) | (0.954) | (0.944) |
| lagged top decile Δ ln investment | 0.750*** | | |
| | (0.253) | | |
| lagged OCF ratio * top decile Δ ln investment | -3.613* | | |
| | (2.115) | | |
| lagged top decile Δ ln capex | | 0.906*** | |
| | | (0.257) | |
| lagged OCF ratio * top decile Δ ln capex | | -5.013** | |
| | | (2.121) | |
| lagged CUR above 85% then decrease | | | 0.099 |
| | | | (0.219) |
| lagged OCF ratio * CUR above 85% then decrease | | | 0.371 |
| | | | (1.802) |
| Controls | yes | yes | yes |
| Firm FE | yes | yes | yes |
| Sector x Year FE | yes | yes | yes |
| N.firm clusters | 3,922 | 3,922 | 3,922 |
| N.obs. | 32,230 | 32,230 | 32,230 |
| Adj.$R^2$ | 0.34 | 0.34 | 0.34 |
| Within $R^2$ | 0.03 | 0.03 | 0.03 |

Table 13: Heterogeneity by investment growth and capacity expansion.
*Notes:* Columns (Ia) and (Ib), as well as (IIa) and (IIb), distinguish from other firms those that the previous year were in the top decile of their sector investment distribution in terms of gross investment and capex, respectively. Columns (IIIa) and (IIIb) focus on firms with high and then decreasing capacity utilization rate (CUR).
*Source: Banque de France manufacturing business survey and FIBEN.*

*Panel A: price increases*

| Frequency (%) of price increases | | | | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (IIIa) | (IVa) |
| lagged operating cash flow ratio | -6.978*** | -7.110*** | -5.643*** | -6.665*** |
| | (1.309) | (1.368) | (1.468) | (1.383) |
| lagged top decile market share | -0.683 | | | |
| | (0.769) | | | |
| lagged OCF ratio * top decile mkt share | 4.429 | | | |
| | (4.352) | | | |
| lagged top quartile market share | | 0.174 | | |
| | | (0.437) | | |
| lagged OCF ratio * top quartile mkt share | | 2.392 | | |
| | | (2.654) | | |
| lagged bottom quartile market share | | | 0.591 | |
| | | | (0.366) | |
| lagged OCF ratio * bottom quartile mkt share | | | -3.107 | |
| | | | (2.138) | |
| lagged bottom decile market share | | | | 0.524 |
| | | | | (0.415) |
| lagged OCF ratio * bottom decile mkt share | | | | -0.316 |
| | | | | (2.488) |
| N.firm clusters | 3,922 | 3,922 | 3,922 | 3,922 |
| N.obs. | 32,230 | 32,230 | 32,230 | 32,230 |
| Adj.$R^2$ | 0.57 | 0.57 | 0.57 | 0.57 |
| Within $R^2$ | 0.16 | 0.16 | 0.16 | 0.16 |

*Panel B: price decreases*

| Frequency (%) of price decreases | | | | |
|---|---|---|---|---|
| | (Ib) | (IIb) | (IIIb) | (IVb) |
| lagged operating cash flow ratio | 4.272*** | 3.871*** | 5.674*** | 5.531*** |
| | (0.937) | (0.974) | (1.190) | (1.042) |
| lagged top decile market share | -1.148** | | | |
| | (0.476) | | | |
| lagged OCF ratio * top decile mkt share | 6.187* | | | |
| | (3.644) | | | |
| lagged top quartile market share | | -0.486 | | |
| | | (0.340) | | |
| lagged OCF ratio * top quartile mkt share | | 4.315* | | |
| | | (2.248) | | |
| lagged bottom quartile market share | | | 0.432* | |
| | | | (0.242) | |
| lagged OCF ratio * bottom quartile mkt share | | | -3.024** | |
| | | | (1.491) | |
| lagged bottom decile market share | | | | 0.081 |
| | | | | (0.270) |
| lagged OCF ratio * bottom decile mkt share | | | | -4.817*** |
| | | | | (1.620) |
| Controls | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,922 | 3,922 | 3,922 |
| N.obs. | 32,230 | 32,230 | 32,230 | 32,230 |
| Adj.$R^2$ | 0.34 | 0.34 | 0.34 | 0.34 |
| Within $R^2$ | 0.03 | 0.03 | 0.03 | 0.03 |

Table 14: Heterogeneity by market shares.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Panel 1: HHI*

| Frequency (%) of: | price increases | | price decreases | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (Ib) | (IIb) |
| lagged OCF ratio | -7.345*** | -5.165** | 4.492** | 3.473* |
| | (2.793) | (2.279) | (1.976) | (1.909) |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 1,215 | 1,127 | 1,215 | 1,127 |
| N.obs. | 7,831 | 8,094 | 7,831 | 8,094 |
| Adj.$R^2$ | 0.54 | 0.61 | 0.40 | 0.35 |
| Within $R^2$ | 0.16 | 0.18 | 0.04 | 0.03 |

*Panel 2: CR4*

| Frequency (%) of: | price increases | | price decreases | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (Ib) | (IIb) |
| lagged OCF ratio | -8.509*** | -4.886** | 4.913** | 3.252* |
| | (3.019) | (2.334) | (2.033) | (1.930) |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 1,174 | 1,071 | 1,174 | 1,071 |
| N.obs. | 7,780 | 8,045 | 7,780 | 8,045 |
| Adj.$R^2$ | 0.55 | 0.61 | 0.39 | 0.35 |
| Within $R^2$ | 0.16 | 0.18 | 0.04 | 0.03 |

*Panel 3: Number of firms*

| Frequency (%) of: | price increases | | price decreases | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (Ib) | (IIb) |
| lagged OCF ratio | -11.560*** | -3.279 | 4.734** | 3.416* |
| | (3.013) | (2.112) | (2.087) | (1.762) |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 1,136 | 1,125 | 1,136 | 1,125 |
| N.obs. | 8,041 | 7,765 | 8,041 | 7,765 |
| Adj.$R^2$ | 0.56 | 0.59 | 0.33 | 0.31 |
| Within $R^2$ | 0.15 | 0.18 | 0.04 | 0.02 |

Table 15: Heterogeneity by sectoral concentration.
*Notes:* Columns (Ia) and (Ib) correspond to the subsample of firms in the top quartile of concentrated sectors, while columns (IIa) and (IIb) correspond to the subsample of firms in the bottom quartile of concentrated sectors, based on alternatively the HHI (Panel 1), the CR4 (panel 2) and the number of firms in the sector defined at the level of 4-digit NACE codes (Panel 3).
*Source: Banque de France manufacturing business survey and FIBEN.*

*Panel A: price increases*

| Frequency (%) of price increases | | | | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (IIIa) | (IVa) |
| lagged OCF ratio | -41.260* | -10.052 | -9.438** | -8.575*** |
| | (24.178) | (7.694) | (4.698) | (1.746) |
| Controls | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 61 | 304 | 573 | 2,278 |
| N.obs. | 138 | 1,208 | 2,719 | 15,809 |
| Adj.$R^2$ | 0.00 | 0.48 | 0.54 | 0.58 |
| Within $R^2$ | 0.35 | 0.15 | 0.17 | 0.16 |

*Panel B: price decreases*

| Frequency (%) of price decreases | | | | |
|---|---|---|---|---|
| | (Ib) | (IIb) | (IIIb) | (IVb) |
| lagged OCF ratio | 46.303* | 6.913 | 5.981* | 5.674*** |
| | (27.452) | (5.011) | (3.306) | (1.318) |
| Controls | yes | yes | yes | yes |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 61 | 304 | 573 | 2,278 |
| N.obs. | 138 | 1,208 | 2,719 | 15,809 |
| Adj.$R^2$ | -0.24 | 0.41 | 0.31 | 0.36 |
| Within $R^2$ | 0.30 | 0.02 | 0.03 | 0.03 |

Table 16: Heterogeneity by firm age.
*Notes:* Columns (Ia) and (Ib) restrict the sample to firms up to the first centile of the sample age distribution (1 year), columns (IIa) and (IIb) to the fifth centile (10 years), columns (IIIa) and (IIIb) to the tenth (14 years), and columns (IVa) and (IVb) below the median age (34 year), for price increases and decreases, respectively.
*Source: Banque de France manufacturing business survey and FIBEN.*

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# Appendix

| Variable | Definition and source |
|---|---|
| *Main variables:* | |
| $\Delta p^+$ | Annual average of monthly frequency (in %) of price increases. Source: Banque de France manufacturing business survey |
| $\Delta p^-$ | Annual average of monthly frequency (in %) of price decreases. Source: Banque de France manufacturing business survey |
| OCF ratio | Operating cash flow ratio computed as: operating cash flow / total assets Source: FIchier Bancaire des ENtreprises |
| *Alternative variables:* | |
| credit rating | Credit rating divided into 4 categories: good (credit ratings eligible to collateral), intermediate (credit ratings not eligible to collateral and at least 5 or since 2022 at least 6+), compromised (credit ratings 6 or worse), none Source: FIchier Bancaire des ENtreprises |
| credit rating grade | Grade corresponding to the inverse ranking of the qualitative categories of the credit ratings, from 0 to 20 (the latter being attributed to firms with the lower credit risk) Source: FIchier Bancaire des ENtreprises |
| gross profit margin | Computed as: (sales - cost of good sold)/sales Source: FIchier Bancaire des ENtreprises |
| current ratio | Computed as: current assets / current liabilities Source: FIchier Bancaire des ENtreprises |
| leverage ratio | Computed as: financial debt / total assets Source: FIchier Bancaire des ENtreprises |
| Whited-Wu index | External financing constraint measure introduced by Whited and Wu [2006] and computed as: 0.65 - (0.091 * cash flow/total assets) - (0.062 * dummy equal to 1 if firm pays cash dividends) + [0.21 * (long-term debt/total assets)] - [0.044 * ln(total assets/1000)] + (0.102 * $\Delta$ ln sales of 2-digit NACE sector) - (0.035 * $\Delta$ ln sales) Source: FIchier Bancaire des ENtreprises |
| eligible to collateral | Credit rate eligible as collateral by the Eurosystem for banks' refinancing operations Source: FIchier Bancaire des ENtreprises |
| payment default | Trade bill payment default Source: FIchier Bancaire des ENtreprises |

| | |
|---|---|
| *Control variables:* | |
| (ln) total assets | Natural log of total assets<br>Source: FIchier Bancaire des ENtreprises |
| (ln) sales | Natural log of sales<br>Source: FIchier Bancaire des ENtreprises |
| Δ ln sales | Log difference of sales<br>Source: FIchier Bancaire des ENtreprises |
| Δ orders | Variation of annual average of monthly balance of opinion about the evolution of orders received<br>Source: Banque de France manufacturing business survey |
| Δ price raw materials | Variation of annual average of monthly balance of opinion about the evolution of the price of raw materials<br>Source: Banque de France manufacturing business survey |
| Δ ln cost of raw materials | Log difference of cost of raw materials<br>Source: FIchier Bancaire des ENtreprises |
| Δ ln cost of merchandise purchased | Log difference of cost of merchandise purchased<br>Source: FIchier Bancaire des ENtreprises |
| inventory to sales | Computed as: inventory / sales<br>Source: FIchier Bancaire des ENtreprises |
| *Instrument:* | |
| mean OCF ratio by sector*year | mean of operating cash flow ratio of firms in a given sector and year, excluding that of the firm itself<br>Source: FIchier Bancaire des ENtreprises |
| banks capital ratio | for firms with loans registered with only one BIC, its capital ratio; for firms with multiple BICs, average capital ratio weighted by the loan amounts registered with each BIC<br>Source: Credit register, Synthèse activité par opérations et zones géographiques |
| *Other variables:* | |
| Δ ln investment | Log difference of tangible and intangible investment<br>Source: FIchier Bancaire des ENtreprises |
| Δ ln capex | Log difference of fixed asset acquisition minus cessions<br>Source: FIchier Bancaire des ENtreprises |
| CUR above 85% then decrease | Capacity utilization rate above 85% followed by decrease of capacity utilization rate<br>Source: Banque de France manufacturing business survey |
| top decile market share | Dummy equal to 1 if firm's market share is above the 90th centile of the market share distribution in same sector and year<br>Source: FIchier Bancaire des ENtreprises |

| | |
|---|---|
| top quartile market share | Dummy equal to 1 if firm's market share is above the 75th centile of the market share distribution in same sector and year Source: FIchier Bancaire des ENtreprises |
| bottom quartile market share | Dummy equal to 1 if firm's market share is below the 45th centile of the market share distribution in same sector and year Source: FIchier Bancaire des ENtreprises |
| bottom decile market share | Dummy equal to 1 if firm's market share is below the 10th centile of the market share distribution in same sector and year Source: FIchier Bancaire des ENtreprises |

Table 17: Variable definitions and sources.

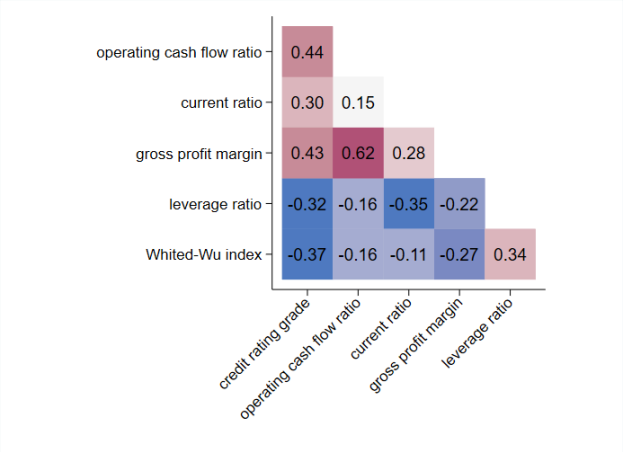
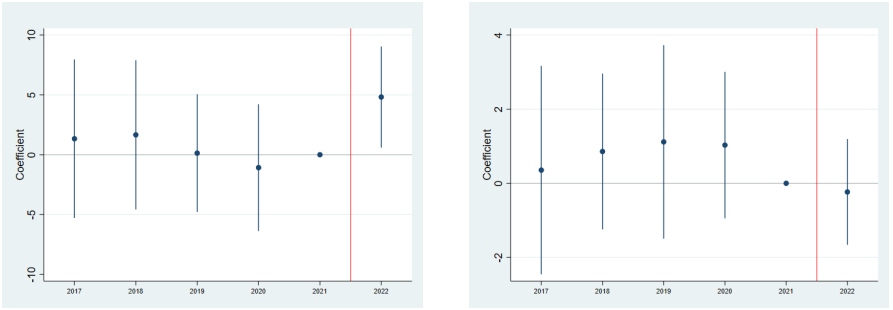



Figure 6: Correlations among quantitative financial constraint proxies.
*Source: Banque de France credit rating and FIBEN.*




(a) price increases (b) price decreases

Figure 7: Pre-trend estimates for price increases (left panel) and for decreases (right panel).
*Source: Banque de France manufacturing business survey and FIBEN.*

| Frequency (%) of: | price increases | | price decreases | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (Ib) | (IIb) |
| lagged OCF ratio below Q1 within sector | 0.806*** | | -0.397*** | |
| | (0.225) | | (0.153) | |
| lagged OCF ratio: Q1-Q3 within sector (ref.) | | | | |
| lagged OCF ratio above Q3 within sector | -0.450** | | 0.614*** | |
| | (0.225) | | (0.166) | |
| lagged OCF ratio below Q1 within sector*year | | 0.811*** | | -0.561*** |
| | | (0.221) | | (0.152) |
| lagged OCF ratio: Q1-Q3 within sector*year (ref.) | | | | |
| lagged OCF ratio above Q3 within sector*year | | -0.668*** | | 0.478*** |
| | | (0.226) | | (0.159) |
| lagged (ln) total assets | -1.669*** | -1.696*** | 0.540 | 0.497 |
| | (0.535) | (0.537) | (0.336) | (0.337) |
| lagged (ln) sales | 1.133* | 1.198* | 1.075** | 1.087** |
| | (0.630) | (0.630) | (0.426) | (0.424) |
| lagged $\Delta$ ln sales | 1.491** | 1.517*** | -0.929** | -0.944** |
| | (0.579) | (0.576) | (0.383) | (0.383) |
| lagged $\Delta$ orders † | 0.884*** | 0.881*** | -0.965*** | -0.962*** |
| | (0.312) | (0.312) | (0.204) | (0.204) |
| $\Delta$ ln cost of raw materials | 1.016*** | 1.030*** | -0.656*** | -0.668*** |
| | (0.337) | (0.337) | (0.215) | (0.215) |
| $\Delta$ ln cost of merchandise purchased | -0.035 | -0.036 | -0.079* | -0.079* |
| | (0.065) | (0.065) | (0.048) | (0.048) |
| $\Delta$ price raw materials † | 26.965*** | 26.962*** | -6.701*** | -6.698*** |
| | (0.643) | (0.643) | (0.412) | (0.412) |
| lagged $\Delta$ price raw materials † | 5.147*** | 5.144*** | -1.481*** | -1.479*** |
| | (0.489) | (0.489) | (0.340) | (0.340) |
| lagged inventory to sales | 1.282 | 1.263 | 1.401 | 1.410 |
| | (1.749) | (1.749) | (1.137) | (1.133) |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,922 | 3,922 | 3,922 |
| N.obs. | 32,230 | 32,230 | 32,230 | 32,230 |
| Adj.$R^2$ | 0.57 | 0.57 | 0.34 | 0.34 |
| Within $R^2$ | 0.16 | 0.16 | 0.03 | 0.03 |

Table 18: Financial constraints and price adjustment: alternative definitions of operating cash flow (OCF) ratio quartiles.
*Source: Banque de France manufacturing business survey and FIBEN.*

| Frequency (%) of : | price increases | | price decreases | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (Ib) | (IIb) |
| ranking by lagged OCF ratio | -2.603*** | | 1.734*** | |
| | (0.445) | | (0.331) | |
| lagged OCF ratio | | -6.394*** | | 4.468*** |
| | | (1.327) | | (0.941) |
| lagged OCF ratio squared | | -5.343 | | 2.002 |
| | | (5.876) | | (4.250) |
| lagged (ln) total assets | -1.834*** | -1.716*** | 0.579* | 0.483 |
| | (0.536) | (0.542) | (0.336) | (0.336) |
| lagged (ln) sales | 1.439** | 1.296** | 0.944** | 1.044** |
| | (0.632) | (0.634) | (0.427) | (0.426) |
| lagged $\Delta$ ln sales | 1.715*** | 1.699*** | -1.063*** | -1.064*** |
| | (0.581) | (0.579) | (0.387) | (0.388) |
| lagged $\Delta$ orders † | 0.871*** | 0.872*** | -0.956*** | -0.956*** |
| | (0.312) | (0.312) | (0.204) | (0.204) |
| $\Delta$ ln cost of raw materials | 1.029*** | 1.025*** | -0.667*** | -0.666*** |
| | (0.337) | (0.337) | (0.215) | (0.215) |
| $\Delta$ ln cost of merchandise purchased | -0.033 | -0.033 | -0.080* | -0.081* |
| | (0.065) | (0.065) | (0.048) | (0.048) |
| $\Delta$ price raw materials † | 26.972*** | 26.969*** | -6.704*** | -6.701*** |
| | (0.643) | (0.643) | (0.412) | (0.413) |
| lagged $\Delta$ price raw materials † | 5.149*** | 5.148*** | -1.482*** | -1.482*** |
| | (0.489) | (0.489) | (0.340) | (0.340) |
| lagged inventory to sales | 0.988 | 1.120 | 1.581 | 1.504 |
| | (1.748) | (1.746) | (1.137) | (1.133) |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| N.firm clusters | 3,922 | 3,922 | 3,922 | 3,922 |
| N.obs. | 32,230 | 32,230 | 32,230 | 32,230 |
| Adj.$R^2$ | 0.57 | 0.57 | 0.34 | 0.34 |
| Within $R^2$ | 0.16 | 0.16 | 0.03 | 0.03 |

Table 19: Financial characteristics and price adjustment: robustness to extreme values of operating cash flow (OCF) ratio.
*Source: Banque de France manufacturing business survey and FIBEN.*

| Frequency (%) of: | price increases | | price decreases | |
|---|---|---|---|---|
| | (Ia) | (IIa) | (Ib) | (IIb) |
| lagged operating cash flow ratio | -7.962*** | -6.483*** | 5.755*** | 5.159*** |
| | (2.247) | (1.840) | (1.756) | (1.647) |
| lagged OCF ratio * period 2010-12 | 2.445 | | -0.072 | |
| | (3.135) | | (2.413) | |
| lagged OCF ratio * period 2021-22 | -3.755 | | -3.148 | |
| | (5.832) | | (2.297) | |
| lagged (ln) total assets | -1.094 | -0.859 | 1.171** | 0.194 |
| | (0.884) | (0.777) | (0.542) | (0.604) |
| lagged (ln) sales | 0.957 | -0.201 | 0.261 | 0.942 |
| | (1.060) | (0.922) | (0.656) | (0.752) |
| lagged $\Delta$ ln sales | 1.483* | 1.665** | -0.572 | -0.285 |
| | (0.882) | (0.750) | (0.647) | (0.728) |
| lagged $\Delta$ orders † | 1.266** | 0.921** | -0.985*** | -1.019*** |
| | (0.534) | (0.448) | (0.334) | (0.369) |
| $\Delta$ ln cost of raw materials | 0.622 | 0.095 | -1.331*** | -1.249*** |
| | (0.578) | (0.516) | (0.341) | (0.367) |
| $\Delta$ ln cost of merchandise purchased | -0.049 | 0.044 | -0.178** | -0.211*** |
| | (0.112) | (0.094) | (0.074) | (0.081) |
| $\Delta$ price raw materials † | 26.952*** | 18.586*** | -7.134*** | -9.060*** |
| | (0.955) | (0.976) | (0.676) | (0.808) |
| lagged $\Delta$ price raw materials † | 4.424*** | 3.654*** | -1.724*** | -1.871*** |
| | (0.748) | (0.700) | (0.551) | (0.612) |
| lagged inventory to sales | -3.193 | 1.616 | 1.950 | 2.353 |
| | (2.860) | (1.937) | (1.894) | (2.229) |
| Firm FE | yes | yes | yes | yes |
| Sector x Year FE | yes | yes | yes | yes |
| Period | 2010-22 | 2010-19 | 2010-22 | 2010-19 |
| N.firm clusters | 1,079 | 1,278 | 1,079 | 1,278 |
| N.obs. | 14,015 | 12,771 | 14,015 | 12,771 |
| Adj.$R^2$ | 0.57 | 0.42 | 0.32 | 0.35 |
| Within $R^2$ | 0.17 | 0.10 | 0.03 | 0.04 |

Table 20: Financial constraints and price adjustment: robustness to subperiods and restricted to 2010-19 in balanced sample.
*Source: Banque de France manufacturing business survey and FIBEN.*

| Frequency (%) of : | price increases | | | | | | |
|---|---|---|---|---|---|---|---|
| | (Ia) | (IIa) | (IIIa) | (IVa) | (Va) | (VIa) | (VIIa) |
| lagged OCF ratio | -6.745*** | -6.339*** | -9.022*** | -5.223*** | -5.835*** | -6.802*** | -7.579*** |
| | (1.283) | (1.246) | (1.295) | (1.124) | (1.127) | (1.155) | (1.196) |
| lagged (ln) total assets | -1.647*** | -1.607*** | 2.158*** | -1.171*** | -0.237 | -2.060*** | -1.235*** |
| | (0.535) | (0.530) | (0.537) | (0.290) | (0.282) | (0.315) | (0.312) |
| lagged (ln) sales | 1.254** | 1.164* | 0.575 | 1.399*** | 0.575* | 2.479*** | 1.753*** |
| | (0.633) | (0.631) | (0.665) | (0.306) | (0.301) | (0.337) | (0.335) |
| lagged Δ ln sales | 1.707*** | 1.151** | 2.898*** | 1.250** | 2.801*** | 1.366** | 3.254*** |
| | (0.580) | (0.559) | (0.570) | (0.552) | (0.526) | (0.540) | (0.540) |
| lagged Δ orders † | 0.871*** | 1.032*** | 0.726** | 2.251*** | 2.261*** | 2.041*** | 2.012*** |
| | (0.312) | (0.301) | (0.312) | (0.325) | (0.320) | (0.326) | (0.336) |
| Δ ln cost of raw materials | 1.028*** | 1.873*** | 3.751*** | 1.257*** | 4.205*** | 2.730*** | 4.823*** |
| | (0.337) | (0.329) | (0.342) | (0.337) | (0.345) | (0.341) | (0.363) |
| Δ ln cost of merchandise purch. | -0.032 | -0.016 | -0.004 | -0.016 | 0.018 | 0.040 | 0.048 |
| | (0.065) | (0.064) | (0.066) | (0.068) | (0.070) | (0.070) | (0.073) |
| Δ price raw materials † | 26.965*** | 28.965*** | 36.949*** | 26.482*** | 36.210*** | 28.407*** | 36.315*** |
| | (0.643) | (0.622) | (0.558) | (0.688) | (0.578) | (0.677) | (0.591) |
| lagged Δ price raw materials † | 5.148*** | 5.798*** | 12.566*** | 4.506*** | 11.074*** | 5.170*** | 11.104*** |
| | (0.489) | (0.473) | (0.428) | (0.574) | (0.471) | (0.557) | (0.478) |
| lagged inventory to sales | 1.109 | -0.608 | 5.045** | 0.375 | 0.530 | -0.024 | 0.153 |
| | (1.746) | (1.768) | (2.006) | (0.903) | (0.896) | (0.911) | (0.901) |
| Firm FE | yes | yes | yes | no | no | no | no |
| Sector | | yes | no | yes | yes | no | no |
| Year | | yes | no | yes | no | yes | no |
| Sector x Year FE | yes | no | no | no | no | no | no |
| N.firm clusters | 3,922 | 3,922 | 3,922 | 3,922 | 3,922 | 3,922 | 3,922 |
| N.obs. | 32,230 | 32,230 | 32,230 | 32,230 | 32,230 | 32,230 | 32,230 |
| Adj.$R^2$ | 0.57 | 0.54 | 0.51 | 0.48 | 0.41 | 0.42 | 0.37 |
| Within $R^2$ | 0.16 | 0.20 | 0.42 | 0.15 | 0.38 | 0.18 | 0.37 |

Table 21: Financial constraints and price increases including different combinations of fixed effects, as well as none. *Source: Banque de France manufacturing business survey and FIBEN.*

| Frequency (%) of : | price decreases | | | | | | |
|---|---|---|---|---|---|---|---|
| | (Ib) | (IIb) | (IIIb) | (IVb) | (Vb) | (VIb) | (VIIb) |
| lagged OCF ratio | 4.600*** | 4.360*** | 4.823*** | 1.738** | 1.706** | 0.090 | -0.077 |
| | (0.934) | (0.905) | (0.919) | (0.882) | (0.837) | (0.892) | (0.893) |
| lagged (ln) total assets | 0.457 | 0.596* | -0.206 | -0.157 | -0.334* | -0.939*** | -1.086*** |
| | (0.334) | (0.338) | (0.317) | (0.210) | (0.196) | (0.226) | (0.223) |
| lagged (ln) sales | 1.059** | 1.144*** | 1.098*** | 0.863*** | 1.034*** | 1.624*** | 1.764*** |
| | (0.425) | (0.415) | (0.405) | (0.217) | (0.204) | (0.246) | (0.243) |
| lagged Δ ln sales | -1.067*** | -1.232*** | -1.470*** | -0.962** | -1.583*** | -1.166*** | -1.616*** |
| | (0.388) | (0.367) | (0.359) | (0.384) | (0.348) | (0.366) | (0.359) |
| lagged Δ orders † | -0.956*** | -0.873*** | -1.156*** | -1.713*** | -1.859*** | -1.854*** | -2.091*** |
| | (0.204) | (0.200) | (0.199) | (0.239) | (0.227) | (0.238) | (0.238) |
| Δ ln cost of raw materials | -0.667*** | -0.803*** | -0.391* | -0.730*** | -0.603*** | -0.727*** | -0.435** |
| | (0.215) | (0.209) | (0.200) | (0.224) | (0.205) | (0.213) | (0.208) |
| Δ ln cost of merchandise purch. | -0.081* | -0.060 | -0.064 | -0.065 | -0.051 | -0.038 | -0.038 |
| | (0.048) | (0.047) | (0.046) | (0.049) | (0.047) | (0.047) | (0.047) |
| Δ price raw materials † | -6.700*** | -7.550*** | -7.092*** | -5.795*** | -6.595*** | -6.503*** | -6.477*** |
| | (0.412) | (0.415) | (0.331) | (0.423) | (0.323) | (0.421) | (0.323) |
| lagged Δ price raw materials † | -1.482*** | -1.574*** | -1.682*** | -0.393 | -0.892*** | -0.435 | -0.799*** |
| | (0.340) | (0.330) | (0.265) | (0.356) | (0.274) | (0.348) | (0.279) |
| lagged inventory to sales | 1.508 | 2.334** | 1.555 | -0.496 | -0.397 | -2.280*** | -2.239*** |
| | (1.133) | (1.124) | (1.121) | (0.692) | (0.675) | (0.639) | (0.641) |
| Firm FE | yes | yes | yes | no | no | no | no |
| Sector | | yes | no | yes | yes | no | no |
| Year | | yes | no | yes | no | yes | no |
| Sector x Year FE | yes | no | no | no | no | no | no |
| N.firm clusters | 3,922 | 3,922 | 3,922 | 3,922 | 3,922 | 3,922 | 3,922 |
| N.obs. | 32,230 | 32,230 | 32,230 | 32,230 | 32,230 | 32,230 | 32,230 |
| Adj.$R^2$ | 0.34 | 0.31 | 0.31 | 0.14 | 0.11 | 0.07 | 0.06 |
| Within $R^2$ | 0.03 | 0.04 | 0.06 | 0.03 | 0.05 | 0.04 | 0.06 |

Table 22: Financial constraints and price decreases including different combinations of fixed effects, as well as none.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Panel A: price increases*

| Frequency (%) of price increases | | | |
|---|---|---|---|
| | (Ia) | (IIa) | (IIIa) |
| | (mostly) | (only) | (share) |
| treatedtime*treatedgroup | 4.693** | 3.623** | 4.758*** |
| | (1.963) | (1.754) | (1.835) |
| Controls | yes | yes | yes |
| Firm FE | yes | yes | yes |
| Sector x Year FE | yes | yes | yes |
| N.firm clusters | 582 | 582 | 618 |
| N.obs. | 2,172 | 2,172 | 2,338 |
| Adj.$R^2$ | 0.64 | 0.64 | 0.64 |
| Within $R^2$ | 0.27 | 0.27 | 0.27 |

*Panel B: price decreases*

| Frequency (%) of price decreases | | | |
|---|---|---|---|
| | (Ib) | (IIb) | (IIIb) |
| | (mostly) | (only) | (share) |
| treatedtime*treatedgroup | -1.281** | -0.961* | -0.663 |
| | (0.628) | (0.545) | (0.572) |
| Controls | yes | yes | yes |
| Firm FE | yes | yes | yes |
| Sector x Year FE | yes | yes | yes |
| N.firm clusters | 582 | 582 | 618 |
| N.obs. | 2,172 | 2,172 | 2,338 |
| Adj.$R^2$ | 0.29 | 0.29 | 0.29 |
| Within $R^2$ | 0.06 | 0.06 | 0.06 |

Table 23: Endogeneity between financial constraints and price adjustment: difference-in-differences approach with alternative assumption.
*Source: Banque de France manufacturing business survey, FIBEN, and M-contran.*

*Sector: Agro-industry*

| Frequency (%) of price | increases (Ia) | decreases (Ib) |
|---|---|---|
| lagged operating cash flow ratio | -14.568*** | 7.211** |
| | (4.465) | (3.179) |
| Controls | yes | yes |
| Firm FE | yes | yes |
| Sector (4-digit NACE) x Year FE | yes | yes |
| N.firm clusters | 615 | 615 |
| N.obs. | 5,079 | 5,079 |
| Adj.$R^2$ | 0.56 | 0.42 |
| Within $R^2$ | 0.15 | 0.05 |

Table 24: Heterogeneity by manufacturing sector: agro-industry sector.
*Notes:* Agro-industry sector defined as 2-digit NACE codes between 10 and 12: manufacture of food products, of beverages, and of tobacco products.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Sector: Wood & paper*

| Frequency (%) of price | increases (Ia) | decreases (Ib) |
|---|---|---|
| lagged operating cash flow ratio | -12.111*** | 10.042** |
| | (4.464) | (3.895) |
| Controls | yes | yes |
| Firm FE | yes | yes |
| Sector (4-digit NACE) x Year FE | yes | yes |
| N.firm clusters | 464 | 464 |
| N.obs. | 3,769 | 3,769 |
| Adj.$R^2$ | 0.62 | 0.34 |
| Within $R^2$ | 0.17 | 0.04 |

Table 25: Heterogeneity by manufacturing sector: wood & paper sector.
*Notes:* Wood & paper sector defined as 2-digit NACE codes between 16 and 18: manufacture of wood, of paper and paper products, as well as printing and reproduction of recorded media.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Sector: Electrical, chemical & pharmaceutical*

| Frequency (%) of price | increases (Ia) | decreases (Ib) |
|---|---|---|
| lagged operating cash flow ratio | -9.407** | 3.659 |
| | (3.799) | (2.669) |
| Controls | yes | yes |
| Firm FE | yes | yes |
| Sector (4-digit NACE) x Year FE | yes | yes |
| N.firm clusters | 524 | 524 |
| N.obs. | 4,229 | 4,229 |
| Adj.$R^2$ | 0.58 | 0.35 |
| Within $R^2$ | 0.19 | 0.03 |

Table 26: Heterogeneity by manufacturing sector: electrical, chemical & pharmaceutical sector.
*Notes:* Electrical, chemical & pharmaceutical sector defined as 2-digit NACE codes between 20 and 21, as well as between 26 and 27: manufacture of chemicals and chemical products, of pharmaceutical products, of computer, electronic and optical products, of electrical equipment.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Sector: Plastic & metal*

| Frequency (%) of price | increases (Ia) | decreases (Ib) |
|---|---|---|
| lagged operating cash flow ratio | -4.008* | 4.872*** |
| | (2.086) | (1.496) |
| Controls | yes | yes |
| Firm FE | yes | yes |
| Sector (4-digit NACE) x Year FE | yes | yes |
| N.firm clusters | 1,207 | 1,207 |
| N.obs. | 10,126 | 10,126 |
| Adj.$R^2$ | 0.58 | 0.32 |
| Within $R^2$ | 0.17 | 0.03 |

Table 27: Heterogeneity by manufacturing sector: plastic & metal sector.
*Notes:* Plastic & metal sector defined as 2-digit NACE codes between 22 and 25: manufacture of rubber and plastic products, of other non-metallic mineral products, of basic metals, of fabricated metal products, except machinery and equipment.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Sector: Machinery & transport equipment*

| Frequency (%) of price | increases (Ia) | decreases (Ib) |
|---|---|---|
| lagged operating cash flow ratio | -5.575** | 2.957* |
| | (2.655) | (1.737) |
| Controls | yes | yes |
| Firm FE | yes | yes |
| Sector (4-digit NACE) x Year FE | yes | yes |
| N.firm clusters | 712 | 712 |
| N.obs. | 5,810 | 5,810 |
| Adj.$R^2$ | 0.54 | 0.26 |
| Within $R^2$ | 0.14 | 0.01 |

Table 28: Heterogeneity by manufacturing sector: machinery & transport equipment sector.
*Notes:* Machinery & transport equipment sector defined as 2-digit NACE codes between 28 and 30, as well as 33: manufacture of machinery and equipment, of motor vehicles, trailers and semi-trailers, of other transport equipment, plus repair and installation of machinery and equipment.
*Source: Banque de France manufacturing business survey and FIBEN.*

*Sector: Clothing, furniture & other*

| Frequency (%) of price | increases (Ia) | decreases (Ib) |
|---|---|---|
| lagged operating cash flow ratio | -2.009 | 0.101 |
| | (3.509) | (1.834) |
| Controls | yes | yes |
| Firm FE | yes | yes |
| Sector (4-digit NACE) x Year FE | yes | yes |
| N.firm clusters | 420 | 420 |
| N.obs. | 3,208 | 3,208 |
| Adj.$R^2$ | 0.50 | 0.18 |
| Within $R^2$ | 0.17 | 0.02 |

Table 29: Heterogeneity by manufacturing sector: clothing, furniture & other sector.
*Notes:* Clothing, furniture & other sector defined as 2-digit NACE codes between 13 and 15, as well as between 31 and 32: manufacture of textiles, of wearing apparel, of leather and related products, of furniture and other.
*Source: Banque de France manufacturing business survey and FIBEN.*