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Abstract

We investigate the relationship between profitability and financial leverage for US listed non-financial corporations by taking into account the degree of product similarity among competing firms, which can drive intense pricing rivalry thus undermining the sustainability of high price-cost mark-ups. We find that in markets characterized by high price-cost mark-ups notwithstanding high product similarity, the relationship between profitability and financial leverage is negative. Instead, in the rest of the markets we find a positive relationship, consistent with the dynamic trade-off theory of corporate finance, whereby firms increase their degree of financial leverage in response to profitability improvements. Not only do firms exposed to comparatively higher degree of product substitutability make less use of financial leverage, but they also rely relatively less on long-term debt. The difference is especially attributable to the period after the great financial crisis.

Key words: Financial leverage, competition, profitability.

JEL classification: D21; G32; L13; L41.

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Introduction

Financial regulators worldwide have frequently raised concerns about the financial stability risks posed by the high levels of financial leverage of non-financial corporations (Goel, 2018).[1] Not only has the issuance of loans to highly leveraged firms reached pre-2008 levels recently, but lending terms have also been loosened.[2] In addition, rather than being used in a productive way, to fund organic growth, most of these proceeds seem to have been used to engineer changes in the corporate liability structure to optimise returns to shareholders, via for instance share buybacks and leveraged-buy-outs (Bank of England, 2018).[3] The concerns about the high levels of corporate leverage have been worsened by the impact of the Covid crisis on the corporate sector.[4]

This paper investigates if, and how, the increased levels of corporate financial leverage can be related to the rising levels of firm mark-ups in the US and other major economies (De Loecker et al., 2020). We test in particular whether over the two decades up to 2017 US listed firms increased their degree of financial leverage following a period of high profitability, defined as high price-cost mark-ups. The (static) trade-off theory suggests that firms should indeed increase their degree of financial leverage in response to profitability improvements, in order to benefit from higher tax-shields. Empirically, though, previous studies find a negative relationship between financial profitability and leverage (Frank and Goyal, 2009). As a potential explanation, Danis et al. (2014) and Frank and Goyal (2015) point out that previous studies may have failed to take into

[1] See, for example, Bloomberg, Fed's Warning on Leveraged Loans Seconded by U.S. Bank Regulator, 03 December 2018, available at https://www.bloomberg.com/news/articles/2018-12-03/fed-s-warning-on-leveraged-loans-seconded-by-u-s-bank-regulator; Financial Times, BoE warns over growth of risky corporate loans, , 17 October 2018, available at https://www.ft.com/content/1cac7c12-d1e7-11e8-a9f2-7574db66bcd5. The French macro-prudential authority intervened to limit banks' concentration risk with regard to highly indebted large French non-financial corporations: see Reuters, France sets limit for bank exposure to corporate debt, 11 May 2018, available at https://www.reuters.com/article/us-france-banking-regulation/france-sets-limit-for-bank-exposure-to-corporate-debt-idUSKBN1IC1ZV. Similarly, the European Central Bank is considering to increase capital requirements for European systemic banks with high exposures to highly leveraged corporate loans: see, Financial Times, ECB threatens banks with capital 'add-ons' over leveraged loan risks, 17 January 2021, available at https://www.ft.com/content/c87dad6b-fc6d-4b4d-9206-1a45a670102d.

[2] See, for example, Financial Times, Janet Yellen sounds alarm over plunging loan standards, 25 October 2018, available at https://www.ft.com/content/04352e76-d792-11e8-a854-33d6f82e62f8.

[3] See, for example, Jamie Powell, Buybacks: free cash didn't always flow, Financial Times, FT Alphaville, 16 April 2020, available at https://ftalphaville.ft.com/2020/04/16/1587024872000/Buybacks--free-cash-didn-t-always-flow/.

[4] See, for example, Sophia M. Friesenhahn and Simon H. Kwan, Risk of Business Insolvency during Coronavirus Crisis, Research from the Federal Reserve Bank of San Francisco, 5 October 2020, available at https://www.frbsf.org/economic-research/files/el2020-30.pdf.

account that firms do not want to continuously adjust their leverage due to financial frictions, such as issuance costs.

We provide another potential explanation for the (average) negative relationship between profitability and leverage. We argue that if firms become less financially constrained, because of higher profit margins, they may aim to reduce their debt, as debt makes them vulnerable to an increase in competition rivalry, as suggested by Bolton and Scharfstein (1990). Furthermore, this pattern should be especially the case in markets where high mark-ups are accompanied by high degree of product homogeneity. The high degree of product homogeneity among the competing firms, and thus substitutability, can entail, despite high margins, a resurgence of competitive rivalry that would tend to erode profit margins, and thus undermine debt serviceability. Whereas, in differentiated markets, the threat of an intensification of competition rivalry eroding high profit margins is less likely. Accordingly, in those markets, we would expect firms to increase their degree of financial leverage in response to profitability improvements, to benefit from higher tax-shields as the trade-off theory suggests. The high levels of leverage of US firms in most markets may thus end up being yet another consequence of the high levels of firm mark-ups identified in recent decades (De Loecker et al., 2020).[5]

Our paper provides several contributions to previous literature. First, we document for the first time the effects of the structurally estimated product market mark-ups, à la de Loecker et al. (2020), on leverage. Previous literature in corporate finance has investigated the relationship between financial profitability and leverage, in light of the trade-off theory of capital structure. As pointed out in De Loecker et al. (2020), firm-level mark-ups are correlated with both market value, dividends and thus profitability. Accordingly, we rely on firm-level mark-ups as capturing firm-level profitability. We show that high recent levels of mark-ups did not lead, on average, to an increase in the financial leverage of US firms over the twenty years before the pandemic struck, consistent with the results of previous literature (Frank and Goyal, 2009, and Danis et al.,

[5] De Loecker et al. (2020) found rising levels of firm mark-ups, defined as firms' revenues relative to their variable costs, in the US from 18 percent in 1980 to 67 percent in 2014. The literature has already investigated whether the higher levels of firm mark-ups (and resulting increase in corporate profits) is linked to the decrease in corporate investment (De Loecker et al., 2020; and Díez et al., 2018) and to the higher reliance on external debt (Gutiérrez, G. and T. Philippon, 2017).

2014). The relationship between mark-ups and leverage is significantly negative and particularly strong in the post-GFC (post-Great Financial Crisis) period.

We show, in a second contribution, that these average results mask a great deal of heterogeneity across markets. To separate markets out, we look at their competitive features. We argue that a period of higher profits could be the result of either a combination of superior efficiency and differentiated product offering, or weakened competition in the relevant market. In the first situation, a firm that takes on an increased level of debt does it from a position of competitive strength, and may not raise concerns about strategic vulnerability (i.e., unlikely to be the target of predation, as in Bolton and Scharfstein, 1990). But the same might not hold true if high profitability appears to be the result of suspended competition rivalry. In markets where consumers exhibit a low preference for variety, in the sense that competitive products are perceived to be closely substitutable, while competing firms experience high mark-ups, on average, there may be a perception of latent intense competitive rivalry.[6] In those markets, if firms become less financially constrained because of higher margins, they may aim to reduce their debt instead, as debt makes them more vulnerable if competition resumes.

We thus try to identify, for the first time, markets that may be vulnerable to an intensification of competition, and define them as those displaying, simultaneously, high levels of mark-ups and high degree of similarity in terms of product description (a proxy for product substitutability/closeness). We show that the effects of profitability on leverage differ dramatically between vulnerable and non-vulnerable markets. Indeed, in non-vulnerable markets, our results show a positive relationship between recent levels of profitability and financial leverage, consistent with the trade-off theory, which posits that firms experiencing high levels of profitability have an incentive to adjust upwards their degree of financial leverage. In contrast, we find that the relationship between recent high levels of profitability and degree of financial leverage is negative in vulnerable markets. Hence, the average negative relationship outlined above, which contradicts the trade-off theory, is driven by vulnerable markets (which constitute less than 20% of our estimationsample).

[6] The presence of high mark-ups in markets subject to a high degree of product homogeneity could be considered normal if this was limited to at most a few leading firms benefiting from superior cost efficiency.

We also find, as a third contribution, striking differences across vulnerable and non-vulnerable markets, in terms of the effect of mark-ups on debt composition. In non-vulnerable markets, firms experiencing high levels of profitability increase their reliance on long-term debt, which is less frequently renewed, and thus cannot be more promptly withdrawn, by the lender. In vulnerable markets, instead, companies rely relatively more on short- rather than on long-term debt following an increase in profitability. This suggests that lenders may be wary of lending long-term to firms operating in vulnerable markets, notwithstanding recent higher levels of profitability. This also suggests that the effects of profitability on the level of leverage may be more likely to be driven by supply, i.e. debtholder-driven, rather than by demand effects.

Finally, we perform a split sample analysis, comparing the results of the pre- and post-GFC sample periods. Lenders adopted a more prudent lending approach in the post-GFC period, as compared to the pre-GFC period (Bank of International Settlements, 2018). If lenders are more cautious, the relationship between profitability-leverage has to be particularly negative when observed high mark-ups are perceived to be at risk. This is confirmed in our empirical results. We find that the reversal of the positive relationship between profitability and leverage, for vulnerable industries, is indeed particularly pronounced in the post-GFC sample period. This is also another piece of evidence pointing at a supply rather than a demand side-effect.

The next section reviews the relevant theoretical and empirical literatures, and develops the hypotheses. Section III outlines the data and methodology used. Section IV presents the results. Section V concludes by discussing policy implications.

II. Hypothesis development

We now develop our hypotheses, building on prior literature. We first summarise the predictions and results of the corporate finance literature investigating the relationship between profitability and leverage. We then explain that, in the presence of competition, the level and type of leverage has strategic effects. As a result, the relationship between profitability and leverage may actually differ across markets, and in particular between

markets whereby sustained levels of profitability can be deemed to be vulnerable due to a the potential for an intensification of competitive rivalry, and those that are not vulnerable. Based on this, we provide hypotheses on the level as well as on the type of debt firms should issue after periods of high profitability.

II.1 Static and dynamic trade-off theories of capital structure

From a corporate finance perspective, the standard prediction under the static trade-off theory of capital structure is that more profitable firms should exhibit a higher degree of leverage. Higher operating profit margins increase the incentives to take on more debt to maximise the benefits from the tax deductibility of paid interest rates. Early empirical evidence, though, pointed in the opposite direction (Fama and French, 2002; Frank and Goyal, 2009; and Graham and Leary, 2011), with more profitable firms tending to have lower leverage ratios, a finding which was more in line with the 'pecking order' theory of capital structure whereby firms prefer to finance their operations with internal funds first (Myers and Majluf, 1984; and Myers, 1984).

However, Danis et al. (2014) and Frank and Goyal (2015) also pointed out that previous studies failed to take into account the fact that firms do not want to continuously adjust their leverage, due to financial frictions such as issuance costs. Firms prefer to wait to move towards their target level of financial leverage until the expected gains are large enough to offset adjustment costs. Hence, there can be periods where financial leverage appears not to keep track with increasing profitability.[7] Under this dynamic approach to the trade-off theory of optimal capital structure,[8] rising profitability can be seen as a forerunner of increases in the level of financial leverage.[9] In this respect, Colla et al.

[7] Eckbo and Kisser (2018) rerun Danis et al. (2014) estimations and showed how the finding of a positive profitability-leverage association is driven by cash-based refinancing events, where firms adjust their leverage upwards by reducing cash holdings, to distribute more dividends and/or repurchase equity. The authors argued that this is not supportive of the dynamic trade-off theory, as firms do not incur transaction costs when using cash holdings (i.e., as opposed to issue new debt). However, firms presumably still face costs when repurchasing equity, so that it makes sense to accumulate enough cash holdings in order to buy back shares in batches rather than adjusting their leverage continuously over time.

[8] See Strebulaev and Whited (2012) for a review of this class of models, whereby managers maximise the unlevered value of firms with the operating cash flow following a geometric Brownian motion process with positive drift. In line with the standard 'real option' setting developed by Dixit (1993), managers factor in the value of a wait-and-see option when deciding whether to incur transaction costs to adjust towards the leverage target. See Abel (2018) for a recent model on optimal leverage as a function of profitability.

[9] Frank and Goyal (2015) found that the adjustment in terms of debt issuance falls short of fully offsetting the increase in the value of equity (both market and book values) in response to the increase in profitability. The authors speculated that this is due to the presence of variable adjustment costs (i.e., on top of fixed

(2012) studied the leverage-buy-outs (LBOs) during the decade before the 2008 financial crisis and confirmed the existence of a positive and significant dynamic relationship between pre-LBO profitability and deal leverage.[10]

II.2 Competition and leverage

We now explain that, in the presence of competition, financial leverage may have strategic effects in the product market, which may, in the first place, affect firm leverage choices. There are actually two different types of arguments. Brander and Lewis (1986), on the one hand, argued that taking on debt can amount to a commitment device to adopt an aggressive strategic stance vis-à-vis other (possibly unlevered) firms, as shareholders benefit from limited liability protection.[11] In a symmetric scenario, the authors showed how this strategic effect would lead oligopolistic firms to take on positive levels of debt. A key assumption in Brander and Lewis (1986) is that, although lenders are foresighted, they cannot design the debt contract strategically by conditioning their ongoing exposure to the competitive performance adopted by the borrowing firm.

In contrast, Bolton and Scharfstein (1990) argued that the leveraged firm is at risk of predation as the unlevered rival anticipates that external funding could be withdrawn in response to poor competitive performance. This is because external creditors cannot tell whether the observed poor profitability of the levered firm is the result of a genuine predatory attack (in which case it would be worth supporting the 'prey' in order to outlast the phase of predation), or due to the comparative inefficiency of the levered firm. Hence, the levered firm should adopt a soft strategic stance, in order to avert a fall in profitability in bad states of the world. This in turn induces the unlevered rivals to adopt a more aggressive strategic stance.

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adjustment costs) which would make a fully-fledged adjustment (i.e., in order to reach the optimal leverage target) too costly. In addition, in line with the findings in Parise (2018), the authors showed how leverage adjustments tend to involve long-term debt maturities rather than short-term ones.

[10] In addition, the authors investigated the split between senior and junior debt, and found that senior leverage, mainly held by banks and institutional investors, significantly increases with profitability and decreases with cash-flow volatility, thus indicating a degree of conservatism. Instead, junior leverage held by high-yield lenders is also positively associated with profitability, but does not depend on the volatility of cash flows.

[11] In general terms, Jensen and Meckling (1976) argued that, with limited liability, the residual claim of the firm's assets by equity-holders or managers is a call option, in that the downside risk is capped whilst the upside gain is not. Hence debt overhang can distort investment via asset substitution (i.e., risk shifting).

The empirical literature is strongly supportive of Bolton and Sharfstein (1990). Kovenock and Phillips (1995), Phillips (1995) and Chevalier (1995) produced evidence indicating that an increase in financial leverage leads the firm in question to subsequently raise its prices (ie, adopt a soft strategic stance); a move that is reciprocated by rival firms, the more so when they too are leveraged. Ovtchinnikov (2010) produced evidence showing that firms respond to an increase in competition, following deregulation, by lowering their leverage.[12] Similarly, Xu (2012) provided evidence of how domestic incumbents react to increased import competition by reducing their leverage through more equity issuance and debt repayment.[13] Dasgupta and Žaldokas (2018) showed that firms reduced their leverage in response to the introduction of leniency programmes, which provide immunity to firms that help antitrust authorities to detect cartels, thus entailing an intensification of competition rivalry going forward. This pattern is consistent with the idea that financial flexibility is valuable under more intense competition.

In terms of debt composition, Boubaker et al. (2018) showed that US firms affected by a large tariff drop, signalling stronger import competition, experience a more significant decrease in the proportion of bank debt in their total debt compared to unaffected firms, where firms with a higher degree of leverage are more reliant on bank debt. In addition, the authors showed that firms exposed to stronger competitive pressure domestically (as captured by the similarity in product descriptions) hold less bank debt and have a lower degree of financial leverage. The authors also found that this effect is particularly pronounced for firms that are financially constrained.

In summary, the empirical literature tends to support the view that high levels of debt weakens firms' competitive stance, so that firms react to a competition threat by reducing their degree of financial leverage. By the same token, firms should not take advantage of improved profitability by increasing their reliance on financial leverage, quite the

[12] Parise (2018) showed how US (full service) incumbent airlines under the threat of new entry by (no-frills) low cost carriers increase their debt maturity, in particular by switching to bank loans (i.e., as opposed to bonds). The increase in debt maturity reduces the risk of refinancing/roll-out failure in case the borrower's future financial performance disappoints because of intensified competition. The author argued that banks are better placed to accommodate this response to an imminent competitive threat thanks to their superior ability to monitor the borrower, that is, in order to avert 'risk-shifting' when expected profitability worsens.

[13] Hoberg et all (2014) found that firms subject to increased competitive threat hoard more cash by constraining their pay-out policy (i.e., less and lower dividends and share repurchases).

opposite indeed. This proposition appears to be at odds with the theoretical proposition and empirical findings under the dynamic trade-off literature of corporate finance that a phase of high profitability leads to an increase in financial leverage.

II.3 Vulnerable vs non-vulnerable markets

To address this apparent inconsistency, we re-examine the relationship between a recent increase in firm-level profitability and current level of financial leverage by introducing a distinction based on mark-ups and product homogeneity in the relevant market. The argument is as follows. A widespread increase in mark-ups in a market subject to a high degree of product homogeneity may be eroded by an intensification in competition rivalry. Therefore, under a high degree of product homogeneity and, thus, substitutability, an improvement in profitability does not necessarily entails a sustainable improvement in expected debt serviceability. Normally, a high degree of product homogeneity should entail a higher degree of pricing rivalry, thus reducing pricing mark-ups. If the relationship between homogeneity and mark-ups is, instead of negative, positive, the market is labelled as vulnerable. In vulnerable markets, firms (and lenders) may be cautious, as observed high mark-ups may be perceived to be at risk. Competition rivalry, which appears to be temporarily suspended, may eventually resume. Thus, an increase in firm-level profitability should not be followed by an increase in the degree of financial leverage. By the same token, firms competing in vulnerable markets should rely more on short rather than on long-term debt, as lenders are less confident that the improvement in profitability is sustainable. On the other hand, short-term debt leaves the borrower more exposed to renewal risk by the lender. Therefore, the increased reliance on short-term debt would be indicative that the lenders' cautiousness is the main (supply-side) driving factor.

Instead, in non-vulnerable markets, a period of higher profits is more likely to be the result of a superior or distinguished product offering, rather than of (potentially short-lived) reduced competition rivalry in the market. In other words, in non-vulnerable markets borrowers and lenders should generally be more relaxed about competition threats going forward. Hence, high profitability shall lead to an increase in financial leverage, as suggested by the dynamic trade-off theory: higher profitability should increase the incentives to take on debt, thanks to the tax deductibility advantage and

given the higher debt serviceability and the resulting lower borrowing costs. An increase in firm-level profitability should thus lead to a corresponding increase in financial leverage and a greater reliance on long-term debt, given that lenders should be less concerned about debt serviceability going forward and, thus, less demanding in terms of debt renegotiation.

It is worth noting that the posited dichotomy between vulnerable and non-vulnerable markets entails that the reduction in financial leverage following an improvement in profitability for firms active in vulnerable markets cannot be explained by the 'pecking order' theory of capital structure. Indeed, it is arguable that that theory should apply more strongly to firms active in non-vulnerable markets, as the improvement in profitability would be seen as more sustainable.

Note that, if lenders are particularly cautious, the relationship between profitability-leverage would have to be particularly negative when observed high mark-ups are perceived to be at risk. Accordingly, in vulnerable markets an increase in firm-level profitability should be followed by a stronger reduction in financial leverage if the lenders are more cautious. As suggested by the Bank of International Settlements (2018), banks became particularly cautious in the post-GFC period: "Recognising the difficulty of disentangling demand and supply drivers, the evidence gathered by the group does not suggest a systematic change in the willingness of banks to lend. But, in line with the objectives of regulatory reform, lenders have become more risk-sensitive and more discriminating across borrowers." [14] We thus expect the reversal of the positive relationship between profitability and leverage, for vulnerable industries, to be particularly pronounced in the post-GFC sample period.

II.4 Hypotheses

[14] Figure A.1 in the Appendix shows that lenders indeed adopted a more prudent lending approach in the post-GFC period, as compared to the pre-GFC period. It is worth noting that, although the trends charted in the graph are based on information collected by the prudential regulator from bank lenders, respondents highlighted that an important factor driving trends in credit risk is the competition for loans between banks and nonbanks, thus entailing that these trends in underwriting standards by bank lenders are indicative of general practices: see, Office of the Comptroller of the Currency - 2016 Survey of Credit Underwriting Practices.

Based on the partition presented above, we put forwards the following testable propositions:

1. In 'vulnerable' markets, i.e. those characterised by a negative relationship between product homogeneity and mark-ups, an increase in firm-level profitability is followed by a reduction in the degree of firm-level financial leverage;
2. instead, in 'non-vulnerable' markets, an increase in firm-level profitability is followed by an increase in the degree of firm-level financial leverage.
3. In 'vulnerable' markets, an increase in firm-level profitability leads to a corresponding increased reliance on short rather than long-term debt (i.e., in terms of proportion of total debt);
4. instead, in 'non-vulnerable' markets, an increase in firm-level profitability leads to a corresponding increased reliance on long rather than short-term debt (i.e., in terms of proportion of total debt).
5. Finally, these effects should be more pronounced in the post-GFC period, as compared to that of the pre-GFC period.

III. Data and Methodology

We now describe the sample, variables and the econometric specification.[15]

Sample. We rely on financial and product market data for US-based, listed non-financial corporations. To this end, we match balance sheet and income statement data from Compustat with the 'product market fluidity' dataset, itself based on Compustat, developed by Hoberg, Phillips, and Prabhala (2014). The firm-level 'fluidity' index is constructed on the basis of a text clustering algorithm which analyses firms' product descriptions included in their Form 10-K statements. The index captures the degree of product similarity across firms, and provides a proxy for the extent of product substitutability. The 'fluidity' dataset covers 13,154 US-based listed non-financial corporations from 1997 to 2017, totalling 107,220 quarterly observations. The total number of observations in Compustat with respect to the same set of 13,154 firms over the same period is 136,105.

[15] A summary of the variable definition and data sources can be found in Table A.1 in the appendix.

Mark-ups and product markets ('clusters'). From Compustat, we also estimate firm specific mark-ups, defined as the ratio of price to marginal cost. Specifically, we use the same methodology applied in De Loecker et al. (2020) and Diez et al. (2018),[16] thus measure variable inputs using "Cost of Goods Sold" (COGS). However, to identify the various sets of competing firms, we rely on the 10-K text-based Fixed Industry Classification (FIC) approach developed by Hoberg and Phillips (2010, 2016), rather than the standard North American Industrial Classification System (NAICS).[17] Specifically, we focus on the classification with 300 'clusters' (Fixed Industry Classification, or 'FIC300').[18]

The descriptive summary statistics of the variables of the final sample of firms are shown in Table 1. Due to the use of a lagged variable, the number of observations shrinks to 74,146 for 12,388 firms over the 1998-2017 period. The average levels of estimated mark-ups are relatively flat during the first decade of the millennium, but increase sharply after the Global Financial Crisis (GFC), as shown in Figure 1. This pattern is similar to the one described in De Loecker et al. (2020).

Leverage. We rely on Compustat data to compute the leverage ratio, given by the ratio of total debt to total assets, both measured in book values. We also calculate the short-term leverage ratio, given by the ratio between short-term debt and total assets; the long-term leverage ratio, given by the ratio between long-term debt and total assets; and the short-term debt proportion, given by the ratio between short-term debt and total debt. Short-term debt comprises notes payable whose maturity is less than one year. As shown in Figure 2, over the sample period the overall leverage ratio decreased after the GFC and increased steadily since then to level higher than before the crisis.

[16] Specifically, we rely on the codes used by Aquilante et al. (2019).
[17] Since we use product market fluidity as an ex ante competition measure, we also use the FIC as an industry classification to calculate mark-ups for consistency's sake. As argued by Hoberg and Phillips (2010, 2016), this approach is more appropriate to analyse the degree of competition rivalry, as it relies on information provided by firms, rather than on information on production process as in the NAICS approach.
[18] Specifically, the 300 industries of FIC300 is most analogous to standard approaches such as 3-digit SIC codes (274 industries) or 4-digit NAICS codes (331 industries). As pointed out by the authors, the actual numbers associated with a cluster assignment do not have economic content beyond their use to identify which firms are in the same cluster.

Vulnerable/non-vulnerable clusters. We identify clusters of competing firms whose current profitability performance might not be perceived to be sustainable over time. A high degree of product similarity, and thus substitutability, as captured by the 'fluidity' index, should entail a higher degree of pricing rivalry, thus undermining the perceived sustainability of pricing mark-ups. Hence, we mark a cluster as vulnerable if the relationship between mark-ups and 'fluidity' is, instead of negative, positive. Specifically, we perform panel-based regressions for each cluster, where firm-specific annual mark-ups are on the left-hand side (*LHS*) and lagged rolling averages of the firm-specific fluidity indices, plus two fixed effects for the current year and the firm in question, are on the right-hand side (*RHS*):

$$Markup_{i,j,t} = \alpha_0 + \alpha_1 \sum_{n=1}^{d} \frac{Fluidity_{i,j,t-n}}{d} + \alpha_2 x_i + \alpha_3 x_t + \varepsilon_{i,j,t} \qquad (1)$$

where i identifies the firm, j the corresponding cluster, t the year, d the number of years taken into account to compute the rolling average of the fluidity index, and x_i and x_t are the corresponding fixed effects.[19]

Based on the number of years used to construct the rolling average (d), we identify vulnerable clusters in three ways.[20] First, vulnerable clusters are identified as those with a statistically significant (at, at least, the 5% level) positive coefficient (α_1) for the lagged three-year rolling 'fluidity' index. Using this approach, we find 34 vulnerableclusters out of the possible 185,[21] corresponding to 18.4% of the total sample. Second, we use five-year rolling averages instead. Based on this approach, wefind 32 vulnerable clusters, which correspond to 17.3% of the total sample. Finally, we narrow the identification to include only those with positive coefficients for both three- and five-year rolling averages. Under this approach, we identify 21 vulnerable clusters, which correspond to 11.4% of the total sample.

[19] It is worth pointing out that this approach identifies a cluster as 'vulnerable' only to the extent that mark-ups tend to increase uniformly across competing firms, notwithstanding high levels of homogeneity. Therefore, clusters with a high 'fluidity' index where the cross-sectional distribution of mark-ups is uneven (i.e., as it would typically be the case when competing firms differ in their level of cost efficiency) are not classified as vulnerable.

[20] Table A.2 in the Appendix shows the estimates and the list of candidate clusters under the three definitions.

[21] We dropped 113 industries with fewer than 50 observations during this estimation procedure.

Figures 1 and 2 compare, respectively, the evolution of average mark-ups and leverage ratios across the sample period between vulnerable and non-vulnerable clusters, using the first definition.[22] Firms in vulnerable and non-vulnerable markets have comparable levels of mark-ups prior to the GFC. But vulnerable markets exhibit a sharp increase in mark-ups after the GFC, while the mark-ups of non-vulnerable markets remain fairly constant. In terms of leverage, vulnerable clusters have comparatively lower leverage ratios across the whole sample period.[23]

Econometric specification. To investigate the relationship between these variables, we perform a regression analysis of the current level of firm specific financial leverage against the lagged three-year rolling average of firm specific mark-ups, as well as an interaction term between mark-ups and a dummy that identifies vulnerable clusters, as well as the usual determinants of leverage and firm and cluster fixed effects. Specifically,

$$\begin{aligned} Leverage\ ratio_{i,j,t} = {} & \alpha_0 + \alpha_1 \sum_{n=1}^{3} \frac{Markup_{i,j,t-n}}{3} + \alpha_2 Vulnerable_j \times \\ & \sum_{n=1}^{3} \frac{Markup_{i,j,t-n}}{3} + \alpha_3 Size_{i,j,t-1} + \alpha_4 HHI_{i,j,t-1} + \alpha_5 Tangibility_{i,j,t-1} + \\ & \alpha_6 Profit\ Risk_{i,j,t-1} + \alpha_7 Cash_{i,j,t-1} + \alpha_8 Market\text{-}to\text{-}book_{i,j,t-1} + \\ & \alpha_9 Leverage\ ratio_{j,t-1} + \alpha_{10} x_i + \alpha_{11} x_t + \alpha_{12} x_j + \varepsilon_{i,j,t} \end{aligned} \quad (2)$$

where indices *i*, *j*, *t* correspond to firm, cluster, and year, respectively, and x_i, x_j and x_t are the corresponding fixed effects. Standard errors are clustered at the industry level.

The dependent variable, $Leverage\ ratio_{i,j,t}$, is a measure of corporate leverage such as the total leverage ratio, long-term leverage ratio, short-term leverage ratio, and short-term debt proportion. $Vulnerable_j$ is a dummy variable that takes the value of one where the corresponding cluster *j* is a vulnerable one, while the vulnerable clusters are defined in three ways, as explained above. This specification allows us to compare the average results (α_2=0) with those of vulnerable/non-vulnerable clusters.

[22] Results are the same under the other two approaches.

[23] The steeper increase in mark-ups in vulnerable clusters is in line with the argument that higher mark-ups are due to increased market power as a result of weakened competition rivalry (De Loecker et al., 2020; and Díez et al., 2018). This trend ought to be more prominent in markets without other legitimate sources of market power such as product differentiation, as it is the case for vulnerable clusters where mark-ups have increased notwithstanding comparatively higher levels of product homogeneity.

In addition to the mark-up and its interaction with vulnerability, we include a set of firm-specific control variables: $Size_{i,j,t-1}$, $HHI_{i,j,t-1}$, $Tangibility_{i,j,t-1}$, $Profit\ Risk_{i,j,t-1}$,[24] $Cash_{i,j,t-1}$, and $Market-to-book_{i,j,t-1}$, which are the ones generally used in previous literature (Boubaker et al., 2018; Danis et al., 2014; Kayhan and Titman, 2007; and Leary and Roberts, 2014). Finally, $Leverage\ ratio_{j,t-1}$ is the value of the average leverage ratio across the relevant cluster in the previous period. The inclusion of the lagged average degree of financial leverage for the corresponding cluster is motivated by the consideration that there can be peer-effects among competing firms seeking to reach what is considered to be a common target in terms of leverage ratio (Leary and Roberts, 2014).[25]

In terms of timeframe, we perform OLS regressions using data for the whole period (i.e. 1998-2017),[26] as well as with the two split samples of the pre- and post-GFC periods (i.e. 1998-2007 and 2008-2017). This distinction aims to capture differences in terms cautiousness, as lenders were forced to adopt a more prudent lending approach in the post-GFC period (Bank for International Settlements, 2018). In a robustness check of the post-GFC period regression, we exclude the data from the crisis period (2008-09, which means that we drop the data of 2008-2011 given the 3 year moving average mark-ups).

IV. Results

IV.1 Effects of mark-ups on total leverage: non-vulnerable vs. vulnerable clusters

This section presents results that are relevant to the first two hypotheses that, respectively, in vulnerable (non-vulnerable) markets, an increase in firm-level profitability is followed by a reduction (increase) in the degree of firm-level financial leverage. Table 2 shows the regression results of the effects of mark-ups on total leverage for the whole sample period. Column 1 shows that, across all the clusters (i.e., using a

[24] Danis, and et al. (2014) use the standard deviation of quarterly operating profits divided by a period of 20 quarters as a variable of risk in the profitability. Given small number of data points due to using annual data, our measure is simply a range, i.e. difference between maximum and minimum of profitability over past five years.

[25] In any case, excluding this term, or the firm-specific controls, from both specifications does not change the results reported in the next section.

[26] Specifically, we adopt the high dimensional fixed effect estimator proposed by Correia (2017).

specification without the interaction term: $\alpha_2 = 0$ in Eq. 2), the mark-up coefficient estimate is negative (i.e. α_1 in Eq. 2). In terms of magnitude, a one standard deviation increase in mark-ups (0.7) leads to a decrease in leverage ratios by 1.01% (=-1.446×0.7). This is equivalent to 4.7% of the average leverage ratio, 21.7%.[27] These findings are consistent with results in previous literature (Frank and Goyal, 2009; Danis et al., 2014).

Columns 2, 3 and 4 show that the relationship between financial leverage and the recent trend in mark-ups differs markedly between vulnerable and non-vulnerable clusters. The coefficient for the main effect (i.e., the non-interacted mark-up term, α_1 in Eq. 2) is positive, but not significant across the three definitions of vulnerable clusters, meaning that firms in non-vulnerable clusters do not significantly change their total leverage ratios in response to changes in mark-ups. The results for the vulnerable clusters are in stark contrast, with negative values for the coefficient of the interacted mark-up term (i.e. α_2 in Eq. 2), and larger (in absolute value) than the main effect. In terms of magnitude, a one standard deviation increase in mark-ups is associated with a reduction in the leverage ratio of between 2.7% to 2.9%, depending on which of the three definitions to identify vulnerable markets is adopted. This implies that firms belonging to vulnerable clusters decrease their total leverage ratios in response to higher mark-ups, consistent with Hypothesis 1.

Notice that if we control for the effect of the crisis by including a GFC dummy, the negative coefficient of the all-cluster results is no longer statistically significant (column 5). But, when separating non-vulnerable and vulnerable clusters, the positive coefficient of the main effect (i.e., the non-interacted mark-up term, α_1 in Eq. 2) becomes significant, across all of the three definitions of vulnerable markets (columns 6, 7 and 8). In line with Hypothesis 2, firms competing in non-vulnerable clusters increase their total leverage ratios in response to higher mark-ups. In terms of magnitudes, a one standard deviation increase in mark-ups leads to increases in the leverage ratio of between 2.1% to 2.4%. This negative effect for the vulnerable clusters holds even when we control for the GFC by including a specific dummy, although the magnitude is reduced to 0.5%.

[27] The average ratio is based on a sample of 73,394 observations, after trimming the top 1% of leverage ratios. Without trimming, the average is 23.2%, based on 74,146 observations.

IV.2 Long-term leverage, short-term leverage and short-term debt proportion

This section present results that are relevant to the third and fourth hypotheses that, respectively, in vulnerable (non-vulnerable) markets, an increase in firm-level profitability leads to a corresponding increased (reduced) reliance on short rather than long-term debt. Specifically, the aim of this section is to shed more light on which component of total leverage firms active in vulnerable markets focus on when adjusting total leverage given a change in mark-ups. Column 1 in Table 3 shows that the results for long-term leverage across the entire sample are similar to those for the total leverage. The estimated mark-up coefficient is again negative and statistically significant. The results for the partitioned clusters are slightly different. Under the first and third definitions of vulnerability, the firm-level long-term leverage ratios for non-vulnerable clusters increase significantly with higher mark-ups (columns 2 and 4) (they were not significant for the total leverage ratios). For vulnerable clusters (under each definition), the coefficients are again negative and significant.

Columns 5 to 8 indicate that changes in the recent trend in mark-ups do not have an impact on the short-term leverage ratio under any specification. Consistent with the results on the long- and short-term leverage, the short-term debt proportion increases significantly following higher mark-ups across all clusters (column 9). The firm-level short-term debt proportions for non-vulnerable clusters are not significantly affected by the mark-ups (columns 10, 11 and 12), which means that Hypothesis 4 is not satisfied. For vulnerable clusters, the coefficients are positive and significant, indicating that an increase in profitability leads to an increased reliance on short-term rather than long-term debt, consistent with Hypothesis 3. A one standard deviation increase in mark-ups leads to increases in the short-term debt proportion of between 2.1% to 2.9%, depending on which of the three definitions of vulnerable markets is considered.

In combination with the results presented above with respect to the long- and short-term leverage, these results indicate that the reduction in total leverage in response to higher mark-ups for firms active in vulnerable markets is driven primarily by a reduction in long-term debt; whereas firms active in non-vulnerable markets are able to increase their long-term leverage following a period of higher mark-ups. These results are indicative that these adjustments are supply-side driven, as firms active in vulnerable markets

would arguably prefer to rely more on long-term debt in order to reduce their exposure to renewal risk.

IV.3 Split sample regressions: pre vs post-GFC

This section presents results that are relevant to the fifth hypothesis the effects posited in the previous four hypotheses should be more pronounced in the post-GFC period, when lenders' underwriting standards were tightened, as compared to that of the pre-GFC period. First, recall that the effect of the mark-up on the total leverage is negative for the whole period (column 1 in Table 2). Table 4 shows that the sign of this mark-up coefficient in the total-leverage regressions are opposite in the two split-sample specifications (i.e., pre- vs post-GFC or 1998-2007 vs. 2008-2017) (columns 1 and 2). While a one standard deviation increase in the lagged 3-year rolling average of mark-ups also leads to a decrease in the total leverage ratio of 1.10% after the GFC (=-1.557×0.7), it leads to an increase of 2.11% before the GFC (=3.02×0.7). The negative sign of the post-GFC period is still in place when we exclude the crisis period (column 3). All of this is consistent with Hypothesis 5.

The positive relationship for non-vulnerable clusters across the whole period, identified in Table 2, is particularly strong before the crisis (columns 4, 7 and 10), while it loses statistical significance over the post GFC period (columns 5, 8 and 11). However, when we drop the crisis period data, the positive significance is restored for all the three definitions of vulnerability and the strength of positive relationship increases up to that of before the crisis for the second and third definitions (columns 6, 9 and 12). This implies that the degree of positive relationship between mark-ups and leverage ratios did not change over the GFC period for non-vulnerable clusters.

As in the whole period, the relationship between mark-ups and leverage after the GFC is negative in vulnerable clusters in contrast to positive or insignificant in non-vulnerable clusters, while the positive relation is stronger in non-vulnerable clusters than in vulnerable clusters before the GFC, except under the first defining criterion for vulnerable clusters. Overall, with split samples, after the GFC the leverage ratio falls, in response to one standard deviation increase in mark-ups, by between -2.3% to -2.4% with the crisis period data included (columns 5, 8, and 11), and -1.2% to -1.4% without it (columns 6, 9,

and 12). In contrast, the relationship before the GFC is positive, but with a long range of sensitivity from 0.3% to 3.5%. This is far weaker than the sensitivities of non-vulnerable clusters, 3.2% to 3.4% except under the first defining criterion, for which the sensitivity range is the same as that of non-vulnerable clusters (columns 4, 7 and 10). It is notable that the relationship changes from positive to negative over the GFC period. Thus, after the GFC firm competing in vulnerable clusters reduced their degree of financial leverage in response to higher mark-ups, while they increased it before the crisis.

IV.4 Extensions

The split sample results for the long-term leverage (Table 5) are similar to those of the total leverage (Table 4). As for the full period results, all the coefficients relative to the short-term leverage ratios are insignificant (Table 6). Accordingly, although the short-term debt proportion is not responsive to an increase in mark-ups for the pre-GFC period, it increases for the post-GFC period (Table 7). This result, together with those for the total and long-term leverage ratios, seem to indicate that the use of financial leverage was restrained in the aftermath of the GFC, not only in terms of overall level, but also with respect to its composition, as the increased proportion of short-term debt entails a less stable structure (i.e., in case it is not renewed). A one standard deviation increase in mark-ups before the GFC corresponds to an increases of between 2.2% to 3.6% in the proportion of short-term debt for vulnerable clusters, whereas it corresponds to a reduction of between 4.8% to 5.1% for non-vulnerable ones. After the GFC, all the coefficients are not statistically significant.

V. Discussion and conclusion

At first scrutiny, the set of results for the whole sample appears to be in contrast with what is posited under the dynamic trade-off theory of corporate finance, whereby firms adjust towards the target optimal level of financial leverage in batches (i.e., due to fixed adjustment costs), so that past levels of high profitability are a precursor for increased levels of financial leverage (Danis et al., 2014; and Frank and Goyal, 2015). However, this approach can mask differences in the way firms adjust their degree of financial leverage in response to recent improvements in profitability, depending on how sustainable the increase in profits is considered to be. In this respect, the potential for intense pricing rivalry due to product homogeneity should arguably invoke a conservative approach from both lenders and firms in their, respectively, lending and borrowing decisions.

By the same token, the finding that firms active in vulnerable markets do not increase their reliance on financial leverage following a period of improved profitability cannot be attributed to the alternative 'pecking order' theory of corporate structure (Myers and Majluf, 1984; and Myers, 1984), positing that firms should rely first of all on internal sources of finance. This is because, if any, it is firms that do not face a threat of intensified competitive rivalry, thus making a profitability improvement more sustainable, that should be expected to rely more on internal financing. However, our finding that firms active in non-vulnerable markets increase their reliance on financial leverage following a period of improved profitability points in the opposite direction.

From the supply-side (i.e., in the lending market), lenders are likely to be more cautious when observed high mark-ups are perceived to be at risk. This is because they have concerns that competition rivalry, which appears to be temporarily suspended, eventually resumes as a result of increased leverage. This could be because the common use of financial leverage induces rival firms to behave more aggressively (i.e., as in Brander and Lewis, 1986). Alternatively, a price war could be triggered by unlevered firms intent on forcing levered rivals out of the market (i.e., as in Bolton and Scharfstein, 1990). This second theoretical insight is also relevant from the demand-side, in that firms would be wary about taking on too much debt, as it may expose them to predation.

Our analysis based on the identification of markets whose profit fundamentals might be deemed questionable, in the sense that firms' ability to set high price-cost mark-ups could be undermined in light of the comparatively higher degree of product homogeneity, provides supportive evidence for this subtler view. First of all, the positive coefficient in case of normal (i.e. non-vulnerable) clusters is in line with the dynamic trade-off theory of corporate finance whereby rising profitability is a forerunner of leverage increases. That is to say, the validity of this tenet of corporate finance is restored once the effect attributable to vulnerable clusters is singled out. By the same token, our results entail that the negative relationship found under the generic specification and over the full period sample is driven by the effect attributable to a minority of clusters (less than 20%). In terms of time period, the reversal of the sign for the lagged mark-ups coefficient is mainly concentrated over the post-GFC period.

We can only speculate on whether the negative relationship between the recent trend in profitability and changes in the use of financial leverage is mainly driven by the demand-side or the supply-side factors. However, the finding that firms in vulnerable clusters rely comparatively less on long-term debt, especially during the post-GFC period, is consistent with the idea that lenders and debt holders mitigate credit risk by shortening the maturity of their exposure to firms competing in markets where pricing rivalry appears to be suspended.

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Tables and Figures

Table 1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Mark-up	74,146	1.31	0.71	0.00	8.84
Leverage ratio	74,146	23.20	29.33	0.00	2424.29
Long-term leverage ratio	73,923	18.15	24.39	0.00	2105.97
Short-term leverage ratio	74,030	2.55	13.50	0.00	2424.29
Short-term debt proportion	60,709	13.44	27.40	0.00	100.00
Cluster Average Leverage	74,146	23.20	11.05	5.89	58.88
Size	74,146	5.56	2.25	-6.91	13.12
HHI	74,146	1990.14	1788.38	209.77	10000.00
Tangibility	74,146	22.92	24.35	0.00	100.00
Profit Risk	55,978	19.71	71.05	0.03	9116.51
Cash	74,091	17.55	20.88	0.00	99.63
Market-to-book	74,092	1.54	2.14	0.00	203.31
Fluidity	73,575	7.29	3.64	0.30	25.17

Figure 1: Average mark-ups: overall, vulnerable and non-vulnerable clusters

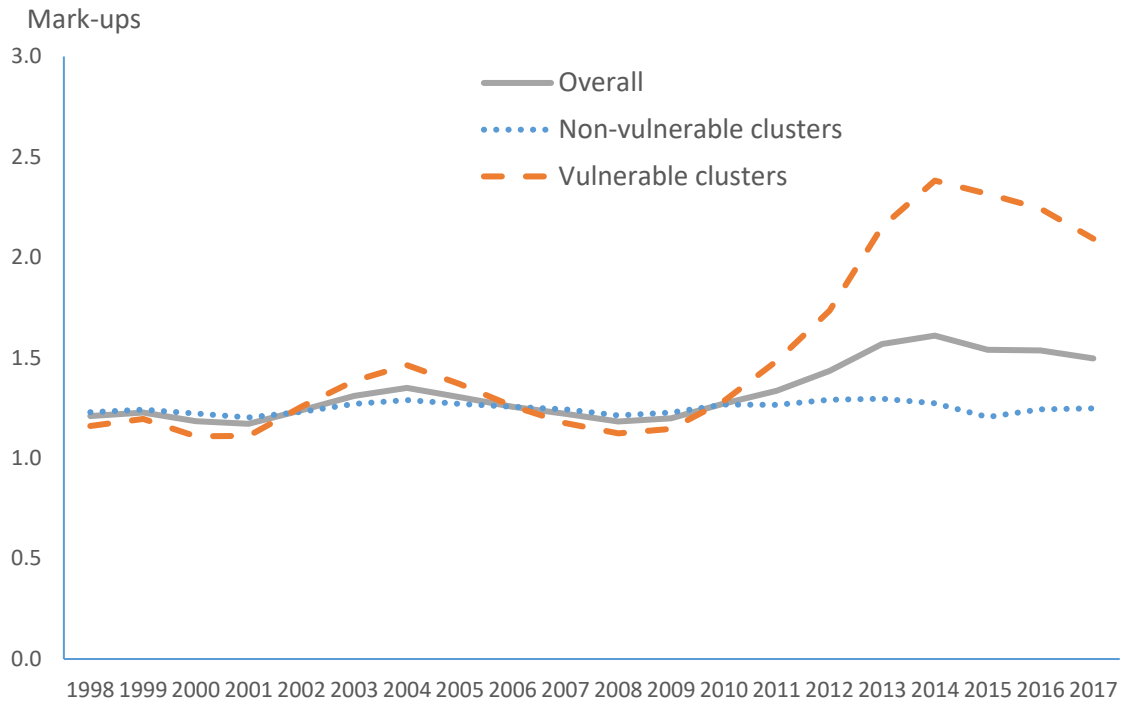


Figure 2: Average leverage ratios: overall, vulnerable and non-vulnerable clusters

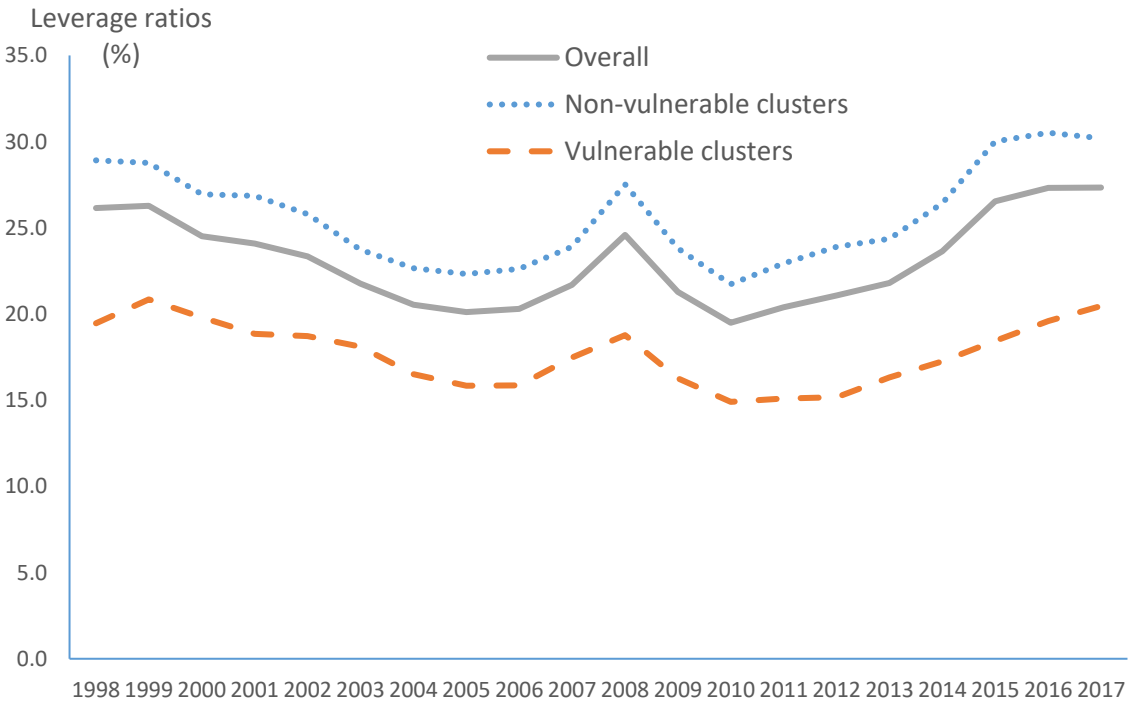


Table 2: Effects of mark-ups on total leverage ratios (full sample period)

Dependent: Total leverage ratios	Without GFC dummy				With GFC dummy			
	All clusters	Vulnerable and Non-vulnerable clusters			All clusters	Vulnerable and Non-vulnerable clusters		
Mark-up (t-1)	-1.446***	2.240	1.890	1.938	-0.280	3.422**	2.895*	2.935*
	(0.439)	(1.415)	(1.347)	(1.335)	(0.513)	(1.648)	(1.555)	(1.534)
Mark-up×Vulnerable1 (t-1)		-4.124***				-4.135**		
		(1.364)				(1.648)		
Mark-up×Vulnerable2 (t-1)			-3.808***				-3.608**	
			(1.298)				(1.544)	
Mark-up×Vulnerable3 (t-1)				-3.877***				-3.668**
				(1.283)				(1.918)
Size (t-1)	-0.008	-0.021	-0.046	-0.043	1.168	0.784	-0.177	-1.592
	(0.940)	(0.944)	(0.939)	(0.940)	(0.924)	(1.204)	(1.094)	(1.042)
HHI (t-1)	-0.000	-0.000	-0.000	-0.000	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility (t-1)	0.042	0.031	0.030	0.029	0.019	0.021	0.018	0.064
	(0.030)	(0.031)	(0.031)	(0.031)	(0.033)	(0.103)	(0.042)	(0.084)
Profit Risk (t-1)	0.069***	0.072***	0.072***	0.072***	0.067***	0.085	0.083**	0.047
	(0.025)	(0.025)	(0.025)	(0.025)	(0.026)	(0.081)	(0.033)	(0.045)
Cash (t-1)	-0.143***	-0.142***	-0.142***	-0.142***	-0.143***	-0.153***	-0.154***	-0.092**
	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)	(0.053)	(0.023)	(0.042)
Market_to-book (t-1)	0.330	0.329	0.341	0.340	0.443	1.345	0.409	0.179
	(0.337)	(0.337)	(0.336)	(0.336)	(0.337)	(0.939)	(0.392)	(0.801)
Cluster average leverage (t-1)	0.373***	0.379***	0.377***	0.376***	0.420***	0.429***	0.427***	0.427***
	(0.057)	(0.057)	(0.058)	(0.058)	(0.055)	(0.055)	(0.056)	(0.057)
GFC dummy					-0.680**	-0.733**	-0.734**	-0.743**
					(0.303)	(0.297)	(0.300)	(0.300)
Constant	15.941**	13.338**	13.614**	13.352**	6.694	4.127	4.452	4.208
	(6.561)	(6.596)	(6.586)	(6.593)	(6.371)	(6.139)	(6.195)	(6.192)
R-sqr	0.728	0.728	0.728	0.728	0.725	0.725	0.725	0.725
adjusted-R-sqr	0.685	0.686	0.686	0.686	0.682	0.682	0.682	0.682
R-sqr-within	0.030	0.031	0.031	0.031	0.037	0.037	0.037	0.037
F	23.2	49.8	44.9	45.4	24.3	29.6	25.1	31.5
p_value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
No_of_obs	36861	36861	36861	36861	36861	36861	36861	36861
Firm Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effect	Y	Y	Y	Y	N	N	N	N
Industry Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) Total leverage ratio = total leverage / total asset (in per cent). 2) Mark-ups are estimated using De Loecker et al. (2020) and Diez, Leigh, and Tambudlertchai (2018). The number of industries is 300 which is from Fixed Industry Classification in Hoberg and Phillips (2010&2016). Then, 3 year moving average of mark-ups is used as a main control variable.

3) Vulnerable 1/2 clusters are the clusters with a positive relationship between fluidity (past three/five year average) and mark-ups based on within cluster regressions. Vulnerable 3 clusters are clusters which belong to both vulnerable 1 and vulnerable 2 clusters. GFC dummy is 1 for 2008-2012 (not just the crisis period of 2008-09) and 0 for the other years, considering a lagged three year average mark-up variable.

4) *, **, and *** imply p-value < 0.10, p-value <0.05, p-value <0.01, respectively. Standard errors clustered at the industry level are in parentheses.

Table 3: Effects of mark-ups on long-term leverage, short-term leverage, and short-term proportion (full sample period)

Dependent variable:	Long-term leverage ratios				Short-term leverage ratios				Short-term debt proportion			
	All clusters	Vulnerable and Non-vulnerable clusters			All clusters	Vulnerable and Non-vulnerable clusters			All clusters	Vulnerable and Non-vulnerable Clusters		
Mark-up (t-1)	-1.548***	2.570**	1.926	2.054*	0.102	0.124	0.282	0.193	2.544***	-1.209	-0.207	-0.554
	(0.434)	(1.100)	(1.201)	(1.187)	(0.064)	(0.551)	(0.505)	(0.492)	(0.411)	(1.492)	(1.544)	(1.474)
Mark-up×Vulnerable1 (t-1)		-4.606***				-0.025				4.097***		
		(1.095)				(0.563)				(1.467)		
Mark-up×Vulnerable2 (t-1)			-3.964***				-0.205				3.043**	
			(1.197)				(0.517)				(1.505)	
Mark-up×Vulnerable3 (t-1)				-4.126***				-0.104				3.439**
				(1.180)				(0.506)				(1.438)
Size (t-1)	0.379	0.365	0.340	0.342	-0.443**	-0.443**	-0.445**	-0.444**	-1.018*	-1.030*	-1.005*	-1.009*
	(0.898)	(0.902)	(0.895)	(0.896)	(0.223)	(0.224)	(0.225)	(0.225)	(0.608)	(0.614)	(0.607)	(0.607)
HHI (t-1)	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility (t-1)	0.053**	0.041	0.041	0.040	0.000	0.000	-0.000	-0.000	-0.004	0.007	0.005	0.007
	(0.026)	(0.027)	(0.027)	(0.027)	(0.011)	(0.011)	(0.011)	(0.011)	(0.029)	(0.029)	(0.028)	(0.029)
Profit Risk (t-1)	0.018***	0.022***	0.021***	0.021***	0.024	0.024	0.025	0.025	0.004	-0.001	0.000	-0.000
	(0.007)	(0.007)	(0.007)	(0.007)	(0.017)	(0.017)	(0.017)	(0.017)	(0.018)	(0.019)	(0.019)	(0.019)
Cash (t-1)	-0.094***	-0.093***	-0.093***	-0.093***	-0.039***	-0.039***	-0.039***	-0.039***	-0.055*	-0.055*	-0.055*	-0.055*
	(0.011)	(0.011)	(0.011)	(0.011)	(0.008)	(0.008)	(0.008)	(0.008)	(0.031)	(0.031)	(0.031)	(0.031)
Market_to-book (t-1)	0.488	0.486	0.499	0.498	0.113	0.113	0.114	0.114	-0.193	-0.193	-0.204	-0.205
	(0.325)	(0.325)	(0.324)	(0.324)	(0.097)	(0.097)	(0.098)	(0.098)	(0.182)	(0.182)	(0.180)	(0.180)
Cluster average leverage(t-1)	0.270***	0.276***	0.273***	0.273***	0.038	0.038	0.038	0.038	-0.019	-0.026	-0.023	-0.023
	(0.042)	(0.042)	(0.043)	(0.043)	(0.024)	(0.024)	(0.024)	(0.024)	(0.030)	(0.029)	(0.029)	(0.029)
Constant	11.108*	8.199	8.684	8.351	3.949***	3.933***	3.823***	3.879***	16.586***	19.530***	18.680***	19.193***
	(5.837)	(5.855)	(5.884)	(5.892)	(1.321)	(1.382)	(1.371)	(1.370)	(4.705)	(4.943)	(4.952)	(4.952)
R-sqr	0.749	0.750	0.750	0.750	0.521	0.521	0.521	0.521	0.675	0.675	0.675	0.675
adjusted-R-sqr	0.710	0.710	0.710	0.710	0.446	0.446	0.446	0.446	0.619	0.619	0.619	0.619
R-sqr-within	0.020	0.022	0.021	0.021	0.008	0.008	0.008	0.008	0.005	0.006	0.005	0.006
F	21.3	65.5	54.8	53.9	6.8	8.0	6.9	7.3	9.1	25.3	32.1	29.5
p_value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
No_of_obs	36751	36751	36751	36751	36821	36821	36821	36821	30134	30134	30134	30134
Firm Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) Long term leverage ratio = long term debt / total asset (in per cent). Long-term debt represents debt obligations due more than one year. Short-term leverage ratio = short-term debt / total asset (in per cent). Short-term debt represents the total amount of short-term notes, so-called 'notes payable.'.Short-term debt proportion = short-term debt / total debt (in per cent). Mark-up is based on past three year average. 2) and 4) are the same as those of table 2 above. 3) Vulnerable 1/2 clusters are the clusters with a positive relationship between fluidity (past three/five year average) and mark-ups based on within cluster regressions. Vulnerable 3 clusters are clusters which belong to both vulnerable 1 and vulnerable 2 clusters.

Table 4: Effects of mark-ups on total leverage ratios (split sample periods)

	Before GFC	**After GFC**	**After GFC (exc. GFC)**	**Before GFC**	**After GFC**	**After GFC (exc. GFC)**	**Before GFC**	**After GFC**	**After GFC (exc. GFC)**	**Before GFC**	**After GFC**	**After GFC (exc. GFC)**
Mark-up (t-1)	3.021*	-1.577***	-1.315***	4.930***	1.559	4.683*	4.622***	1.488	5.554**	4.923***	1.659	5.818**
	(1.571)	(0.294)	(0.502)	(1.800)	(1.332)	(2.747)	(1.590)	(1.190)	(2.685)	(1.557)	(1.164)	(2.615)
Mark-up×Vulnerable1 (t-1)				-3.602	-3.300**	-6.438**						
				(2.211)	(1.436)	(2.791)						
Mark-up×Vulnerable2 (t-1)							-3.673*	-3.255**	-7.458***			
							(2.055)	(1.323)	(2.744)			
Mark-up×Vulnerable3 (t-1)										-4.539**	-3.445***	-7.767***
										(1.918)	(1.300)	(2.668)
Size (t-1)	-1.520	1.180	0.956	-1.553	1.147	-1.553	-1.568	1.131	0.838	-1.592	1.133	-0.140
	(1.054)	(0.985)	(1.244)	(1.048)	(0.982)	(1.048)	(1.047)	(0.979)	(1.221)	(1.042)	(0.979)	(1.099)
HHI (t-1)	0.000	-0.000	0.000	0.000	-0.000	0.000	0.000	-0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility (t-1)	0.064	0.038	0.046	0.065	0.027	0.065	0.065	0.025	0.026	0.064	0.024	0.019
	(0.084)	(0.047)	(0.108)	(0.084)	(0.048)	(0.084)	(0.084)	(0.049)	(0.103)	(0.084)	(0.049)	(0.042)
Profit Risk (t-1)	0.046	0.062	0.077	0.047	0.065	0.047	0.047	0.065	0.084	0.047	0.065	0.084**
	(0.045)	(0.039)	(0.080)	(0.045)	(0.040)	(0.045)	(0.045)	(0.040)	(0.081)	(0.045)	(0.040)	(0.033)
Cash (t-1)	-0.091**	-0.124***	-0.156***	-0.091**	-0.123***	-0.091**	-0.092**	-0.124***	-0.153***	-0.092**	-0.124***	-0.153***
	(0.042)	(0.017)	(0.053)	(0.042)	(0.017)	(0.042)	(0.042)	(0.017)	(0.053)	(0.042)	(0.018)	(0.022)
Market_to-book (t-1)	0.180	0.625**	1.337	0.173	0.624**	0.173	0.182	0.631**	1.322	0.179	0.631**	0.393
	(0.802)	(0.314)	(0.939)	(0.801)	(0.311)	(0.801)	(0.801)	(0.310)	(0.939)	(0.801)	(0.310)	(0.392)
Industry average leverage(t-1)	0.155**	0.383***	0.402***	0.165**	0.388***	0.422***	0.165**	0.386***	0.418***	0.166**	0.387***	0.416***
	(0.078)	(0.076)	(0.123)	(0.081)	(0.077)	(0.131)	(0.082)	(0.076)	(0.128)	(0.082)	(0.076)	(0.127)
Constant	21.411***	8.760	8.739	20.529***	6.581	4.415	20.804***	6.605	3.751	20.562***	6.278	3.275
	(7.415)	(7.908)	(8.099)	(7.489)	(7.947)	(8.446)	(7.502)	(7.868)	(8.314)	(7.498)	(7.874)	(8.276)
R-sqr	0.795	0.780	0.776	0.795	0.780	0.777	0.795	0.780	0.777	0.795	0.780	0.777
adjusted-R-sqr	0.731	0.735	0.697	0.731	0.735	0.697	0.731	0.735	0.697	0.731	0.735	0.697
R-sqr-within	0.012	0.029	0.023	0.013	0.029	0.024	0.013	0.029	0.025	0.013	0.030	0.025
F	2.5	25.2	7.0	2.8	30.0	11.9	2.8	29.8	13.1	2.9	28.8	12.9
p_value	0.013	0.000	0.000	0.005	0.000	0.000	0.004	0.000	0.000	0.003	0.000	0.000
No_of_obs	15314	21040	9519	15314	21040	9519	15314	21040	9519	15314	21040	9519
Firm Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) Total leverage ratio = total leverage / total asset (in per cent). Mark-up is based on past three year average. 2) and 4) are the same as those of table 2 above.
3) Vulnerable 1/2 clusters are the clusters with a positive relationship between fluidity (past three/five year average) and mark-ups based on within cluster regressions. Vulnerable 3 clusters are clusters which belong to both vulnerable 1 and vulnerable 2 clusters. We assume that GFC period is 2008-2009. Given lagged 3 year moving average mark-up, we exclude the data of 2008-2012 for after-GFC period sample analysis.

Table 5: Effects of mark-ups on long-term leverage ratios (split sample periods)

	Before GFC	**After GFC**	**After GFC (exc. GFC)**	**Before GFC**	**After GFC**	**After GFC (exc. GFC)**	**Before GFC**	**After GFC**	**After GFC (exc. GFC)**	**Before GFC**	**After GFC**	**After GFC (exc. GFC)**
Mark-up (t-1)	1.639	-1.700***	-1.598**	4.449***	2.087	4.684***	3.765***	1.962	5.834***	4.164***	2.097*	6.072***
	(1.661)	(0.238)	(0.630)	(1.555)	(1.307)	(1.525)	(1.375)	(1.192)	(1.885)	(1.370)	(1.167)	(1.859)
Mark-up×Vulnerable1 (t-1)				-5.305**	-3.984***	-6.395***						
				(2.108)	(1.387)	(1.671)						
Mark-up×Vulnerable2 (t-1)							-4.874**	-3.889***	-7.717***			
							(2.014)	(1.285)	(2.035)			
Mark-up×Vulnerable3 (t-1)										-6.023***	-4.041***	-7.998***
										(1.890)	(1.262)	(2.008)
Size (t-1)	-1.298	1.394*	0.336	-1.346	1.355	-1.346	-1.362	1.336	1.918***	-1.394	1.340	0.309
	(1.112)	(0.841)	(0.981)	(1.101)	(0.838)	(1.101)	(1.098)	(0.831)	(0.700)	(1.089)	(0.832)	(0.982)
HHI (t-1)	0.000	-0.000	0.000	0.000	-0.000	0.000	0.000	-0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility (t-1)	0.083	0.041	0.041	0.084	0.028	0.084	0.084	0.026	-0.014	0.083	0.025	0.028
	(0.087)	(0.030)	(0.037)	(0.087)	(0.031)	(0.087)	(0.087)	(0.031)	(0.049)	(0.087)	(0.031)	(0.037)
Profit Risk (t-1)	-0.008	0.021***	0.019*	-0.007	0.025***	-0.007	-0.007	0.024***	0.039***	-0.007	0.025***	0.025**
	(0.022)	(0.006)	(0.010)	(0.022)	(0.007)	(0.022)	(0.022)	(0.007)	(0.010)	(0.022)	(0.007)	(0.011)
Cash (t-1)	-0.021	-0.102***	-0.096***	-0.022	-0.102***	-0.022	-0.022	-0.102***	-0.099**	-0.022	-0.102***	-0.093***
	(0.034)	(0.024)	(0.016)	(0.034)	(0.024)	(0.034)	(0.034)	(0.024)	(0.049)	(0.034)	(0.024)	(0.016)
Market_to-book (t-1)	0.418	0.679**	0.548	0.408	0.678**	0.408	0.420	0.686**	1.297	0.417	0.686**	0.549
	(0.733)	(0.269)	(0.351)	(0.732)	(0.267)	(0.732)	(0.732)	(0.265)	(0.892)	(0.732)	(0.264)	(0.351)
Industry average leverage(t-1)	0.122	0.253***	0.270***	0.136*	0.259***	0.240***	0.134*	0.257***	0.237***	0.136*	0.257***	0.235***
	(0.075)	(0.047)	(0.051)	(0.077)	(0.047)	(0.056)	(0.078)	(0.047)	(0.054)	(0.078)	(0.047)	(0.054)
Constant	17.204**	6.574	11.882**	15.902**	3.943	-0.719	16.397**	4.001	-1.583	16.075**	3.664	-2.048
	(7.381)	(6.100)	(5.823)	(7.412)	(6.204)	(4.798)	(7.407)	(6.188)	(4.939)	(7.397)	(6.214)	(4.929)
R-sqr	0.795	0.811	0.746	0.795	0.812	0.838	0.795	0.812	0.838	0.795	0.812	0.838
adjusted-R-sqr	0.731	0.773	0.689	0.731	0.773	0.780	0.731	0.773	0.781	0.731	0.773	0.781
R-sqr-within	0.006	0.025	0.019	0.007	0.027	0.022	0.007	0.027	0.024	0.007	0.027	0.024
F	1.7	28.9	10.2	2.6	47.2	19.2	2.9	45.0	17.6	3.3	44.7	16.7
p_value	0.099	0.000	0.000	0.009	0.000	0.000	0.003	0.000	0.000	0.001	0.000	0.000
No_of_obs	15272	20972	9484	15272	20972	9484	15272	20972	9484	15272	20972	9484
Firm Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1)) Long term leverage ratio = long term debt / total asset (in per cent). Long-term debt represents debt obligations due more than one year. Mark-up is based on past three year average. 2) and 4) are the same as those of table 2 above. 3) Vulnerable 1/2 clusters are the clusters with a positive relationship between fluidity (past three/five year average) and mark-ups based on within cluster regressions. Vulnerable 3 clusters are clusters which belong to both vulnerable 1 and vulnerable 2 clusters. We assume that GFC period is 2008-2009. Given lagged 3 year moving average mark-up, we exclude the data of 2008-2012 for after-GFC period sample analysis.

Table 6: Effects of mark-ups on short-term leverage ratios (split sample periods)

	Before GFC	After GFC	After GFC (exc. GFC)	Before GFC	After GFC	After GFC (exc. GFC)	Before GFC	After GFC	After GFC (exc. GFC)	Before GFC	After GFC	After GFC (exc. GFC)
Mark-up (t-1)	0.121	0.153	0.277	-0.545	0.417	2.675	-0.282	0.396	2.234	-0.386	0.363	2.153
	(0.452)	(0.116)	(0.304)	(0.699)	(0.928)	(2.845)	(0.654)	(0.838)	(2.599)	(0.650)	(0.824)	(2.515)
Mark-up×Vulnerable1 (t-1)				1.256	-0.278	-2.575						
				(0.915)	(0.881)	(2.811)						
Mark-up×Vulnerable2 (t-1)							0.923	-0.258	-2.125			
							(0.858)	(0.796)	(2.567)			
Mark-up×Vulnerable3 (t-1)										1.210	-0.223	-2.043
										(0.865)	(0.784)	(2.483)
Size (t-1)	-0.366	-0.248	-0.598	-0.354	-0.250	-0.354	-0.354	-0.251	-0.646	-0.347	-0.251	-0.531*
	(0.498)	(0.270)	(0.685)	(0.504)	(0.274)	(0.504)	(0.505)	(0.276)	(0.701)	(0.506)	(0.275)	(0.288)
HHI (t-1)	-0.000	0.000	0.000	-0.000	0.000	-0.000	-0.000	0.000	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility (t-1)	0.003	0.021	0.081	0.003	0.020	0.003	0.003	0.020	0.073	0.003	0.020	0.013
	(0.023)	(0.025)	(0.083)	(0.023)	(0.024)	(0.023)	(0.023)	(0.024)	(0.077)	(0.023)	(0.024)	(0.016)
Profit Risk (t-1)	0.009	0.033	0.066	0.009	0.033	0.009	0.009	0.033	0.069	0.009	0.033	0.026
	(0.008)	(0.036)	(0.071)	(0.008)	(0.037)	(0.008)	(0.008)	(0.037)	(0.074)	(0.008)	(0.037)	(0.025)
Cash (t-1)	-0.040*	-0.026**	-0.026	-0.040*	-0.025**	-0.040*	-0.040*	-0.026**	-0.025	-0.040*	-0.026**	-0.038***
	(0.021)	(0.010)	(0.028)	(0.021)	(0.010)	(0.021)	(0.021)	(0.010)	(0.027)	(0.021)	(0.010)	(0.012)
Market_to-book (t-1)	0.007	0.275	0.603	0.009	0.275	0.009	0.006	0.275	0.597	0.007	0.275	0.186
	(0.102)	(0.258)	(0.616)	(0.102)	(0.258)	(0.102)	(0.102)	(0.259)	(0.609)	(0.102)	(0.259)	(0.128)
Industry average leverage(t-1)	-0.002	0.063	0.116	-0.005	0.063	0.124	-0.004	0.063	0.121	-0.005	0.063	0.120
	(0.010)	(0.054)	(0.128)	(0.010)	(0.054)	(0.133)	(0.010)	(0.054)	(0.130)	(0.010)	(0.054)	(0.130)
Constant	4.840	0.716	-0.985	5.149*	0.533	-2.712	4.993*	0.545	-2.404	5.067*	0.555	-2.420
	(3.100)	(1.445)	(3.268)	(2.961)	(1.758)	(4.925)	(2.979)	(1.706)	(4.760)	(2.953)	(1.725)	(4.780)
R-sqr	0.636	0.596	0.575	0.636	0.596	0.575	0.636	0.596	0.575	0.636	0.596	0.575
adjusted-R-sqr	0.523	0.514	0.423	0.523	0.514	0.423	0.523	0.514	0.423	0.523	0.514	0.423
R-sqr-within	0.004	0.010	0.023	0.004	0.010	0.024	0.004	0.010	0.024	0.004	0.010	0.024
F	1.2	1.7	0.2	3.0	2.5	0.5	2.4	2.4	0.6	2.9	2.4	0.6
p_value	0.292	0.091	0.995	0.002	0.011	0.887	0.015	0.015	0.802	0.003	0.013	0.825
No_of_obs	15296	21017	9510	15296	21017	9510	15296	21017	9510	15296	21017	9510
Firm Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) Short-term leverage ratio = short-term debt / total asset (in per cent). Short-term debt represents the total amount of short-term notes, so-called 'notes payable.' Mark-up is based on past three year average. 2) and 4) are the same as those of table 2 above. 3) Vulnerable 1/2 clusters are the clusters with a positive relationship between fluidity (past three/five year average) and mark-ups based on within cluster regressions. Vulnerable 3 clusters are clusters which belong to both vulnerable 1 and vulnerable 2 clusters. We assume that GFC period is 2008-2009. Given lagged 3 year moving average mark-up, we exclude the data of 2008-2012 for after-GFC period sample analysis.

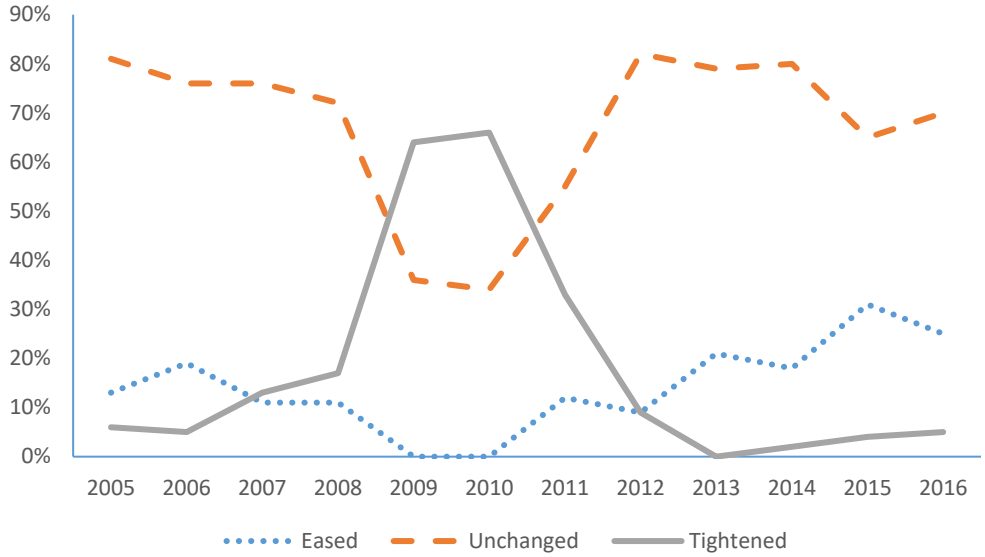
Table 7: Effects of mark-ups on short-term proportion (split sample periods)

	Before GFC	**After GFC**	**After GFC (exc. GFC)**	**Before GFC**	**After GFC**	**After GFC (exc. GFC)**	**Before GFC**	**After GFC**	**After GFC (exc. GFC)**	**Before GFC**	**After GFC**	**After GFC (exc. GFC)**
Mark-up (t-1)	-2.213	2.346***	1.431***	-7.284***	0.972	0.828	-6.890***	1.392	0.722	-7.116***	0.964	0.430
	(3.056)	(0.239)	(0.213)	(2.334)	(1.464)	(1.327)	(2.157)	(1.513)	(1.301)	(2.134)	(1.443)	(1.289)
Mark-up×Vulnerable1 (t-1)				10.463***	1.428	0.638						
				(3.583)	(1.440)	(1.391)						
Mark-up×Vulnerable2 (t-1)							11.189***	0.999	0.757			
							(3.094)	(1.473)	(1.341)			
Mark-up×Vulnerable3 (t-1)										12.224***	1.449	1.072
										(2.875)	(1.402)	(1.331)
Size (t-1)	-1.187	-0.898	-0.396	-1.106	-0.889	-1.106	-1.092	-0.885	-0.387	-1.060	-0.882	-0.937
	(1.193)	(0.800)	(0.878)	(1.176)	(0.802)	(1.176)	(1.172)	(0.795)	(0.876)	(1.166)	(0.796)	(0.679)
HHI (t-1)	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tangibility (t-1)	0.043	0.015	-0.021	0.041	0.020	0.041	0.041	0.018	-0.019	0.042	0.020	0.044
	(0.056)	(0.041)	(0.037)	(0.056)	(0.041)	(0.056)	(0.056)	(0.039)	(0.038)	(0.057)	(0.039)	(0.031)
Profit Risk (t-1)	-0.016	0.036**	0.012	-0.017	0.034**	-0.017	-0.017	0.034**	0.010	-0.017	0.034**	-0.024
	(0.013)	(0.015)	(0.014)	(0.013)	(0.017)	(0.013)	(0.013)	(0.017)	(0.015)	(0.013)	(0.017)	(0.021)
Cash (t-1)	-0.017	-0.056	0.003	-0.016	-0.056	-0.016	-0.016	-0.056	0.003	-0.016	-0.056	-0.021
	(0.044)	(0.038)	(0.038)	(0.044)	(0.038)	(0.044)	(0.043)	(0.038)	(0.038)	(0.043)	(0.038)	(0.035)
Market_to-book (t-1)	-0.590**	-0.186	0.187	-0.574*	-0.183	-0.574*	-0.596**	-0.187	0.188	-0.592**	-0.187	-0.125
	(0.294)	(0.268)	(0.243)	(0.292)	(0.268)	(0.292)	(0.294)	(0.267)	(0.243)	(0.294)	(0.267)	(0.256)
Industry average leverage(t-1)	-0.068	0.013	-0.055	-0.096	0.011	-0.057	-0.097	0.012	-0.057	-0.099*	0.011	-0.057
	(0.062)	(0.035)	(0.036)	(0.059)	(0.036)	(0.037)	(0.059)	(0.036)	(0.036)	(0.059)	(0.036)	(0.036)
Constant	23.767**	13.727**	13.048**	25.938***	14.737**	13.507**	25.616***	14.412**	13.593**	26.228***	14.821**	13.856**
	(9.626)	(6.041)	(6.414)	(8.872)	(6.327)	(6.546)	(8.666)	(6.467)	(6.466)	(8.602)	(6.506)	(6.485)
R-sqr	0.751	0.744	0.843	0.751	0.744	0.843	0.751	0.744	0.844	0.751	0.744	0.844
adjusted-R-sqr	0.666	0.687	0.784	0.667	0.687	0.784	0.667	0.687	0.784	0.667	0.687	0.784
R-sqr-within	0.002	0.007	0.003	0.004	0.007	0.003	0.005	0.007	0.003	0.005	0.008	0.003
F	1.2	24.8	9.0	2.0	22.5	9.1	2.6	22.9	10.6	3.1	22.1	11.1
p_value	0.293	0.000	0.000	0.039	0.000	0.000	0.008	0.000	0.000	0.002	0.000	0.000
No_of_obs	12244	17365	7938	12244	17365	7938	12244	17365	7938	12244	17365	7938
Firm Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) Short-term debt proportion = short-term debt / total debt (in per cent). Mark-up is based on past three year average. 2) and 4) are the same as those of table 2 above. 3) Vulnerable 1/2 clusters are the clusters with a positive relationship between fluidity (past three/five year average) and mark-ups based on within cluster regressions. Vulnerable 3 clusters are clusters which belong to both vulnerable 1 and vulnerable 2 clusters. We assume that GFC period is 2008-2009. Given lagged 3 year moving average mark-up, we exclude the data of 2008-2012 for after-GFC period sample analysis.

Appendix

Figure A.1: Trends in US banks' underwriting standards for large corporates



Source: Office of the Comptroller of the Currency - 2016 Survey of Credit Underwriting Practices

Table A.1: Variable definitions and sources

Variable	Definition	Source
[Dependent variables]		
Leverage ratio	Total debt divided by total asset (AT) in percent. Total debt is sum of long-term debt due in more than a year (DLTT), long-term debt due in one year (DD1), and Notes payable (NP).	Compustat
Long-term leverage ratio	Long-term debt (due in more than a year, DLTT) divided by Total Asset (AT) in percent.	Compustat
Short-term leverage ratio	Short-term debt (Notes payable, NP) divided by Total Asset in percent.	Compustat
Short-term debt proportion	Short-term debt (Notes payable, NP) divided by Total Debt defined as above in percent.	Compustat
[Control variables]		
Mark-up	Ratio of price to marginal cost is estimated using the methodology applied in De Loecker et al. (2020).	Author's calculation based on Compustat data
Cluster average leverage	Average of leverage ratios defined as above in a cluster in each year.	Compustat
GFC dummy	Dummy variable that equals 1 for 2008-2012 and 0 for the other years, considering the variable of lagged three year average mark-up.	

[Control variables for robustness checks]		
Size	Natural logarithm of net sales (SALE).	Compustat
HHI	Herfindahl Hirschman Index for a cluster is calculated as the sum of squared market share for for all firms in the cluster in each year. The market share of firm i is defined as net sales (SALE) for the firm divided by the cluster's total net sales in percent.	Author's calculation based on Compustat data
Tangibility	Net property, plant and equipment (PPENT) divided by total asset (AT) in percent.	Compustat
Profitability Risk	Difference between maximum and minimum of profitability over past five years. Profitability is calculated as operating income before depreciation (OIBDP) divided by total asset (AT) in percent.	Author's calculation based on Compustat data
Cash	Cash and equivalents (CHE) divided by total assets (AT) in percent.	Compustat
Market-to-book	The sum of market equity and book debt divided by total asset (AT). Market equity = common shares outstanding (CSHO)* share price (PRCC_F). Book debt is total debt defined as above.	Author's calculation based on Compustat data
[Other variables]		
Fluidity	The degree of product similarity, a measure of potential competition rivalry based firm's product description.	Hoberg and Phillips (2010, 2016)

Table A.2: Lists of vulnerable clusters

Industry (FIC 300)	Coefficient of 3 yr average Fluidity		Vulnerable1	Coefficient of 5 yr average Fluidity		vulnerable2	vulnerable3
1	-0.004	(0.006)	..	0.004	(0.010)	..	..
2	0.016***	(0.005)	Yes	0.023***	(0.008)	Yes	Yes
3	-0.078	(0.058)	..	-0.055	(0.082)	..	..
4	0.038***	(0.011)	Yes	0.047***	(0.013)	Yes	Yes
6	0.024***	(0.007)	Yes	0.018*	(0.009)	..	..
7	-0.007***	(0.002)	..	-0.008***	(0.002)	..	..
9	-0.002	(0.009)	..	0.007	(0.011)	..	..
10	0.021***	(0.007)	Yes	0.030***	(0.011)	Yes	Yes
11	0.054	(0.035)	..	0.006	(0.062)	..	..
12	0.002	(0.003)	..	-0.005	(0.004)	..	..
13	0.027***	(0.007)	Yes	0.060***	(0.011)	Yes	Yes
14	0.012**	(0.005)	Yes	0.021***	(0.007)	Yes	Yes
15	-0.012***	(0.004)	..	-0.016***	(0.006)	..	..
16	0.002	(0.001)	..	0.004*	(0.002)	..	..
17	0.000	(0.003)	..	-0.003	(0.004)	..	..
18	0.002*	(0.001)	..	0.001	(0.002)	..	..
20	-0.017	(0.015)	..	0.005	(0.023)	..	..
21	0.023	(0.030)	..	0.138***	(0.040)	Yes	..
23	-0.001	(0.003)	..	0.009*	(0.005)	..	..
24	0.019***	(0.005)	Yes	0.023***	(0.008)	Yes	Yes
25	0.006**	(0.002)	Yes	0.014***	(0.004)	Yes	Yes
26	-0.025	(0.063)	..	-0.046	(0.130)	..	..
27	0.001	(0.003)	..	-0.010*	(0.006)	..	..
28	-0.002	(0.204)	..	0.074	(0.442)	..	..
32	0.002	(0.003)	..	0.009**	(0.004)	Yes	..
33	-0.002	(0.003)	..	-0.010**	(0.004)	..	..
34	-0.015	(0.015)	..	-0.001	(0.004)	..	..
35	-0.011	(0.009)	..	0.004	(0.011)	..	..
36	0.006	(0.013)	..	-0.014	(0.022)	..	..
37	-0.004	(0.004)	..	-0.007**	(0.003)	..	..
38	-0.013**	(0.007)	..	-0.019*	(0.010)	..	..
39	0.001	(0.003)	..	-0.000	(0.004)	..	..
40	-0.012	(0.011)	..	0.003	(0.011)	..	..
41	-0.045**	(0.022)	..	-0.046*	(0.025)	..	..
43	-0.001	(0.004)	..	-0.006	(0.008)	..	..
44	-0.019**	(0.007)	..	-0.047***	(0.010)	..	..
45	0.021***	(0.006)	Yes	0.020***	(0.007)	Yes	Yes
46	0.017*	(0.010)	..	0.013	(0.013)	..	..
47	-0.006**	(0.003)	..	-0.009**	(0.004)	..	..
48	-0.007*	(0.004)	..	-0.006	(0.006)	..	..
50	0.009	(0.024)	..	-0.017	(0.031)	..	..
52	-0.007	(0.013)	..	-0.045***	(0.015)	..	..
53	-0.023***	(0.008)	..	-0.023*	(0.013)	..	..
54	0.001	(0.004)	..	0.002	(0.006)	..	..
55	0.021**	(0.009)	Yes	0.014	(0.010)	..	..
56	-0.006*	(0.003)	..	-0.010**	(0.004)	..	..
57	-0.014**	(0.007)	..	-0.012*	(0.006)	..	..
59	0.249**	(0.114)	Yes	0.378***	(0.100)	Yes	Yes
60	0.069***	(0.020)	Yes	0.054*	(0.032)	..	..
61	0.000	(0.002)	..	0.000	(0.003)	..	..
62	-0.020*	(0.010)	..	-0.026**	(0.013)	..	..
63	-0.006	(0.008)	..	-0.000	(0.011)	..	..
64	-0.008	(0.013)	..	0.007	(0.021)	..	..
66	-0.012**	(0.005)	..	-0.009	(0.008)	..	..
67	-0.032	(0.059)	..	0.061	(0.114)	..	..
69	0.063***	(0.017)	Yes	0.103	(0.047)	..	..
70	0.000	(0.008)	..	-0.009	(0.012)	..	..
72	0.013	(0.018)	..	0.029*	(0.014)	..	..
73	-0.011	(0.008)	..	-0.010	(0.011)	..	..
74	-0.016***	(0.004)	..	-0.023***	(0.005)	..	..
75	-0.002	(0.007)	..	-0.000	(0.011)	..	..
76	0.035*	(0.019)	..	0.039**	(0.018)	Yes	..
77	0.012	(0.010)	..	0.004	(0.015)	..	..
78	-0.043**	(0.016)	..	n.a		..	..
79	-0.033***	(0.011)	..	-0.049***	(0.016)	..	..
80	0.075**	(0.023)	Yes	0.007	(0.060)	..	..
81	0.225	(0.250)	..	-0.153	(0.116)	..	..

82	-0.085	(0.087)	..	-0.064	(0.181)	..	..
83	-0.006	(0.011)	..	-0.015	(0.035)	..	..
84	-0.012	(0.029)	..	-0.073**	(0.023)	..	..
85	-0.023***	(0.008)	..	-0.032***	(0.011)	..	..
86	-0.016	(0.012)	..	-0.030*	(0.016)	..	..
87	-0.021***	(0.006)	..	-0.025***	(0.008)	..	..
88	0.052	(0.043)	..	0.006	(0.071)	..	..
90	0.011***	(0.004)	Yes	-0.002	(0.005)	..	..
92	-0.010	(0.010)	..	0.009	(0.016)	..	..
93	0.017***	(0.004)	Yes	0.023***	(0.007)	Yes	Yes
94	-0.009***	(0.003)	..	-0.017***	(0.004)	..	..
96	-0.006	(0.006)	..	-0.007	(0.011)	..	..
97	0.015	(0.014)	..	-0.022	(0.023)	..	..
98	0.012*	(0.006)	..	0.030***	(0.011)	Yes	..
99	-0.011	(0.049)	..	-0.221***	(0.047)	..	..
100	-0.051*	(0.028)	..	-0.040	(0.072)	..	..
101	0.147***	(0.036)	Yes	0.369***	(0.108)	Yes	Yes
106	-0.050	(0.158)	..	-0.086	(0.448)	..	..
107	0.019	(0.015)	..	0.073**	(0.027)	Yes	..
112	0.046***	(0.012)	Yes	0.068	(0.035)	..	..
113	0.001	(0.002)	..	0.008***	(0.003)	Yes	..
115	0.002	(0.008)	..	0.012	(0.012)	..	..
116	0.170**	(0.065)	Yes	0.356**	(0.119)	Yes	Yes
120	0.075**	(0.036)	Yes	0.121**	(0.050)	Yes	Yes
121	-0.357	(0.147)	..	n.a		..	..
122	0.003	(0.072)	..	0.317	(0.177)	..	..
123	0.009*	(0.005)	..	0.003	(0.006)	..	..
125	0.030**	(0.013)	Yes	0.025	(0.022)	..	..
126	0.013**	(0.005)	Yes	0.026***	(0.008)	Yes	Yes
127	-0.004	(0.007)	..	0.001	(0.013)	..	..
129	0.035**	(0.017)	Yes	0.036	(0.023)	..	..
131	0.002	(0.003)	..	0.001	(0.005)	..	..
132	0.022	(0.040)	..	-0.047	(0.058)	..	..
133	-0.358	(0.159)	..	n.a.		..	..
136	0.058	(0.058)	..	0.235**	(0.083)	Yes	..
137	-0.137***	(0.046)	..	-0.110	(0.093)	..	..
139	-0.018	(0.014)	..	-0.043**	(0.017)	..	..
141	-0.033***	(0.008)	..	-0.048***	(0.012)	..	..
143	0.042**	(0.017)	Yes	0.038	(0.028)	..	..
146	0.022	(0.086)	..	-0.261	(0.308)	..	..
147	0.070**	(0.029)	Yes	0.196	(0.089)	..	..
151	-0.105**	(0.035)	..	-0.149	(0.100)	..	..
152	n.a.		..	n.a.		..	..
153	-0.086*	(0.046)	..	0.398***	(0.052)	Yes	..
155	-0.022	(0.015)	..	-0.064**	(0.012)	..	..
156	-0.067**	(0.031)	..	-0.054	(0.041)	..	..
157	-0.067	(0.107)	..	-0.227	(0.195)	..	..
158	0.066	(0.043)	..	0.350	(.)	..	..
162	-0.002	(0.005)	..	-0.012	(0.008)	..	..
163	-0.006	(0.005)	..	-0.020	(0.010)	..	..
166	0.062	(0.113)	..	0.342	(0.233)	..	..
168	-0.000	(0.022)	..	-0.000	(0.027)	..	..
169	0.017	(0.009)	..	0.083	(0.027)	..	..
171	0.040***	(0.011)	Yes	0.043***	(0.010)	Yes	Yes
172	0.005	(0.007)	..	0.015	(0.010)	..	..
174	-0.020	(0.025)	..	-0.057	(0.035)	..	..
175	-0.093*	(0.046)	..	-0.165**	(0.063)	..	..
178	0.031	(0.471)	..	n.a.		..	..
181	-0.040**	(0.018)	..	-0.039	(0.025)	..	..
182	0.022	(0.014)	..	0.038	(0.041)	..	..
183	0.063***	(0.022)	Yes	0.077***	(0.023)	Yes	Yes
188	-0.170***	(0.048)	..	-0.173***	(0.033)	..	..
193	-0.047	(0.060)	..	0.035	(0.067)	..	..
194	0.011	(0.037)	..	n.a.		..	..
196	-0.895***	(0.193)	..	-0.010	(0.193)	..	..
198	0.030***	(0.009)	Yes	0.026*	(0.013)	..	..
199	0.029	(0.023)	..	0.030	(0.077)	..	..
200	0.026	(0.076)	..	-0.002	(0.116)	..	..
204	-0.011***	(0.003)	..	-0.004	(0.005)	..	..
205	0.012	(0.016)	..	0.014	(0.023)	..	..
206	n.a.		..	n.a.		..	..
207	-0.033	(0.021)	..	-0.048*	(0.024)	..	..

211	-0.018**	(0.008)	..	0.002	(0.013)	..	..
212	-0.003	(0.004)	..	-0.002	(0.004)	..	..
214	-0.010	(0.150)	..	n.a.		..	..
215	-0.004	(0.004)	..	-0.006	(0.005)	..	..
218	0.011	(0.007)	..	0.019**	(0.008)	Yes	..
219	-0.041***	(0.013)	..	-0.058***	(0.015)	..	..
220	0.002	(0.004)	..	0.003	(0.006)	..	..
221	0.019*	(0.010)	..	0.027*	(0.015)	..	..
225	-0.049	(0.034)	..	-0.065	(0.056)	..	..
226	0.417	(0.932)	..	n.a.		..	..
229	0.002	(0.012)	..	0.011	(0.015)	..	..
233	-0.042	(0.036)	..	-0.050	(0.090)	..	..
234	0.037	(0.031)	..	0.040	(0.079)	..	..
238	-0.018	(0.015)	..	-0.008	(0.019)	..	..
239	-0.031	(0.020)	..	-0.025	(0.033)	..	..
243	-0.005*	(0.003)	..	-0.006	(0.004)	..	..
244	-0.008	(0.009)	..	0.004	(0.010)	..	..
245	0.048**	(0.021)	Yes	0.071***	(0.019)	Yes	Yes
246	0.021	(0.029)	..	n.a.		..	..
248	0.035***	(0.012)	Yes	0.039***	(0.014)	Yes	Yes
250	-0.001	(0.009)	..	0.004	(0.016)	..	..
252	0.003	(0.007)	..	0.008	(0.010)	..	..
253	-0.030	(0.026)	..	0.031	(0.080)	..	..
257	n.a.		..	n.a.		..	..
260	0.018	(0.017)	..	-0.002	(0.032)	..	..
261	-0.021***	(0.005)	..	-0.033***	(0.011)	..	..
262	-0.040**	(0.018)	..	-0.008	(0.061)	..	..
264	0.014**	(0.004)	..	0.016**	(0.003)	Yes	..
265	-0.113	(0.077)	..	-0.250	(0.275)	..	..
269	-0.167	(0.269)	..	n.a.		..	..
273	-0.002	(0.014)	..	0.030*	(0.017)	..	..
276	0.002	(0.003)	..	0.008*	(0.004)	..	..
278	0.067*	(0.022)	..	0.100	(.)	..	..
280	-0.078	(0.142)	..	n.a.		..	..
281	-0.025	(0.035)	..	0.018	(0.042)	..	..
284	0.013	(0.009)	..	0.039***	(0.013)	Yes	..
285	-0.079	(0.046)	..	n.a		..	..
286	0.017***	(0.006)	Yes	0.032***	(0.008)	Yes	Yes
287	0.019**	(0.007)	Yes	0.036***	(0.005)	Yes	Yes
288	-0.253***	(0.065)	..	-0.310***	(0.102)	..	..
289	-0.009*	(0.005)	..	-0.039**	(0.016)	..	..
291	0.049**	(0.019)	Yes	0.043	(0.058)	..	..
293	-0.011	(0.068)	..	0.005	(.)	..	..
294	-0.001	(0.003)	..	-0.004	(0.003)	..	..
297	-0.010***	(0.003)	..	-0.017***	(0.004)	..	..
298	0.042**	(0.020)	Yes	0.087**	(0.039)	Yes	Yes
No. of industries (% out of total 185)			**34 (18.4)**			**32 (17.3)**	**21 (11.4)**

Notes: 1) The coefficients are estimated based on a panel regression equation – Mark-up (i,t] = 3 or 5 year average product market fluidity (i,t-1) for each cluster j, where i is a firm in the cluster j ,and t is a fiscal year. Firm and year fixed effects are included in the equation. Some number of industries (3 for 3 year average fluidity equation, 14 for 5 year average fluidity equation) do not have estimated values due to insufficient observations.

2) Mark-ups are estimated using De Loecker et al. (2020) and Diez, Leigh, and Tambudlertchai (2018). Initially, the number of industries is 298 from Fixed Industry Classification in Hoberg, Phillips, and Prabhala (2014). We dropped 113 industries with fewer than 50 observations during this estimation procedure.

3) Vulnerable clusters are those with positive coefficients at p-value <0.05. In general, mark-up, an ex post competition measure is expected to be negatively associated with product market fluidity, an ex ante competition measure.

4) *, **, and *** imply p-value < 0.10, p-value <0.05, p-value <0.01, respectively. Standard errors are in parentheses.