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Product market competition and financial default: evidence from Italian private firms

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ABSTRACT

This study investigates the relationship between product market competition and financial default in private firms and the moderating role of group affiliation in this relationship. The empirical research uses a sample of Italian firms and a multivariate regression approach. It augments Altman's default prediction model with three measures of competition: product market fluidity, HHI, and Li's (2010) measures of competition. It analyzes the in-sample and out-of-sample prediction abilities of models augmented by competition. The findings show that competition has a significant positive association with default, suggesting that the risk-increasing effect of competition prevails over the disciplinary effect. Interaction analysis provides evidence that group affiliation moderates the effect of competition on default. Group-affiliated private firms are less likely to default than non-group-affiliated firms at similar levels of competition, signaling a disciplinary effect channeled by group affiliation. Furthermore, we find that adding product market fluidity to Altman's model significantly increases its predictive ability. This study contributes to the literature on the financial outcomes of competition with evidence of private firms. This shows that group affiliation moderates the relationship between

competition and defaults. This study also contributes to financial default studies with evidence that competition enhances default predictions. This study suggests that competition indicators might be used in financial distress early warning systems for private firms the European Union is recently promoting.

Keywords: product market competition, financial default, private firms, group affiliation

JEL Code: G2, G3, M2, M4

1. Introduction

Academic research has long been interested in the relation between product market competition (henceforth, PMC) and corporate financing choices. However, the existing evidence remains mixed. A stream of literature supports the risk-increasing effect of competition, providing evidence that PMC increases business risks, uncertainty of future cash flows, cost of bank loans, and corporate bonds (Irvine & Pointiff, 2009; Valta, 2012; Platt, 2020). Other studies suggest that PMC is an effective disciplinary mechanism that reduces managerial slack, promotes the optimal use of internally generated cash resources, and reduces the use of external debt (Chhaochharia et al., 2017; Boubaker et al., 2018). PMC discourage managers from corporate wrongdoing and enhance economic efficiency, pushing firms in more competitive industries to direct their efforts to secure long-term survival and avoid bankruptcy (Guadalupe & Perez-Gonzalez, 2007; Arouri et al., 2021; Amairi et al., 2022). Whether the disciplinary effect of PMC on corporate debt prevails over its risk-increasing effect (or vice-versa) remains an open question.

While prior literature is almost entirely based on US public firms, this study focuses on the relationship between PMC and financial defaults in private firms. PMC varies across countries due to several factors, including the regulatory environment, labor market, firms' ownership and governance structures, financial markets, and banking institutions (Healy et al., 2014). An important factor contributing to this variability is the role of private firms in the economy. In many countries with less financially developed, bank-based contexts (La Porta et al., 1998; Beck et al., 2010; Svirydzenka, 2016; World Bank, 2024), public equities represent a non-majority fraction of the overall economy, meaning that a substantial share of competition involves private firms. Moreover, banks and lenders focus their default risk assessment efforts on private firms, given their predominance among clients, limited access to financial markets, and less frequent assessments by independent credit rating agencies and analysts (Agarwal &

Taffler, 2008). Despite their economic significance, private firms are generally under-investigated by both PMC and financial default studies compared with public firms (Hoberg et al., 2014; Babar & Habib, 2021).

To address this gap, we investigate a large sample of private Italian firms. This setting is suitable for studies on competition and default in private firms. Similar to many countries worldwide, Italy has a vast majority of private firms that represent the backbone of the national economy (Muller et al., 2017). Prior research suggests that Italy shares similarities with other economies regarding governance structures (Sheifer & Vishny, 1997), ownership structures characterized by the prevalence of family firms (Minichilli et al., 2010), regulatory frameworks governing competition (Lorenz, 2013), and the pivotal role of banks in funding firms (Kaya & Schildbach, 2014). Thus, empirical findings derived from the Italian setting may offer insights relevant to other European Union countries and numerous bank-based industrial economies worldwide. Also, in Italy, intensified competition can heighten risk, given weak internal controls, use of multiple bank credit lines, and inefficient creditor-rights protection (Mazza & Azzali, 2015; Cappelletti & Mistrulli, 2017; World Bank, 2020). These factors may foster riskier strategies and reduce external monitoring by lenders (Zhao et al., 2014; Lammers et al., 2023). At the same time, the European Union actively promotes competition as a policy instrument to strengthen firms' internal efficiency and managerial discipline, as reflected in major policy frameworks (EU, 2008, 2025; Lausberg et al., 2024;). Hence, Italy exemplifies a tension between the risk-increasing and disciplinary effects of competition, making it a compelling setting to investigate.

Our study also investigates the moderating role of group affiliation in the relationship between PMC and financial default in private firms. Recent research provides evidence that information on group affiliation improves default prediction (Beaver et al., 2019) and that product market competition has a disciplinary effect on group controlling shareholders'

opportunistic tunneling across subsidiary firms (Guo et al., 2022). Collectively, these studies suggest that group affiliation is likely to moderate the relationship between product market competition and financial default. Thus, this research question is addressed.

Our empirical research augments Altman's default prediction model with three measures of PMC: product market fluidity (Hoberg et al., 2014)[1], Herfindahl–Hirschman Index (HHI), and Li's (2010) measures of competition. The empirical results show that PMC has a significant positive association with the likelihood of financial default, regardless of the measure of competition employed. This finding suggests that the risk-increasing effect of competition prevails over the disciplinary effect of private firms. Further analysis shows that the interaction between competition and group affiliation has a significantly negative association with the likelihood of default, signaling a disciplinary effect channeled by group affiliation. Cross-sectional analyses confirm that competition has no risk-increasing effect on group-affiliated firms.

The robustness tests indicate that endogeneity does not bias our results. In-sample and out-of-sample tests also provide evidence that including a PMC measure enhances financial default prediction. The increase is not only statistically significant but also economically significant.

This study contributes to the literature on PMC in several ways. First, we contribute to the literature on the financial outcomes of competition (Valta, 2012; Platt, 2020; Hasan et al., 2021; Amairi et al., 2022). This shows that for private firms, the risk-increasing effect of competition on the likelihood of financial default overall prevails over the disciplinary effect.

[1] Product market fluidity is a text-based measure of competition developed by Hoberg et al. (2014) and derived by analyzing the firms' description of its own business and products in the financial statements. "Fluidity captures how rivals are changing the product words that overlap with firm i's vocabulary. Because fluidity focuses on product space dynamics and changes in products, it is an entirely new construct relative to the industry definitions and variables" (Hoberg et al. 2014, p. 294). It "measures the change in a firm's product space due to moves made by competitors in the firm's product markets" (Hoberg et al. 2014, p. 294). In Section 3.2 we further discuss the concept and its differences with other measures. Further information on the measurement of fluidity is reported in Appendix B.

This study also provides evidence that group affiliation plays a moderating role in the relationship between product market competition and default in private firms. Indeed, groups provide resources to subsidiary firms under tightened competition (i.e., propping) and avoid opportunistic tunneling with intra-group operations to mitigate the affiliated firm's default risk (Guo et al., 2002; Benkraiem et al., 2022).

Second, to the best of our knowledge, this is the first study to analyze product market fluidity in private firms in a non-US setting. We show that firm-specific text-based measures of competition (i.e., fluidity) can be reliably computed using a sample of private firms, overcoming one of the major limitations of prior research, which considered only competition from public firms and did not capture the competitive pressure from private companies (Hoberg et al., 2014; Mattei and Platikanova, 2017). This is particularly important because in Italy, as well as in many countries worldwide, the competitive pressure largely comes from private firms, since they represent the vast majority of firms in the economy and a significant portion of the national GDP.

Finally, this study also contributes to the recent literature on financial default in private firms (Susi & Lukason, 2019; Altman et al., 2020; Oware and Botchway, 2023; De Silva et al., 2024). Our empirical analysis shows that the inclusion of a product market competition measure enhances default prediction for private firms. Developing new predictors is more relevant for private firms, given that market-based prediction models are unavailable for this type of firm. The benefits of using competition variables in prediction models are likely to be much higher than the cost of implementing them, even when using more complex measures, such as market product fluidity[2].

[2] Developing new predictors is relevant for private firms given the size of the credit market. In the last decade, the median stock value of non-financial corporate debt in the EU27 countries has reached 35,000 billions of euros, about 98.8% of the EU27 GDP (Eurostat, 2021). The data includes the debt of public companies, but the debt of private firms is likely to represent a substantial stake of this amount.

The remainder of this paper is organized as follows. Section 2 reviews the literature and develops the hypotheses. Section 3 explains the research methodology, and Section 4 presents the empirical findings. A discussion of the findings in Section 5. Finally, Section 6 presents the conclusions of this study.

2. Literature review and hypothesis development

Research on the relationship between product market competition and the cost of debt suggests that the intensity of competition can result in a higher likelihood of default. Valta (2012) provides evidence that stronger competition increases the cost of bank loans as more intense competition increases business risks and the uncertainty of future cash flows. By contrast, firms in concentrated industries are insulated by barriers to entry, engage in less innovation, and are less risky, benefitting from the lower cost of bank loans (Valta, 2012). Platt (2020) found that firms facing more competitive threats face a higher cost of corporate bond debt. Huang and Lee (2013, p. 329) argue that an "increase in product market competition intensity (the number of firms in an industry) amplifies a firm's credit risk." Bernini and Montagnoli (2017) find that firms' demand for credit is typically higher in industries with greater competitive pressure. However, a greater proportion of firms are discouraged from loan applications because of the greater cost of credit. The authors also find that firms operating in a more competitive environment must provide more collateral. Consistently, Hasan et al. (2021) find that banks charge higher loan spreads for firms in more competitive local product markets in a sample of Chinese firms.

Product market competition also affects a firm's liquidation value (Ortiz-Molina & Phillips, 2014). Liquidation values are important when pricing debt contracts. Higher liquidation values lower the cost of debt, and vice versa (Bolton & Scharfstein, 1996; Valta,

2012). By lowering a firm's liquidation values and increasing the cost of debt, competition intensity can lead to higher default risk (Valta, 2012; Ortiz-Molina & Phillips, 2014).

The aforementioned literature is almost entirely aimed at investigating public firms. However, these arguments can also be extended to private firms. For private firms, product market competition may increase the likelihood of financial default because intense competition increases business risks, uncertainty about future profits and cash flows, and the cost of debt (Bernini & Montagnoli, 2017). Consistent with this view, although not directly related to financial default, several studies suggest that intense competition can have severe negative consequences for private firms' value and cost of debt. Studying a sample of Swiss private firms, Beiner et al. (2011) find that competition is linked to decreased firm value. In a sample of South Korean firms, Ryu (2020) find that increased competition lowers firm value due to increased business risks. Mitani (2014) demonstrated that Japanese firms exposed to greater product market competition exhibit higher leverage. Additionally, Halabi et al. (2021) investigate a sample of UK firms and find that firms in more competitive industries with poor diversification experience significantly higher credit risk.

Some studies also suggest that competition has a disciplinary effect on management decision making, as it reduces managerial slack and promotes the efficient use of available resources. Shleifer and Vishny (1997, p. 738) point out that "product market competition is probably the most powerful force towards economic efficiency in the world." In this view, competition also substitutes for corporate governance mechanisms and alleviates agency problems related to manager–shareholder conflicts of interest and monitoring the efficient use of the firm's resources by managers (Hart, 1983; Chhaochharia et al., 2017; Boubaker et al., 2018; Battisti et al., 2024). Leventis et al. (2011) consistently find that product market competition lowers agency costs (proxied by audit fees) in a sample of Greek firms. Other studies of Japanese and Taiwanese firms show that competition mitigates agency conflicts,

leading to higher dividends (He, 2012; Kao & Chen, 2013). In summary, these studies suggest that competition can mitigate agency conflicts and reduce the need for certain governance practices in some contexts.

Private firms usually have concentrated ownership and mitigate agency conflicts between shareholders and managers, with controlling shareholders often being managers or closely controlling managers (e.g. Young et al., 2008; Miller et al., 2010). In this context, competition is less likely to be a substitute for corporate governance as a monitoring device for managers' efficient use of resources. In line with this perspective, Ko et al. (2016) find that in East Asian firms with concentrated ownership, competition does not lead to higher managerial discipline, as evidenced by a strong pay-performance linkage. Similarly, Medioli et al. (2023) find that European firms, characterized by concentrated ownership, do not always optimize their operations to withstand competition, but instead pursue tax avoidance objectives through profit shifting.

In summary, the literature on the relationship between product market competition and financial defaults highlights the risk-increasing effects of competition on private firms. At the same time, it underscores the limitations of competition as a substitute for corporate governance in monitoring managerial efficiency. Therefore, we hypothesize that for private firms, the risk-increasing effect of competition on financial defaults prevails over the disciplinary effect.

HP1: There is a positive association between product market competition and financial default in private firms.

Group affiliation has potential benefits and costs (Khanna and Yafeh, 2007; Beaver et al., 2019). Potential benefits (i.e., propping) are related to access to intra-group capital markets (Desai et al., 2004; Claessens et al. 2006, Chittoor et al. 2015), related-party transactions including sales, trade credit, equity issuances, and intra-group loan guarantees (Jian & Wong

2010; Kim & Nilsen 2014; Buchuk et al. 2014). Other benefits are related to resource sharing, especially intangible resources (Chang & Hong, 2002).

On the potential cost side, prior research provides evidence of tunneling. Controlling shareholders may use the intra-group transactions not to efficiently manage resources, but to expropriate wealth from lenders and minority shareholders, thus increasing the group affiliated firm's default risk (e.g., Dyck and Zingales, 2004; Lee and Yah, 2004; Beaver et al., 2019; Iazzi et al., 2023). Recent research suggests that product market competition plays a disciplinary role in mitigating controlling shareholders' tunneling (Guo et al., 2022). When a subsidiary is under fierce competition, groups privilege propping over tunneling to reduce the affiliated firm's default risk (Beaver et al., 2019; Guo et al., 2022). Hence, competition is likely to have a disciplinary effect on subsidiary firms through group affiliation. For subsidiary firms, the positive association between competition and financial default (i.e., the risk-increasing effect) may be weakened, absent, or reversed to a negative association, depending on the strength of the disciplinary effect of competition channeled by group affiliation. Thus, we formulate the following hypothesis:

HP2: Group affiliation moderates the effect of product market competition on financial default in private firms.

3. Research methodology

3.1. **Sample selection**

The initial sample includes all private firms in the AIDA Bureau Van Dijk database[3], which are above the dimensional thresholds mandating the issuance of complete financial statements for the period 2008–2016, that is, firms with a turnover above 8.8 million euros.

[3] AIDA Bureau Van Dijk database is the section of Orbis Bureau Van Dijk global database with detailed data on Italian companies (Hristov et al., 2024). Bureau Van Dijk is a leading provider of financial data owned by Moody's.

Consistent with the literature on bankruptcy prediction (Campbell et al., 2008; Beaver et al., 2019), we exclude firms in regulated industries (financial and utility sectors). Moreover, we drop firm-year observations in industry-year groups in which the number of bankrupt firms is smaller than 10 to prevent the model from converging. To identify bankrupt firms, we used the AIDA Bureau Van Dijk database to specify whether a firm is active or subject to a bankruptcy procedure. We then excluded firm-year observations for which we could not calculate the product market fluidity because the business description was missing. The final sample consists of an unbalanced panel with 32,313 firm-year observations, which include both bankrupt and non-bankrupt firms. Table 1 Panel A lists the sample selection processes.

To identify group-affiliated firms, we use the type of corporation as mandatorily registered at the Chamber of Commerce (and indicated in AIDA Bureau Van Dijk). Corporations or limited liability companies with a controlling parent company are registered in specific categories and are separated from others[4]. Our sample included 27,299 firm-year observations of non-group-affiliated companies and 5,014 firm-year observations of group-affiliated companies.

:::::::: INSERT TABLE 1 ABOUT HERE ::::::::::::

3.2. Model specification and selection of variables

We estimate the following dynamic logistic regression of Altman's model (Altman, 1968; Duffie et al., 2007; Susi and Lukason, 2019; Shi & Li, 2024).

Equation 1

$$Bankruptcy_{it} = \beta_0 + \beta_1 (Product\ Market\ Competition)_{it-1} + \beta_2 WCTA_{it-1} + \beta_3 RETA_{it-1} + \beta_4 SATA_{it-1} + \beta_5 DEBT_{it-1} + \beta_6 ROA_{it-1} + \beta_6 SIZE_{it-1} + \beta_7 OWNCONC_{it-1} + \beta_8 EARLY_{it-1} + \sum_{t=0}^{n} YearFixedEffects + \sum_{t=0}^{n} IndustryFixedEffects + \varepsilon_{it}$$

[4] More specifically, we identify firms owned by a unique controlling shareholder.

where $Bankruptcy_{it}$ is a binary variable equal to one if firm *i* at time *t* is bankrupt, and zero otherwise. We consider bankruptcy when an insolvency procedure is initiated.

This study uses three alternative measures of market competition. First, we use fluidity (Fluidity), a text-based measure assessing changes in a firm's competitive environment due to competitors' movements in a firm's product markets (Hoberg et al., 2014). This measure is derived from a textual analysis of product descriptions available in firms' financial statements extracted from the AIDA Bureau Van Dijk database. Fluidity is the cosine similarity between a firm's vector of words (describing the firm's products) and the change in the rivals' vector of words. Thus, it captures the changes in competitors' products relative to the focal firm, with a focus on product space dynamics and changes in product offerings (Hoberg et al., 2014). Although complex to calculate, fluidity is a valuable measure that captures the dynamic component of competition at a highly fine-grained level, using qualitative information on specific product offerings from the business and has the advantage of being a firm-specific measure of product market competition description (Babar & Habib, 2021; Ahn & Chung, 2024). The higher the fluidity, the higher the competitive pressure. Further information on the fluidity measurement is provided in Appendix B.

Second, we use the Herfindahl–Hirschman Index (HHI), which measures concentration at the industry level. The higher the HHI, the lower is the product market competition (Cui et al., 2023). Third, we calculate Li's (2010) competition measures by running a principal component analysis on eight indicators of competition drawn from the literature, computed at the industry-year level. The eight competition indicators are the Herfindahl-Hirschman Index (IND-HHI), the four-firm concentration ratio (IND-CON4), the industry-average property, plant, and equipment (IND-PPE), product market size (IND-MKTS), aggregate industry price-cost margin (IND-MGN), industry average capital expenditures (IND-CPX), number of firms

operating in an industry (IND-NUM), and industry aggregated ROA (IND-ROA)[5]. The first is a measure of competition from potential entrants (POTENT) for industry *j* in year *t*, which is loaded with IND-PPE and industry capital expenditures. We multiplied POTEN by -1 so that the higher the POTENT, the lower the barriers to entry and the higher the competition. The second measure is a measure of competition from existing competitors (EXIST) for industry *j* in year *t*, which is loaded with the industry HHI, industry four-firm concentration ratio, and number of firms operating in the industry. We multiplied EXIST by -1 so that the higher the EXIST, the lower the market share concentration (and the higher the number of competitors), and the higher the competition. Finally, the third measure is the competition linked to the level of industry profitability (PROFIT) for industry *j* in year *t*, which is loaded with industry ROA and price-cost margin (IND-MGN). The higher the PROFIT, the higher the average profitability of the industry and, following Li's (2010) interpretation, the higher the probability of new entrants. For industry classification, we use the four-digit NACE 2007 codes.

The use of these three variables ensures robust findings and a comprehensive analysis. These measures may capture different nuances of competition: the dynamic component related to changes in competitors' products relative to the firm, market concentration within an industry, and other dimensions covered by Li's (2010) measures, such as potential entrants and industry profitability.

The financial ratios included in our empirical analysis are (Altman, 1968): working capital on total assets (*WCTA*), retained earnings on total assets (*RETA*), revenues on total assets (*SATA*), debt ratio, measured as total liabilities on total assets (*DEBT*); ratio of earnings before interest and taxes on total assets (*ROA*); and firm size (*SIZE*), measured by the natural logarithm of assets. We also included control for ownership concentration, measured by the percentage

[5] All the variables are defined in Appendix A. Li (2010) uses also the industry average research and development (R&D) expenses that are not available in our dataset, because Italian-GAAP do not require disclosing R&D costs. For this reason, we use eight, instead of nine, competition indicators to compute the Li's (2010) competition measures.

of shares owned by the largest shareholder (OWNCONC) and for a dummy variable for firms in the early stage of their lifecycle, identified as those firms with a firm age between 1 and 5 years (Coad, 2018)[6]. We add time effects (with year dummies) and industry effects (with dummies based on the two-digit NACE (2007) code). Appendix A defines all dependent, explanatory, and control variables used in the analysis[7].

Equation 1 is used to test HP1. To test HP2, we add a dummy variable for group affiliation and an interaction variable between our competition measures and the group affiliation dummy to Equation 1.

4. Empirical findings

4.1. Descriptive statistics and univariate analysis

Table 1 Panel B reports the breakdown of defaulting firms by industry. The average bankruptcy rate is about 3.0% in our sample. Most industries are generally close to the average with rates between 2 and 4%. Construction has the highest default rate: about 5.6%. Regarding governance, for group affiliated firms, the average bankruptcy rate is 2.55% in any given year included in the sample, while for non-group affiliated firms it is 3.15%. Early-stage firms have a default rage about 9.6% (Table 1 Panel C). However, they represent only the 3% of the total sample. The rate is still above the total sample average for young firms. These findings are consistent with Coad (2018)'s suggestion that critical age effects occur between 5 and 10 years. We do not find significant differences in default rates across quartiles of ownership concentration. Only for the first quartile (lower ownership concentration) the default rate is slightly lower than the total average about 2.6%, whereas the rate is near the 3% in the other quartiles.

[6] Due to lack of mandatory disclosure in financial statements, we do not have data on cash flows to build life cycle proxies based on cash flow patterns (Dickinson, 2011).
[7] To avoid the potential bias related to the presence of outliers, we winsorized all the variables at the top and bottom 1% level.

Table 2 reports the descriptive statistics, also distinguishing between bankrupt and non-bankrupt firms. Bankrupt firms have higher mean and median values of Fluidity and competition from existing rivals (EXIST), than non-bankrupt firms. Competition, as measured by the HHI, is also stronger for bankrupt firms than in non-bankrupt firms, although the difference in the mean is not significant. Non-bankrupt firms appear to have slightly higher competition from potential entrants than bankrupt firms. The average ownership concentration (OWNCONC) is about 61.8%, indicating that the largest shareholder exerts a tight control over these private firms. The median ownership concentration is also about 54%.

:::::::: INSERT TABLE 2 ABOUT HERE ::::::::::::

Table 3 shows the Pearson's correlation coefficients. All correlations among the competition variables are statistically significant, with most having a low correlation coefficient. Notably, the correlation between HHI and Li's measure of competition from existing rivals (EXIST) is −0.58, indicating a reasonably strong negative association and supporting internal consistency, as HHI is one of EXIST components, along with the industry four-firm concentration ratio, and the number of firms operating in the industry. These corrections suggest that, while the measures are related, they capture distinct dimensions of product market competition (PMC), which is a conceptually complex construct. Fluidity captures the dynamic and firm-specific component of competitive threats based on changes in product descriptions by rivals. HHI reflects static market concentration at the industry level, while Li's measures aggregate multiple indicators (e.g., number of firms, concentration ratios) to assess industry competition, as well as the competitive pressure from potential entrants.

Fluidity, HHI, and Li's (2010) measure of competition from existing rivals (EXIST) are significantly correlated with the likelihood of bankruptcy. A higher debt (DEBT) is associated

with a higher likelihood of bankruptcy. Leverage has a significant negative association with the HHI, signaling that debt is higher in less concentrated (i.e., more competitive) industries. Competition from existing rivals (EXIST) is also associated with higher leverage.

:::::::: INSERT TABLE 3 ABOUT HERE ::::::::::::

4.2 Main findings

Table 4, Panel A, presents the estimated logistic model coefficients without industry effects, while Table 4 Panel B, replicates the findings adding industry fixed effects. The explanatory and control variables are 1 year lagged. Column (1) reports the estimated coefficient of Altman's bankruptcy prediction model. The findings show that the control variables are significant at 1% and in the expected direction.

Column 2 of Table 4 Panel A shows that the 1-year-lagged product market fluidity (Fluidity) has a significant positive association with the likelihood of bankruptcy (coefficient at the 1% level). The findings suggest that firms with more fluid products face a higher default risk. Column 3 of Table 4 Panel A shows that the 1-year-lagged value of the HHI has a significant negative association (p-value <0.01), signifying that lower market concentration (i.e., more intense competition) increases the likelihood of default. Li's (2010) measures further confirm that more intense competition from existing competitors (EXIST) is associated with higher default probability, while the PROFIT and POTENT variables are not statistically significant.

These findings support HP1 and suggest that competition has a risk-increasing effect on default, prevailing over the disciplinary effect. Competition increases idiosyncratic risk, uncertainty, and performance volatility, which, in turn, significantly augments a firm's default likelihood.

Table 4 Panel B, columns 1 to 4, replicates the analysis including industry fixed effects. The findings show that the coefficient of Fluidity remains positive and highly significant. Furthermore, the HHI coefficient shows a negative and significant association with bankruptcy risk, and competition from existing rivals (EXIST) confirms its positive effect on the probability of default.

We further investigate the relative importance of the competition measures by estimating our main model including all PMC variables – Fluidity, HHI, Li's (2010) measures – simultaneously[8]. This analysis assesses whether the three measures capture independent dimensions of product market competition when controlling for one another. The results are displayed in Column 5 of Table 4 Panel A and B. They show that both Fluidity and EXIST retain positive and statistically significant associations with the likelihood of bankruptcy (p-value < 0.01), while the coefficient of HHI becomes statistically insignificant. This finding is not surprising, as HHI is one of the indicators used to construct the EXIST principal component, along with industry four-firm concentration ratio, and number of firms operating in the industry. Consequently, EXIST absorbs much of the information conveyed by HHI, reducing its independent contribution when included simultaneously. Although both Fluidity and EXIST are highly significant, it is difficult to determine which measure has the greatest economic impact on bankruptcy risk, given the unavoidable differences in their scales (firm-level dynamic competition versus industry-level structural competition). Overall, these results confirm that Fluidity and EXIST capture complementary and independent dimensions of product market competition that significantly affect the likelihood of default, reinforcing the robustness of our findings.

:::::::: INSERT TABLE 4 ABOUT HERE ::::::::::::

[8] We thank an anonymous reviewer for the suggestion.

Table 5 displays the results of the baseline model (Equation 1) augmented with the group dummy variable (GROUP-AFFILIATED) and an interaction variable between this dummy and competition measures to test HP2. Column 1 shows that Fluidity has a positive and significant association with default, and the interaction between Fluidity and group affiliation is negative and statistically significant at the 10% level. The difference between the coefficients (1.479 – 2.320) is -0.841, revealing the moderating effect of group affiliation, as the risk-increasing effect of competition is weakened for group-affiliated firms. Similarly, Column 3 shows that the interaction between industry profitability (PROFIT) and group affiliation is negative and significant at the 10% level, indicating that group affiliation may also attenuate the competitive pressures captured by industry profitability.

To reinforce this evidence, we conduct a cross-sectional analysis splitting the sample between non-group-affiliated and group-affiliated firms (Table 6). Columns 2–4 of Table 6 show that competition measures (Fluidity, HHI, EXIST) have a significant risk-increasing effect for non-group-affiliated firms, whereas Columns 5–8 show no evidence of a risk-increasing effect for group-affiliated firms. These results are consistent across all competition measures. These findings suggest that competition does not increase the likelihood of default for group-affiliated firms. The disciplinary effect channeled by group affiliation offsets the risk-increasing effect of competition, even if it does not *per se* reduce the likelihood of default. Groups appear to privilege disciplined resource supply (i.e., propping) over opportunistic tunneling when the subsidiary firm is under stronger competition. The cross-sectional analysis suggests that the group's support of the subsidiary counterbalances the risks generated by competition for the subsidiary's survival but does not overcompensate the subsidiary exposed to competition.

Overall, while the interaction terms in the pooled regressions provide partial support for HP2, the cross-sectional analysis offers more robust evidence that group affiliation shields firms from the risk-increasing effects of heightened competition. Since the cross-sectional results show no significant association between competition and default for group-affiliated firms, there is inherently less variation for the interaction terms to capture in the pooled regressions. Taken together, these findings suggest that group affiliation mitigates the adverse effects of competition, consistent with a disciplinary effect channeled through internal group mechanisms such as propping rather than tunneling.

4.3 Predictive ability analysis in-sample and out of sample

We investigate the predictive ability of models including competition measures versus the baseline Altman's model, assessing the predictive ability of the models using the classification table and ROC approaches[9]. Table 7 shows that the model with Fluidity (with or without industry FE) had the highest percentage of correctly classified, sensitivity (reducing the costliest Type I prediction error), and AUC. We also analyzed the differences in the AUC to test whether the increase is significant. The difference in the Fluidity model AUC (with or without industry FE) versus Altman's model is significant at the 1% level, whereas the difference between Li's model and Altman's model is significant at the 5% level without industry FE and at the 10% level with FE. The difference between the Altman's model and the model with HHI is not significant. The findings suggest a significant increase in predictive ability when using a firm-specific measure of competition, such as Fluidity, or more sophisticated measures, such as Li (2010).

[9] To ensure comparability and parse out the predictive ability of competition measure, we exclude controls not include in the original Altman's model (i.e., size, ownership concentration and the control for early life cycle stage). We used a cut-off of 0.030 to calibrate the accuracy.

Table 8 presents the out-of-sample analysis results. We estimated the coefficients of the logit model (all with industry FE) using an iterative process for each year of bankruptcy and each year considered in the sample using firm-year data from 2008 to 2015 and bankruptcy years from 2009 to 2016. We then calculated the average values obtained for each estimation. The results show that the models augmented with competition measures have a higher average percentage of correctly classified firms, higher sensitivity, and higher average AUC than Altman's model. The sensitivity of the fluidity model is approximately 5,14% higher, and the AUC is approximately 0.3 higher than that of Altman[10].

:::::::: INSERT TABLE 7 ABOUT HERE ::::::::::::

:::::::: INSERT TABLE 8 ABOUT HERE ::::::::::::

4.4 Robustness tests

We run several robustness tests. First, we add a control variable identifying firms in the decline stage of their life cycle. Dickinson (2011) identify decline firms as those with negative operating cash flows and positive cash flows from investing activities (due to divestments), and with either positive or negative cash flows from financing activities. We do not have cash flow data, due to lack of mandatory disclosure in our sample firms' financial statements. We thus identified decline firms as those with negative EBITDA (calculated as net profits plus depreciation and amortization, to proxy for operating cash flows) and with negative change in PPE and intangible assets net of depreciation and amortization (to proxy for divestments). Table

[10] The increase is economically relevant. Such a reduction of the Type I error is potentially worth tens of millions in optimally allocated credit. E.g., the aggregated financial debt of Italian non-financial firms was, on average, €3,572 billion in the period 2007–2014 (ISTAT, 2019).

9 replicates our main analyses providing fully consistent results. Our proxy for the decline life cycle stage has a significant positive association with the default likelihood, as expected[11].

Second, we ran an analysis using two- and 3-year-lagged values of competition measures and control variables, obtaining results related to competition consistent with those mentioned above (untabulated). Third, we also run an analysis to address potential endogeneity concerns using the dynamic panel generalized method of moments (GMM) developed by Arellano and Bover (1995) and Blundell and Bond (1998). We obtained consistent results (untabulated). Further, untabulated results do not provide evidence of a non-linear relationship between competition and default. We also replicated the analyses using the HHI and Li's measures of competition using data up to 2019 and obtained consistent results (untabulated)[12]. We did not have access to the database of business descriptions to calculate the Fluidity measure after 2016.

5. Discussion of the findings

5.1 Theoretical implications

The findings of this study contribute to the ongoing debate regarding the relationship between product market competition (PMC) and corporate financing (Valta, 2012; Bernini & Montagnoli, 2017; Platt, 2020), particularly within the context of private firms. Prior literature has presented mixed evidence regarding the impact of PMC on corporate financing choices, supporting both a risk-increasing effect and disciplinary effect of competition on the likelihood (Valta, 2012; Platt, 2020; Boubaker et al., 2018).

[11] In further analyses, we also use our proxy for the decline life cycle stage as alternative dependent variable (untabulated). The findings are directionally consistent but weaker. This may reflect that, even if conceptually motivated, our proxy is likely an imperfect measure of the decline stage as defined in the literature. It is to be noted that we did not find support in the literature for an augmented Altman's model with this alternative dependent variable.

[12] We did not extend the analysis beyond 2019, because, like other governments worldwide, the Italian government suspended the default procedures for some time to prevent mass corporate default.

Our findings are consistent with economic theory suggesting that firms in highly competitive markets experience faster mean reversion in profitability (Porter, 1985; Aghion, 2002; Healy et al., 2014). This occurs because high-profit firms attract new entrants that erode their profits, while low-profit firms either improve or exit the market, thus increasing their financial distress risks (Healy et al., 2014). In competitive markets, the mean reversion occurs more rapidly, leaving firms with limited time to adjust their operations and cost structures, and making them more vulnerable to competition-driven revenue fluctuations. Our findings are consistent with predictions of this economic theory, showing that firms in highly competitive industries face faster profit mean reversion, increasing uncertainty in cash flows, ability to serve the debt, and likelihood of financial distress.

Our findings also show that risks arising from accelerated mean reversion may be moderated by business group affiliation, which can provide financial stability and resource-sharing mechanisms to buffer against financial distress (Beaver et al., 2019; Guo et al., 2022). This implies that while non-affiliated firms may experience faster profit erosion and higher default risk, group-affiliated firms may have access to internal resources reallocation that allows them to weather competitive pressures more effectively. These findings highlight the importance of group affiliation in mitigating the adverse effects of competition on private firms' default rates. Economies dominated by private firms may benefit from group organizations in industries that are more exposed to intense competition.

Healy et al. (2014) suggest that mean reversion in accounting performance is also affected by earnings management. However, several factors indicate that earnings management might not be a primary channel through which competition increases default risk in private firms. Unlike public firms, private firms face less mandatory disclosure and lack capital market-based pressures, leading to fewer incentives for earnings manipulation (Dechow et al., 2010). Their bank-centric financing model prioritizes cash flows and leverage over reported earnings,

making EBITDA and debt-service coverage ratios more relevant for credit assessments (Beck et al., 2008). Consistently, Mafrolla & D'Amico (2017) find no impact of borrowers' earnings management activity on loan costs in a sample of European private firms. Future research could further investigate this topic by examining whether specific forms of earnings management in private firms (e.g., tax-induced earnings management; Sundvik, 2017) increase default risk in competitive environments.

Besides market forces, another channel through which competition increases the default risk is leverage, which is particularly important in bank-based economies. Higher competition increases business risk and cash flow volatility, leading banks to charge higher interest rates, impose stricter borrowing terms, and ask for collaterals (Valta, 2012). This is particularly relevant for private firms depending on bank loans rather than equity markets for capital. Firms in highly competitive industries may take on excessive debt to sustain operations, increasing financial fragility and the probability of default. Business groups can serve as a buffer against competition-induced financial distress by providing financial support through internal capital markets (Khanna & Yafeh, 2007). Group-affiliated firms benefit from intra-group financing and shared resources, reducing their dependence on external debt. These findings align with the notion that market discipline and ownership structures are interdependent in shaping firms' risk-taking behavior (Forssbæck, 2011).

Our study underscores the importance of industry as a channel through which competition influences default risk. By incorporating industry-level competition measures, we demonstrate that the more a measure captures industry-specific competition, the greater its predictive value for default. The superior predictive ability of fluidity compared to other competition measures may be attributed to its richer representation of underlying market conditions and the competitive pressures firms face. Fluidity captures detailed shifts in competitive dynamics and

integrates qualitative information from business descriptions, offering a more comprehensive understanding of the factors driving firms' default risk.

A key strength of fluidity is its ability to reflect the dynamic nature of competition at a highly granular level. It provides nuanced insights into how firms respond to competitive pressure and evolve their product offerings over time, which is particularly valuable for private firms. Traditional measures such as the HHI offer a static view of market concentration but fail to account for product differentiation within an industry. Unlike public firms, private firms are less likely to adopt low-cost strategies due to resource constraints (Chang & Hughes, 2012; Gunasekeran et al., 2011). Therefore, a measure that captures product offerings presents a valuable tool for studying competition among private firms. In this respect, our study also contributes to the literature on product market competition by extending the application of firm-specific, text-based competition measures to private firms and non-U.S. settings (Babar & Habib, 2021).

Overall, our empirical findings derived from the Italian setting may offer insights relevant to other European countries and numerous bank-based developed economies worldwide. Italy shares similarities with other market-based economies regarding the large prevalence of private firms in the economy, their governance and ownership structures, the regulatory frameworks governing competition, and the crucial role banks play in funding firms (Sheifer & Vishny, 1997; Minichilli et al., 2010; Kaya & Schildbach, 2014). This underscores the importance of considering the unique characteristics of private firms and the settings in which they represent the backbone of the economy when examining the implications of PMC on default likelihood.

Finally, this study contributes to the growing stream of research on financial default in private firms (Susi & Lukason, 2019; Altman et al., 2020; Oware and Botchway, 2023; De Silva et al., 2024). Our evidence suggests that accounting-based default prediction can be

effectively complemented by information about a firm's competitive environment. This represents a novel approach in default prediction research, particularly for private firms for which market-based prediction models cannot be applied.

5.2 Managerial implications

Our study has interesting implications for management practice. Our findings support the notion that the risk-increasing effect of product market competition on financial default prevails over the disciplinary effect in private firms. This highlights the importance of carefully managing the impact of competition on corporate financing choices, and underscores the need for *ad hoc* strategies to mitigate default risk in competitive environments. These implications extend to risk management practices, corporate financing decisions, and managerial decisions aimed at promoting resilience in private firms.

These findings also underscore the importance of constantly monitoring and understanding the competitive landscape in which a firm operates. By recognizing the impact of product market competition on default risk, management teams can adopt proactive strategies to mitigate financial distress and enhance resilience in competitive environments. This may include diversifying product offerings, identifying niche markets, and strengthening relationships with key stakeholders to ensure sustained competitiveness and financial viability (Chang & Hughes, 2012; Gunasekeran et al., 2011).

Additionally, our results suggest that group organizations in industries that are more exposed to intense competition may bolster resilience to competitive pressures in private firms. Group affiliation offers private firms a range of benefits that can help them thrive in a competitive environment. These benefits include access to shared resources (financial and nonfinancial), knowledge, and expertise. Group affiliation can also provide a supportive ecosystem conducive to innovation, centralized R&D facilities, shared distribution channels,

and economies of scale in procurement and production (Chang & Hong, 2002; Khanna and Yafeh, 2007; Beaver et al., 2019).

5.3 Policy implications

This study has policy implications for early warning systems of financial distress. The findings of this study show that the predictive ability of bankruptcy prediction models can be improved with product market competition indicators to help financial institutions reduce the costs generated by misclassifying bankrupt firms as non-bankrupt firms. Improving bankruptcy forecasts enhances the proper allocation of financial resources and reduces banks' non-performing loans. Moreover, product market competition indicators could also be used in financial distress early warning systems, such as the one promoted by the European Union's recent regulation for a new approach to business failure and insolvency (Directive EU 2017/1132 "Restructuring and Insolvency" and 2019/1023 "Preventive Restructuring Frameworks"), aimed at reducing default filing through early detection and solution of financial distress situations.

6. Conclusions

This study investigates the relationship between PMC and financial defaults. Using a sample of private Italian firms, we show that PMC has a prevailing risk-increasing effect on the likelihood of financial default. This research also provides evidence that group affiliation has a moderating effect on the relationship between PMC and default. The findings also show that including a measure of PMC increases the predictive ability of the Altman model. Among PMC measures, fluidity provides the highest predictive ability, and the increase is economically significant.

This study contributes to the literature on the effect of competition on financial default (Valta, 2012; Bernini & Montagnoli, 2017; Platt, 2020), showing that competition has an increasing effect on default risk for private firms, which overcomes its potential disciplinary role. This study also contributes to the literature on product market competition by extending the use of firm-specific text-based measures of competition to the analysis of private firms and non-US settings (Babar & Habib, 2021). Finally, this study contributes to the research on financial default in private firms (Susi & Lukason, 2019; Altman et al., 2020; De Silva et al., 2024), with evidence that accounting-based default prediction can be complemented by considering a firm's competitive environment.

This study has implications for management practices. Recognizing the influence of competition on default risk, it recommends the early proactive adoption of strategies to navigate financial distress and enhance resilience in competitive environments. It also suggests considering group organizations to obtain valuable resources that bolster resilience to competition. Our results may also have policy implications for early warning systems for financial distress.

This study has some limitations. Although the Italian setting shares similarities with European Union countries and numerous bank-based economies, our findings may not extend to emerging economies. Future research could further investigate this topic, even undertaking a cross-country analysis across diverse institutional settings. Future research could also address moderating factors, such as the features of the top management team or intellectual capital, which may influence the relationship between competition and default risk.

Declaration of potential conflict of interest

None.

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Table 1 – Sample selection and breakdown

Panel A – Sample selection

This table shows the process followed to select our empirical sample.

	Firm-year obs.
All the firm-year obs. in the AIDA Bureau Van Dijk database, which are above the dimensional thresholds mandating the issuance of the complete financial statements for the period 2008–2016	261,368
- *Utilities and finacial instituions*	*(157,750)*
- *Firm-year obs. in industry-year groups with less than 10 bankrupt firms*	*(14,566)*
- *Firm-year obs. without fluidity measure*	*(55,175)*
- *Firm-year obs without ownership data*	*(1,564)*
Final sample	**32,313**

Panel B – Sample breakdown by industry

Code	NACE 2007 description	Bankrupt obs	Bankrupt obs %	Non-Bankrupt obs	Total obs
10	Manufacture of food products	63	0.017	3655	3,718
14	Manufacture of textile/fashion products	42	0.028	1439	1,481
15	Manufacture of leather and related products	49	0.038	1237	1,286
23	Manufacture of other non-metallic mineral products	79	0.036	2115	2,194
25	Manufacture of fabricated metal products	135	0.020	6574	6,709
29	Manufacture of motor vehicles, trailers	11	0.014	781	792
31	Manufacture of furniture	68	0.048	1339	1,407
32	Other manufacturing	29	0.028	997	1,026
41	Construction of buildings and other	120	0.056	2006	2,126
45	Wholesale and retail trade of motor vehicles and motorcycles	198	0.041	4671	4,869
47	Retail trade	138	0.029	4667	4,805
52	Warehousing and transportation	27	0.014	1873	1,900
		959	0.030	31354	32,313

Panel C – Sample breakdown by firm age

	Bankrupt obs	Bankrupt obs %	Number of obs
Early Stage (1-5 years)	9	0.096	94
Young firms (6-10 years)	57	0.043	1,317
Mature firms (>10 years)	893	0.029	30,902
Total/Average	959	0.030	32,313

Table 2 – Descriptive statistics

This table reports both summary statistics and the test of differences in means for the explanatory variables included in our models. The sample period stretches from January 1, 2008, to December 31, 2016. All variables were measured using annual data. The test of difference in means is a t-test; p-values are displayed in parentheses. All variables are defined in Appendix. ***, **, and * represent statistical significance at the 1%, 5%, and 10% level.

Variables	Non-Bankrupt firms			Bankrupt firms			Non-bankrupt – Bankrupt		Full sample			
	Mean	Median	SD	Mean	Median	SD	Difference in means		Mean	Median	SD	N
Fluidity	0.046	0.037	0.037	0.052	0.042	0.040	0.0080***	(-6.64)	0.047	0.038	0.038	32.313
HHI	0.188	0.042	0.295	0.161	0.037	0.282	-0.0082	(-0.91)	0.187	0.042	0.295	32.313
EXIST	2.081	1.804	2.229	2.670	2.034	2.586	-0.475***	(-6.56)	2.097	1.833	2.242	32.313
POTENT	-0.004	0.102	0.475	-0.060	0.104	0.594	0.0376*	(2.38)	-0.006	0.102	0.478	32.313
PROFIT	-0.196	-0.093	0.743	-0.262	-0.231	0.925	0.0589*	(2.46)	-0.198	-0.093	0.748	32.313
WCTA	0.183	0.165	0.223	-0.020	0.015	0.283	0.196***	(26.33)	0.177	0.161	0.227	32.313
RETA	0.149	0.097	0.157	0.098	0.045	0.145	0.0559***	(10.79)	0.148	0.094	0.157	32.313
SATA	1.454	1.184	1.009	1.228	0.919	1.077	0.226***	(6.71)	1.448	1.179	1.012	32.313
DEBT	0.149	0.159	0.242	0.350	0.383	0.222	-0.205***	(-25.03)	0.155	0.166	0.244	32.313
ROA	3.560	2.950	6.868	-4.472	-0.520	10.423	7.122***	(31.03)	3.334	2.890	7.117	32.313
SIZE	9.577	9.439	1.074	9.431	9.501	1.182	0.135***	(3.83)	9.572	9.440	1.077	32.313
OWNCONC	61.793	53.750	28.331	63.308	58.030	27.932	1.294*	(-1.15)	61.836	53.995	28.321	32.313
EARLY	0.003	0.000	0.050	0.008	0.000	0.089	0.0066***	(-3.78)	0.003	0.000	0.052	32.313

Table 3 – Correlation coefficients

This table shows the Pearson's correlation coefficients for both the dependent and explanatory variables included in the analyses. All variables are defined in Appendix. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	Bankruptcy	Fluidity	HHI	EXIST	POTENT	PROFIT	WCTA	RETA	SATA	DEBT	ROA	SIZE	OWNCONC	EARLY
Bankruptcy	1.00													
Fluidity	0.03***	1.00												
HHI	-0.02*	0.02*	1.00											
EXIST	0.04***	0.06***	-0.58***	1.00										
POTENT	-0.02**	-0.01	0.10***	-0.54***	1.00									
PROFIT	-0.01*	-0.03***	0.10***	-0.45***	0.39***	1.00								
WCTA	-0.15***	-0.04***	0.04***	-0.06***	0.07***	0.09***	1.00							
RETA	-0.05***	-0.04***	0.06***	-0.06***	0.04***	0.04***	0.46***	1.00						
SATA	-0.04***	0.10***	0.08***	0.05***	-0.03***	-0.18***	-0.02*	-0.10***	1.00					
DEBT	0.14***	-0.00	-0.12***	0.09***	-0.00	-0.04***	-0.48***	-0.41***	-0.20***	1.00				
ROA	-0.19***	-0.02**	0.06***	-0.10***	0.05***	0.11***	0.32***	0.10***	0.10***	-0.29***	1.00			
SIZE	-0.02***	-0.04***	0.00	-0.04***	-0.06***	0.07***	-0.06***	-0.01	-0.40***	0.08***	0.03***	1.00		
OWNCONC	0.01	0.01	0.05***	-0.04***	-0.01	0.01	-0.00	-0.01	0.01	-0.09***	0.00	0.16***	1.00	
EARLY	0.02**	0.02**	-0.00	0.01	-0.02*	-0.01*	-0.02***	-0.02**	0.06***	-0.00	-0.02*	-0.01*	0.01	1.00

Table 4 – Main regression models. All variables are defined in Appendix. Robust standard errors are contained in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

Panel A - Results without industry fixed effects

Variables	(1)	(2)	(3)	(4)	(5)
	Base model	Model with Fluidity	Model with HHI	Model with Li's variables	Model with all competition measures
WCTA$_{t-1}$	-1.329***	-1.337***	-1.397***	-1.347***	-1.374***
	(0.236)	(0.236)	(0.234)	(0.236)	(0.182)
RETA $_{t-1}$	-1.375**	-1.374**	-1.337**	-1.323**	-1.250***
	(0.535)	(0.538)	(0.524)	(0.534)	(0.409)
SATA $_{t-1}$	-0.255***	-0.278***	-0.311***	-0.259***	-0.266***
	(0.0575)	(0.0585)	(0.0622)	(0.0581)	(0.0521)
DEBT $_{t-1}$	2.395***	2.387***	2.295***	2.396***	2.529***
	(0.210)	(0.211)	(0.209)	(0.211)	(0.178)
ROA $_{t-1}$	-0.0870***	-0.0865***	-0.0863***	-0.0870***	-0.0731***
	(0.00604)	(0.00610)	(0.00615)	(0.00607)	(0.00500)
SIZE $_{t-1}$	-0.330***	-0.341***	-0.350***	-0.324***	-0.264***
	(0.0183)	(0.0187)	(0.0187)	(0.0184)	(0.0454)
OWNCONC $_{t-1}$	0.00244	0.00235	0.00234	0.00243	0.00211**
	(0.00153)	(0.00153)	(0.00154)	(0.00153)	(0.000963)
EARLY $_{t-1}$	1.270**	1.207**	1.263**	1.244**	1.012**
	(0.511)	(0.520)	(0.525)	(0.521)	(0.425)
Fluidity $_{t-1}$		3.559***			4.797***
		(1.002)			(0.764)
HHI $_{t-1}$			-0.800***		0.155
			(0.264)		(0.252)
EXIST $_{t-1}$				0.115***	0.112***
				(0.0218)	(0.0234)
POTENT $_{t-1}$				0.0400	0.0798
				(0.119)	(0.107)
PROFIT $_{t-1}$				-0.0343	-0.0295
				(0.0654)	(0.0475)
Obs	32,313	32,313	32,313	32,313	32,313
Year FE	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	NO

Panel B – Results with industry fixed effects

Variables	(1)	(2)	(3)	(4)	(5)
	Base model	Model with Fluidity	Model with HHI	Model with Li's variables	Model with all competition measures
$WCTA_{t-1}$	-1.550***	-1.394***	-1.448***	-1.410***	-1.475***
	(0.240)	(0.230)	(0.231)	(0.231)	(0.187)
$RETA_{t-1}$	-1.345**	-1.322**	-1.331**	-1.291**	-1.225***
	(0.528)	(0.530)	(0.524)	(0.527)	(0.409)
$SATA_{t-1}$	-0.293***	-0.371***	-0.356***	-0.353***	-0.250***
	(0.0631)	(0.0619)	(0.0626)	(0.0612)	(0.0566)
$DEBT_{t-1}$	2.251***	2.312***	2.246***	2.312***	2.551***
	(0.208)	(0.207)	(0.207)	(0.207)	(0.178)
ROA_{t-1}	-0.0841***	-0.0853***	-0.0857***	-0.0857***	-0.0715***
	(0.00630)	(0.00621)	(0.00621)	(0.00619)	(0.00506)
$SIZE_{t-1}$	-0.374***	-0.343***	-0.347***	-0.330***	-0.256***
	(0.0210)	(0.0199)	(0.0199)	(0.0196)	(0.0461)
$OWNCONC_{t-1}$	0.00260*	0.00256*	0.00257*	0.00263*	0.00261***
	(0.00154)	(0.00154)	(0.00154)	(0.00154)	(0.000966)
$EARLY_{t-1}$	1.409***	1.337**	1.369***	1.375***	1.103**
	(0.538)	(0.520)	(0.520)	(0.518)	(0.432)
$Fluidity_{t-1}$		2.786***			4.664***
		(1.038)			(0.799)
HHI_{t-1}			-0.702***		-0.0132
			(0.265)		(0.272)
$EXIST_{t-1}$				0.0860***	0.0803***
				(0.0224)	(0.0277)
$POTENT_{t-1}$				0.0645	0.0740
				(0.124)	(0.127)
$PROFIT_{t-1}$				0.0155	-0.0136
				(0.0636)	(0.0518)
Obs	32,313	32,313	32,313	32,313	32,313
Year FE	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES

Table 5 – Interaction Analysis. All variables are defined in Appendix. Robust standard errors are contained in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

Variables	(1)	(2)	(3)
	Model with Fluidity	Model with HHI	Model with Li's variables
$WCTA_{t-1}$	-1.496***	-1.523***	-1.342***
	(0.187)	(0.185)	(0.183)
$RETA_{t-1}$	-1.212***	-1.360***	-1.421***
	(0.405)	(0.408)	(0.404)
$SATA_{t-1}$	-0.227***	-0.304***	-0.0882*
	(0.0551)	(0.0502)	(0.0483)
$DEBT_{t-1}$	2.541***	2.406***	2.510***
	(0.177)	(0.168)	(0.174)
ROA_{t-1}	-0.0727***	-0.0712***	-0.0687***
	(0.00507)	(0.00499)	(0.00518)
$SIZE_{t-1}$	-0.254***	-0.3799***	-0.333***
	(0.0466)	(0.0167)	(0.0392)
$OWNCONC_{t-1}$	0.0028***	0.00306***	0.00343***
	(0.0009)	(0.000984)	(0.000993)
$EARLY_{t-1}$	1.251***	1.271***	1.229***
	(0.415)	(0.426)	(0.428)
GROUP-AFFILIATED	0.0855	-0.187	-0.173
	(0.160)	(0.124)	(0.188)
$FLUIDITY_{t-1}$	1.479***		
	(0.421)		
$FLUIDITY_{t-1}$* GROUP-AFFILIATED	-2.320*		
	(1.355)		
HHI_{t-1}		-0.619***	
		(0.190)	
HHI_{t-1}* GROUP-AFFILIATED		0.305	
		(0.329)	
$EXIST_{t-1}$			0.0838***
			(0.0207)
$POTENT_{t-1}$			0.0486
			(0.122)
$PROFIT_{t-1}$			0.0222
			(0.0496)
$EXIST_{t-1}$* GROUP-AFFILIATED			-0.0312
			(0.0697)

POTENT $_{t-1}$* GROUP-AFFILIATED			0.378
			(0.456)
PROFIT $_{t-1}$* GROUP-AFFILIATED			-0.368*
			(0.213)
Observations	32,313	32,313	32,313
Year FE	YES	YES	YES
Industry FE	YES	YES	YES

Table 6 – Cross-sectional analysis - All variables are defined in Appendix. Robust standard errors are contained in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

	Non-group affiliated			Group-affiliated firms		
Variables	Model with Fluidity	Model with HHI	Model with Li's variables	Model with Fluidity	Model with HHI	Model with Li's variables
WCTA$_{t-1}$	-1.522***	-1.530***	-1.514***	-1.729***	-1.744***	-1.819***
	(0.272)	(0.272)	(0.272)	(0.586)	(0.584)	(0.574)
RETA $_{t-1}$	-1.772***	-1.744***	-1.789***	-0.0502	-0.0671	-0.218
	(0.606)	(0.602)	(0.602)	(1.115)	(1.119)	(1.108)
SATA $_{t-1}$	-0.403***	-0.384***	-0.400***	0.0970	0.0931	0.0754
	(0.0767)	(0.0764)	(0.0791)	(0.108)	(0.108)	(0.108)
DEBT $_{t-1}$	2.245***	2.264***	2.244***	2.302***	2.283***	2.154***
	(0.235)	(0.236)	(0.234)	(0.528)	(0.537)	(0.545)
ROA $_{t-1}$	-0.0835***	-0.0836***	-0.0835***	-0.0874***	-0.0870***	-0.0881***
	(0.00740)	(0.00737)	(0.00736)	(0.0120)	(0.0120)	(0.0122)
SIZE $_{t-1}$	-0.371***	-0.360***	-0.370***	-0.395***	-0.393***	-0.410***
	(0.0242)	(0.0241)	(0.0243)	(0.0521)	(0.0517)	(0.0517)
OWNCONC $_{t-1}$	0.00349*	0.00351*	0.00343*	-0.00203	-0.00225	-0.00261
	(0.00181)	(0.00181)	(0.00181)	(0.00481)	(0.00483)	(0.00479)
EARLY $_{t-1}$	1.063	1.096	1.097	1.970**	1.934*	2.013*
	(0.675)	(0.672)	(0.670)	(0.975)	(1.005)	(1.039)
Fluidity $_{t-1}$	3.397***			-1.899		1.327
	(1.117)			(3.316)		(1.079)
HHI $_{t-1}$		-0.564**			-0.486	
		(0.274)			(0.788)	
EXIST $_{t-1}$			0.0569**			0.128
			(0.0280)			(0.0777)
POTENT $_{t-1}$			0.0206			0.676
			(0.153)			(0.500)
PROFIT $_{t-1}$			0.0341			-0.00356
			(0.0729)			(0.193)
Obs.	27,299	27,299	27,299	5,014	5,014	5,014
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES

Table 7 – Predictive ability: in-sample analysis

	Independent variables	Base Model (1)	Fluidity (2)	HHI (3)	Li (2010) measures (4)
In sample without industry FE	Percentage of correctly classified	65.66	66.28	66.02	66.43
	Sensitivity	76.02	77.08	75.92	75.44
	Specificity	65.34	65.94	65.70	66.14
	AUC	0.775	0.784	0.777	0.780
	Difference in AUC		22.00***	1.78	6.41**
In sample with industry FE	Percentage of correctly classified	67.35	67.67	67.41	67.51
	Sensitivity	75.92	76.69	76.21	76.21
	Specificity	67.08	67.39	67.13	67.24
	AUC	0.789	0.794	0.790	0.790
	Difference in AUC		16.22***	2.15	2.97*

Table 8 – Predictive ability: out-of-sample analysis

Independent variables	Base Model (1)	Fluidity (2)	HHI (3)	Li (2010) measures (4)
Percentage of correctly classified	77.91	79.43	79.02	78.18
Sensitivity	78.40	83.54	79.97	81.06
Specificity	68.26	69.98	68.73	67.71
AUC	0.800	0.827	0.808	0.810

Table 9 – Robustness test. All variables are defined in Appendix. Robust standard errors are contained in parentheses. ***, **, and * represent statistical significance at the 1%, 5%, and 10% level, respectively.

Variables	(1)	(2)	(3)	(4)	(5)
	Base model	Model with Fluidity	Model with HHI	Model with Li's variables	Model with all competition measures
$WCTA_{t-1}$	-1.349***	-1.220***	-1.268***	-1.233***	-1.241***
	(0.248)	(0.240)	(0.241)	(0.241)	(0.201)
$RETA_{t-1}$	-1.479***	-1.463***	-1.459***	-1.421**	-1.482***
	(0.562)	(0.564)	(0.558)	(0.562)	(0.451)
$SATA_{t-1}$	-0.232***	-0.315***	-0.293***	-0.293***	-0.179***
	(0.0590)	(0.0589)	(0.0597)	(0.0584)	(0.0558)
$DEBT_{t-1}$	2.218***	2.245***	2.202***	2.254***	2.685***
	(0.215)	(0.215)	(0.216)	(0.215)	(0.188)
ROA_{t-1}	-0.0714***	-0.0719***	-0.0722***	-0.0719***	-0.0695***
	(0.00690)	(0.00690)	(0.00690)	(0.00691)	(0.00574)
$SIZE_{t-1}$	-0.378***	-0.350***	-0.355***	-0.336***	-0.203***
	(0.0211)	(0.0202)	(0.0204)	(0.0199)	(0.0445)
$OWNCONC_{t-1}$	0.00208	0.00206	0.00205	0.00213	0.00234**
	(0.00160)	(0.00160)	(0.00161)	(0.00160)	(0.00108)
$EARLY_{t-1}$	1.375***	1.279***	1.323***	1.328***	1.133***
	(0.500)	(0.492)	(0.492)	(0.492)	(0.409)
$DECLINE_{t-1}$	1.920***	1.954***	1.938***	1.956***	1.849***
	(0.136)	(0.137)	(0.138)	(0.137)	(0.111)
$Fluidity_{t-1}$		3.107***			4.236***
		(1.095)			(0.898)
HHI_{t-1}			-0.805***		-0.154
			(0.275)		(0.317)

EXIST $_{t-1}$				0.0867***	0.0828***
				(0.0235)	(0.0307)
POTENT $_{t-1}$				0.0426	0.0731
				(0.126)	(0.135)
PROFIT $_{t-1}$				0.0302	-0.00994
				(0.0642)	(0.0608)
Obs	32,313	32,313	32,313	32,313	32,313
Year FE	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES

Appendix A – Definition of variables

Dependent variable		
Name	**Label**	**Measures**
Bankruptcy score	*Bankruptcy$_t$*	Binary variable equal to 1 if firm i is bankrupt in year t, 0 otherwise
Product market competition variable		
Market Fluidity	*Fluidity*	Text-based variable that captures changes in rival firms' product descriptions compared to the firm's product description
Competition from existing rivals	EXIST	A principle component obtained using principal component analysis of eight competition variables; it measures competition from existing rivals
Competition from potential entrants	POTENT	A principle component obtained using principal component analysis of eight competition variables; it measures the competition from potential entrants
Industry profitability	PROFIT	A principle component obtained using principal component analysis of eight competition variables; it measures industry profitability
Herfindahl–Hirschman Index	HHI	The sum of squared market shares of all firms in the industry j at year t; it measures the market concentration. The industry is identified using four-digit NACE 2007 codes.
Financial Ratio		
Profitability	EBITA	Earnings before interest and taxes at time t on total assets at time t
Liquidity	WCTA	Working capital at time t on total assets at time t
Leverage	DEBT	Equity at time t on total assets at time t
Liquidity	RETA	Retained earnings at time t on total assets at time t
Liquidity	SATA	Sales at time t on total assets at time t
Control Variables		
Time	*Year FE*	Dummy variable for each year
Industry	*Industry FE*	Dummy variable for each industry
Firm's size	*Size*	Natural logarithm of firm's total assets
Early life cycle stage	*Early*	Dummy, 1 if the firm is between 1 and 5 years old since constitution, 0 otherwise
Ownership concentration	*Ownconc*	Percentage of share owned by the largest shareholder

Li's (2010) competition indicators

Herfindahl-Hirschman Index	IND-HHI	The sum of squared market shares of all firms in the industry *j* at year *t*. The industry is identified using four-digit NACE 2007 codes.
the four-firm concentration ratio	IND-CON4	The sum of market shares of the four largest firms in the industry *j* at year *t*. The industry is identified using four-digit NACE 2007 codes.
industry-average property, plant and equipment	IND-PPE	The average net value of property, plant, and equipment (tangible fixed assets) of all firms in the industry *j* at year *t*. The industry is identified using four-digit NACE 2007 codes.
the product market size	IND-MKTS	The natural log of aggregate sales of all firms in the industry *j* at year *t*. The industry is identified using four-digit NACE 2007 codes.
the aggregate industry price-cost margin	IND-MGN	The aggregate sales of all firms in the industry *j* at year *t* divided by their aggregate operating costs. The industry is identified using four-digit NACE 2007 codes.
the industry average capital expenditures	IND-CPX	The average of capital expenditures of all firms in in the industry *j* at year *t*. The industry is identified using four-digit NACE 2007 codes.
The number of firms operating in an industry	IND-NUM	Total number of firms in the industry *j* at year *t*. The industry is identified using four-digit NACE 2007 codes.
the industry aggregated ROA	IND-ROA	The aggregate operating profit before depreciation of all firms in the industry *j* at year *t* divided their aggregate total Assets. The industry is identified using four-digit NACE 2007 codes.

Appendix B – Product market fluidity

This appendix describes the data source for and calculation of product market fluidity. Following Hoberg et al. (2014), this study measures fluidity by analyzing the text included in the business description that all Italian firms must provide to the Chambers of Commerce by law. The Chambers of Commerce are in charge of archiving firms' financial statements and key information such as business description, owner identity, the industry in which the firm operates, and the registered office, among others. The business description includes the company's objective and the description of the product and services offered within an industry.

The business descriptions are available in the Bureau Van Dijk database, together with the firms' financial statements. More specifically, business descriptions are available in the CDs of the AIDA database (Bureau Van Dijk). We had to use the CDs because the business description is a static variable in the AIDA database, and, consequently, to capture the change in companies' business descriptions, we had to download them separately from the December AIDA CD of each year of our time span (2008–2016). According to Italian law, all companies must communicate the business description, as it is in the articles of association with the local Chamber of Commerce. Such a description is accurate and complete due to the legal consequences for a company's directors if they should make decisions outside the scope of the business description incorporated in the articles of association: A company's directors are personally liable for any loss arising from transactions that are not clearly within the economic activities described in the articles on the association's business description. For this reason, directors have a strong incentive to have these articles drafted accurately and to ensure that the business description is fully comprehensive of the company's activities. Moreover, in case of changes to the company's economic activities, the directors have an equally strong incentive to promptly update the business description in the articles of association.

"Fluidity captures how rivals are changing the product words that overlap with firm i's vocabulary" (Hoberg et al., 2014, p. 298). Fluidity is intuitively a cosine similarity between a firm's own word usage vector Ni,t and the aggregate rivals' change vector D$t-1,t$. Fluidity is greater when a firm's words overlap more with D$t-1,t$, the vector that reflects rival actions. One can find an example of the calculation in Hoberg et al. (2014), on page 319. The higher the fluidity, the higher is the competitive threat. The crucial point is that threat and instability arise from competitors' actions, which a static measure of market share would not capture (Hoberg et al., 2014). Fluidity can be calculated regardless of the language of the business description.

This study uses computational linguistics to calculate fluidity using Python software specifically created for the research. Below, we report several examples of business descriptions belonging to different industries in order to provide a better sense of the texts analyzed to build the fluidity measure.

Industry	Business description (Italian original)	Business description
Merchandising	commercio all'ingrosso di prodotti petroliferi e lubrificanti per trazione, di combustibili per riscaldamento	wholesale of petroleum products and traction lubricants, heating fuels
Consumer electronics	produzione di computer, componenti elettronici, cavi, videogames e giocattoli, accessori, produzione di software applicativo; il commercio all'ingrosso ed al dettaglio dei prodotti di cui sopra e rappresentanze, installazioni e gestioni di reti informatiche e telematiche, servizi di manutenzione e riparazione relativi ai beni ed ai servizi di cui sopra, attività di elaborazione dati e servizi informatici e contabili, attività di noleggio dei beni e prodotti di cui innanzi, servizi di logistica per conto terzi nei medesimi settori nei quali opera la società, corsi di formazione professionale nei predetti settori	production of computers, electronic components, cables, videogames and toys, accessories, production of application software; the wholesale and retail trade of the above products, and representation, installation and management of it and telematics networks, maintenance and repair services relating to the goods and services referred to above, data processing as well as data processing and computer and accounting services, hire of the above goods and products, logistics services for third parties in the same sectors as the above, services for third parties in which the company operates, professional training courses in the above sectors

Automotive	progettazione produzione e commercializzazione di autovetture veicoli speciali e veicoli commerciali senza limitazioni di portata derivati allestimenti gruppi sottogruppi parti staccate ricambi e accessori nonché la commercializzazione di accessori oggetti articoli e prodotti appartenenti a qualsiasi classe merceologica purché direttamente connessa con la vendita di autoveicoli e veicoli commerciali	design, production and marketing of passenger cars, special vehicles and commercial vehicles without limitation of capacity, derivatives, fittings, subgroups, detached parts, spare parts and accessories, as well as the marketing of accessories, objects and products belonging to any product class, provided that they are directly related to the sale of motor vehicles and commercial vehicles