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Can Small Firms Innovate Away From Competition?

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In this paper we test whether innovation allows entrepreneurs to navigate their way out of highly competitive markets into calmer waters where competitive pressures are reduced. In doing so, we establish three key findings: first, in line with the Schumpeterian creative destruction theory, our results document a decreasing marginal effect of prior innovation on consecutive perceived competition, an effect that is stronger for small firms operating in more competitive markets; then, we highlight the different synergistic effects generated by the complementarity between tangible and intangible innovation activities in competitive and oligopolistic markets that support the Schumpeterian view; finally, we establish that such synergies have proven crucial in navigating out of the COVID-19 pandemic.

Introduction

The question of how competition affects innovation has attracted a lot of attention in the literature. Starting from the early works of Schumpeter (1934), scholars have developed divergent theories on the impact of competition on innovation. Some point out a positive effect (Arrow, 1962), whereas others find a negative (Schumpeter, 1942) or a non-monotonic (Aghion et al., 2005) effect. Such theories were mostly tested on large firms (e.g. Blundell, Griffith and Van Reenen, 1999; Cornett et al., 2019; Geroski, 1990; Peneder and Worter, 2014; Tingvall and Poldahl, 2006), because of beliefs that small firms tend to be marginal players of innovation. An interest in smaller firms emerged after the work of Acs and Audretsch (1988) and is mainly devoted to testing traditional theories on competition and innovation. Nevertheless, the question of how innovation affects the competitive dynamics of markets in the context of small firms remains unexplored. Economists tend to assume that small firms, because of their size per se, tend to operate in highly competitive markets where they are price takers and face many similar sized competitors (Chamberlain, 1937; Robinson, 1934; Stigler, 1957). In contrast, entrepreneurship scholars tend to take the opposite view, namely that because entrepreneurs are dynamic agents of change and innovators, they are able to find niche markets that can sustain high profit levels (Bradburd and Ross, 1989). One notable exception is Cowling and Nadeem (2020), who show that a significant share of the population of small firms is able to establish a presence in markets where they offer a slightly differentiated product or service that offers some protection from competition. It follows that understanding how the intensity of perceived competition is shaped and influenced by a firm's prior innovation efforts may help us understand more about how some firms are able to navigate their way out of highly competitive markets and reach a more stable position where they offer a differentiated (or completely new) product or service that shields them from some (or all) of their competitors.

Reaching a protected market position allows a small firm to exert some price setting. Because of this ability, a small firm can differentiate its product, improve profitability and introduce a more resilient business model.

Equally, as markets and competition are fluid and dynamic, understanding how small firms that used to have a protected market position may lose this by not innovating adds to our knowledge and understanding of the evolutionary competitive dynamics of small firms. These aspects largely remain unexplored, and this is our first contribution to the literature. Using a large panel data set covering 11 Eurozone countries over the period 2015–2021, we investigate innovation and competition dynamics and test whether innovating reduces future perception of competition. In addition, we can establish

what types of innovation are most important in shaping these dynamics by taking advantage of tangible (new products and services, new production processes) and intangible (marketing and organization) innovation. This is our second point of value added. Our final aspect of value added relates to our ability to leverage the COVID-19 shock to establish whether commitment to innovation (or not) allows firms to move out from competitive markets during turbulent market phases.

From our analysis of the dynamics of the impact of past innovation and perceived competition, we establish four key findings. First, half of Eurozone small firms declare that they operate in very competitive markets, while the rest of the firms declare that they operate in monopolistic and oligopolistic markets in which competitive pressures are lower. Innovation rates are similar across competitive and monopolistic markets, while they are lower for firms in oligopolistic markets.

Second, we find that specific modes of innovation can help firms transition away from competition. In particular, the complementary role of organizational and marketing innovation enhances incremental product innovation for firms operating in oligopolistic markets, whereas marketing innovation strengthens the relationship between product innovation and firms' performance, thereby permitting firms to gain competitiveness in competitive markets. This second set of results is in line with the theoretical framework employed by Battisti and Stoneman (2010), whose results emphasize the complementarity of organizational and technological innovations that generates positive synergistic effects and helps firms' competitiveness. Third, we find that the synergies between all modes of innovation made small and medium enterprises (SMEs) resilient during the pandemic and helped them to move away in 'calm waters' (less competitive markets) at the expense of less innovative competitors. In this sense, the returns to innovation when firms face a severe exogenous shock, such as COVID-19, are magnified as the old established ways of doing business may not be sustainable in the short term. This is again consistent with the Schumpeterian view that entrepreneurs are agents of creative destruction and disequilibrium and with the recent findings that technological resources or capabilities can result in a better outcome of competitive advantage (Huang et al., 2015).

We advance the literature in two key respects. First, we depart from the literature on the relationship between competition and innovation for small firms (Farè, 2022; Mulkay, 2019; Moen et al., 2018) by analysing whether innovation disrupts market competition. To do so, we place each firm in a specific market based on the perceived level of competition and treat competition and innovation as co-determinants of change in market structure and firm positioning. Our novel approach relies on a Schumpeterian perspective of the firm as a dynamic and innovative actor that leverages dynamic capabilities (Petit and Teece, 2021). The Schumpeterian thought serves as the backbone for our discussion and interpretation of the results, allowing us to advance the stream of research investigating the unique contribution of established small firms to the innovation–competition relationship. Second, we dive into the mechanism by showing how specific types of innovation (product, process, organization and marketing) contribute the most to reducing competition. To effectively deal with econometric issues, we test our main results by leveraging the COVID-19 shock in a difference-in-differences framework.

The rest of the paper is organized as follows. First we review the literature on the relationship between innovation and competition and the market structure. We then present our data and descriptive statistics. In the section on empirical methodology, we present our econometric results and a discussion of key findings. We conclude with the results and a discussion on the broad implications of our analysis and what it means for theory and future empirical work in this area.

Literature review

The classic discussion about the relationship between competition and innovation centres around three dominant theories conceived by (later) Schumpeter (1942), Arrow (1962) and Scherer (1967). In later Schumpeter, innovation is a dynamic process that disrupts existing market structures, leading to the obsolescence of old technologies and products. The role of entrepreneurs is central as they are the agents of "creative destruction" who bring ideas and introduce innovations that disrupt existing markets. Schumpeter posits a monotonic negative relationship between competition and innovation. The Schumpeterian effect suggests that increased competition makes innovation less profitable because the incentive to innovate is tied to the potential rent a firm can earn from its innovation. In contrast, Arrow (1962) introduces the value of information in the market for competition and argues that monopolistic firms have a lower incentive to innovate, compared with firms in competitive markets. Monopolistic rents from market power drive down motivation to invest in risky and costly innovation. Scherer (1967) refined the ideas of Schumpeter (1942) and Arrow (1962) and examined how different market structures influence innovation. In highly concentrated markets (with few large firms), firms have the resources, but lack of competitive pressures might discourage them from innovating. In competitive markets (with many small firms), intense competition drives innovation, but firms have limited resources to route to innovative projects. A recent theory of Aghion et al. (2005) supports the views of Scherer, finding an inverted-U relationship

between competition and innovation. According to these authors' empirical findings, innovation increases with competition up to a certain point, after which further increases in competition reduce innovation. In Aghion et al. (2005), the Schumpeterian effect – that is, large firms with market power are more likely to innovate because they can deploy resources to innovative projects – coexists with the escape competition effect, in which moderate levels of competition spur firms to escape from competitive pressure – that is, firms in competitive markets innovate to gain a temporary advantage over their rivals, thus improving their market position.

Several works empirically tested the main theories on the relationship between competition and innovation, most of the time in the context of large firms. Until early 2000, the empirical literature supported either the Schumpeterian or the Arrowian position. Bérubé, Duhamel and Ershov (2012), Blundell, Griffith and Van Reenen (1999) and Kraft (1989) support the Schumpeterian interpretation of a positive link between market power and innovation for large firms located in the United States, UK and Canada. Their main common argument is that dominant firms innovate because of a relatively greater incentive for doing it. In contrast, the Arrowian view of a positive relationship between competition and innovation is supported in the empirical works of Geroski (1990) and more recently in Ganglmair et al. (2020) and Thakor and Low (2022). Importantly for us, Thakor and Lo (2022) find that greater product market competition induces firms to reduce investments in tangible assets and increase investments in R&D, in line with the 'escape competition' effect in neck-and-neck industries (Aghion et al., 2005).

Motivated by the possibility of an inverted-U relationship between competition and innovation as hinted at by Scherer (1967), Aghion et al. (2005) provide evidence of an inverted-U relationship between product market competition (Lerner index) and innovation (citation-weighted patents), where the Arrowian and the Schumpeterian effects coexist for large UK firms. After Aghion et al. (2005), many studies tested the inverted-U relationship on large firms. Cornett et al. (2019), Crowley and Jordan (2017), Friesenbichler and Peneder (2016), Halpern and Murakozy (2015), Karaman and Lahiri (2014), Peneder and Worter (2014), Polder and Veldhuizen (2012) and Tingvall and Poldahl (2006) further confirm the findings of Aghion et al. (2005) of an inverted U-shaped relationship between industry competition and innovation.

The empirical evidence on the relationship between competition and innovation for small firms is scarce. Acs and Audretsch (1988) found that the innovation activity of small and large firms responds to considerably different technological and economic environments. Importantly, this study also found that market concentration was negatively associated with innovation, and this provides a basis for further investigation into the role of small firms in the innovation landscape, as most small firms start in relatively competitive markets where the returns to innovation might be higher. Farè (2022) confirms the findings of Aghion et al. (2005) of an inverted U-shaped relationship, whereby innovation initially increases with competition and then slightly declines. In contrast, Moen et al. (2018) and Mulkay (2019) do not support the evidence of an inverted-U relationship between competition and innovation for small firms. Askenazy et al. (2013) show an inverted U-shaped relationship that becomes flatter when the relative cost of R&D increases until it vanishes altogether for small firms. Finally, Ayyagari et al. (2011) find that foreign competition is positively associated with higher innovation rates but, by contrast, there is no association between state-owned competition and firm innovation.

While most of the literature has focused on how competition shapes innovation, the inverse relationship also holds. Successful innovations generally entail lower production costs, a higher quality of products and services and can alter the dynamics and structures of markets as innovation sends out competitors, blocks new ones and forces business model changes in competitors. In this paper, we contribute to the literature by using a dynamic approach and treat competition and innovation as co-determinants of changes in market structure and firm positioning therein. Our main argument is that innovation disrupts the markets in which a firm operates and allows the firm to move away from their competitors. In this respect, the early work of Schumpeter (1911) placed the entrepreneur front and centre and argued that they were embedded in, and inseparable from, innovation. Only with this understanding was Schumpeter able to set out his theory of creative destruction, which refers to the endogenous shift in the economy and markets through the destruction of old, established ways of doing business and the creation of new ways by entrepreneurs[1] (Langroodi, 2021). Rather, for Schumpeter economic development is a discontinuous change that disturbs the equilibrium and displaces it with new innovations. Within this framework, we test the relationship for small firms. Economists tend to implicitly assume that small firms tend to operate in highly competitive markets and levelled sectors where firms are at technological par with one another. However, this is not necessarily true. Cowling and Nadeem (2020), using survey data from the UK, found that 57.1% of small firms faced intense competition, 32.0% faced moderate competition, and only 11.0% faced weak or no

[1]In this respect, growth and business cycle dynamics are mutually dependent and reinforcing and are the end outcomes of a process of destruction of the old ways (the failure of firms) and the reallocation of productive resources to dynamic entrepreneurial innovators.

Table 1. Summary of the characteristics of different market structures

	Perfect competition	Monopolistic competition	Oligopoly	Monopoly
Number of competing firms	Large	Many	Few	One
Barriers to entry	None	None	High	High
Size of competitor firms	Small	Small	Small/Large	None
Product differentiation	Homogeneous	Differentiated	Differentiated	Single product
Market power	Price taker	Some price setting ability	Price setter	Price setter
Incentive to innovate	High	High	Low	Low
Future gains on innovation	High	High	Low	Low

Source: Department of Business, Innovation and Skills (2016) and Cowling and Nadeem (2020) and authors' own elaboration.

competition. Depending on the market in which a firm operates, the incentive and the gains on competition will change. In this regard, we place each firm in one of the typical market structure categories identified in the industrial organization literature – namely monopoly, oligopoly, monopolistic competition and perfect competition – and study how innovation allows firms to move away from competition. This approach is new as compared with the above empirical papers on competition and innovation for small firms. For reasons of space, we synthesize the characteristics of each market in Table 1.[2] If we assume that most (or all) entrepreneurs want to make above normal profits, then it follows that they would seek to avoid perfect competition if possible. Oligopoly is a realistic goal for small firms. In a static sense, sustaining an oligopolistic competitive market position would be a sensible strategic goal, or, in a dynamic sense, at least moving to a position where competitive pressures are reduced might be a means of achieving one's desired profits. There are many strategies that might help secure or achieve such a market position, but perhaps one of the most obvious and empirically validated would be to engage in innovation.

Data and variable definitions

Firm-level data are from the ECB/European Commission 'Survey on the Access to Finance of Enterprises' (SAFE). The survey has three characteristics that makes it particularly suitable for our paper: (1) it contains information on perceived competition and innovation dynamics; (2) when possible, firms are resurveyed along the waves of the survey, giving us the possibility to extract a panel of firms resurveyed; (3) it collects a large set of information on firm characteristics such as country, sector, size, age, performance, legal status, ownership structure. The survey started in 2009H1 and is conducted every six months. Firms surveyed are randomly selected from the Dun & Bradstreet business register and stratified by country, economic activity and size. In terms of sectoral activity, survey respondents are divided into four large industries based on the one-digit NACE classification: manufacturing, construction, services, and retail and trade.[3] In this study, we use 12 waves of the survey (from wave 13 to wave 25), which correspond to the period from 2015 to 2022,[4] for the 11 major Eurozone economies.

Competition

To measure competition, we rely on the following question (code: Q0b_2): 'How important have the following problems been for your enterprise in the past six months? Please answer on a scale of 1–10, where 1 means it is not at all important and 10 means it is extremely important.' The survey lists competition[5] as a pressing problem without specifying the nature of competition issues: product or market. Moreover, we do not have information on the number of firm competitors, although it is reasonable to expect that the number of competing firms increases with perceived competition. Our measure is an imperfect proxy for the intensity of competition because of its subjective nature. However, using subjective measures rather than industry indicators of competition has some advantages. First, a firm-level measure of competition can properly account for the fact that, in a given industry, a firm might produce different products and/or services for different markets that would not be possible to capture with industry-level measures of competition.

[2]See Cowling and Nadeem (2020) for a detailed description of each market.

[3]Firms in agriculture, public administration and financial services are excluded.

[4]See Table A.1 for further details on the reference period and the distribution of firms across countries. We retain the 11 major Eurozone economies because firms domiciled in these countries are surveyed in all the waves used, whereas small countries are usually surveyed on an annual basis (for example: firms domiciled in Hungary are surveyed every two waves). We start our analysis from wave 14 because in that survey wave the SAFE questionnaire was revisited and expanded.

[5]The other listed problems are: finding customers, access to finance, cost of production or labour, availability of skilled staff or experienced managers, regulation.

Figure 1. Time-series of average competition intensity over waves of the survey.
This figure shows the average level of perceived competition of the surveyed firms for the sample period 2015H1–2021H1.

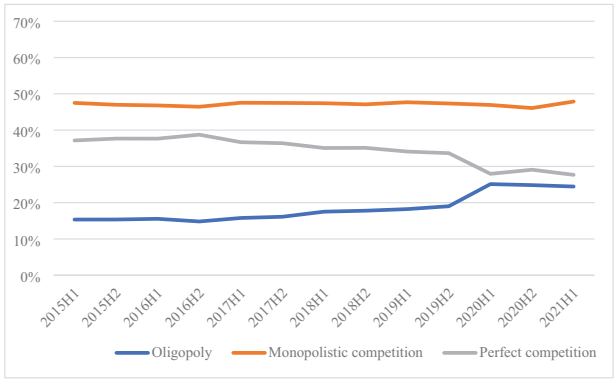

Figure 2. Frequency of the three market structures along the waves of the survey.
This figure shows the frequency of firms in each market segment (oligopoly, monopolistic competition and perfect competition) along the waves of the survey.

Second, despite being in the same sector, entrepreneurs can have different perceptions of competition that strongly influence their key strategic decisions. Indeed, as argued in Schumpeter (1942), entrepreneurs feel themselves to be in a competitive situation even if they are alone in their field or if, although not alone, they hold a position such that the government fails to see any effective competition between them and any other firm.

In Figure 1, we plot the average perception of competition of the surveyed firms over the waves of the survey. The measure remains relatively stable over time and exhibits a slow reduction in the last waves of the survey (post COVID-19 period). Although this reduction may be interpreted as a response to a cleansing effect of the pandemic that compromised inefficient and zombie firms' profitability, the share of these firms increased after the COVID-19 pandemic following the introduction of fiscal policies and monetary easing (Havemeister and Horn, 2023). Such an increase might have caused negative spillover effects on investments and credit conditions on healthy innovative firms.

We split the perceived competition into three partitions that identify the three markets presented in Section Literature review: oligopoly, monopolistic competition and perfect competition. More precisely, we identify the three markets in the following way: (1) oligopoly: market in which a firm declares a perceived competition level from 1 to 3; (2) monopolistic market: a market in which a firm declares a perceived competition level from 4 to 7; (3) perfect competition: a market in which a firm declares a perceived competition level from 8 to 10. In Figure 2, we plot the frequency of the three markets along the waves of the survey. Similar to in Figure 1, the frequency of firms in each market remains roughly stable before the COVID-19 period (2020H1). Starting from that wave, we detect a drop in the frequency of firms in the monopolistic market and an increasing percentage of firms in the oligopolistic market.

Innovation

To measure whether firms are innovators or not, we rely on question Q1, which states: 'During the past 12 months have you introduced: (a) a new or significantly improved product or service to the market?; (b) a new or significantly improved production process or method?; (c) a new organisation of management?; (d) a new way of selling your goods or services?' Following previous works (Farè, 2022; Ferrando et al., 2019; 2020; Santos and Cincera, 2021), we define innovative firms as those that answer "yes" for at least one of the four options. We also construct four different dummies to separate the four types of innovation (product, process, organization and marketing). The split in the four categories allows us to measure not only if a firm innovates or not, but also how. The main advantage of our survey question is that it can track if a firm innovates and how it innovates.[6] However, in contrast, using survey questions does not allow us to measure the intensive margin of innovation (how much a firm innovates). This can also be difficult to measure using balance sheet measures of innovation intensity, because small firms tend to under-report R&D activities (Baumann and Kritikos, 2016).

Next, we focus on the impact of the type of innovation process on the perceived competition. In Figure 3 we plot the frequency of innovation activities over the waves of the survey. As one can see, the four types of innovation activities remain fairly constant over the waves of the survey. The only notable increase is related to the

[6]Questions on innovation are straight out of Schumpeter's definition of innovation as a new combination of resources.

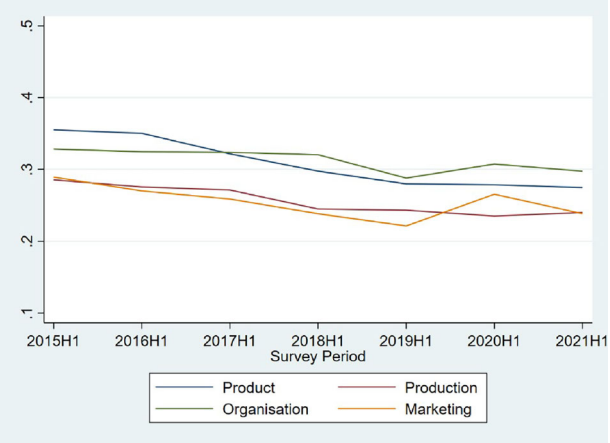

Figure 3. Innovation type over waves of the survey
Percentage of product, production, organization and marketing innovation along the waves of the survey.

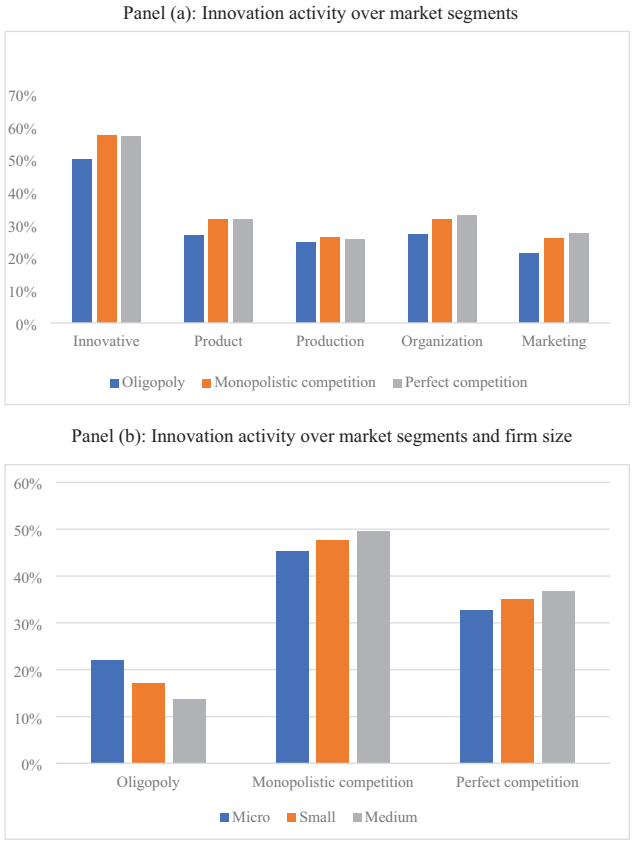

Figure 4. Innovation activity over market segments and firm size
Panel A the innovation activity over the three market segments identified (oligopoly, monopolistic competition and perfect competition). Panel B shows the innovation activity over the three market segments and across firm size.

COVID-19 period for marketing and organization innovation. The shift, although not large in magnitude, is expected because in such a period firms reorganized their activities and selling strategies to navigate out of the pandemic shutdown.[7]

In Figure 4(a), we show innovation activities in the three identified market segments. Firms in the oligopolistic market (those with a perceived level of competition lower than 4) are less innovative than firms in the other two market structures. Firms in monopolistic markets have a similar level of innovation to firms in the perfect competition market. The figure provides us with a first argument in support of our hypothesis of a decreasing marginal effect of innovation on competition depending on the market in which a firm operates. Firms in oligopolistic markets face lower competition pressures, thereby leading to lower innovation in comparison with similar firms in monopolistic and perfect competition markets. Our findings also suggest that firms operating in perfectly competitive markets are innovating to try to shift to a position where their products and services are differentiated from those of their current competitors and hence achieve a monopolistic market position. This preliminary finding seems to support the theories of Aghion et al (2005) and Scherer (1967). Firms in competitive markets tend to innovate more than firms in less competitive markets, the intensive levels of innovation appear to support the dynamic entrepreneurial firms in line with the Schumpeterian creative destruction theory. In Figure 4(b), we present the frequency of innovation across market segments and size. One important aspect emerges from the figure, namely the similar level of innovation across small and micro-sized firms across competitive markets. This evidence confirms the idea that firms appear to be able to navigate towards protected market positions independently from their size, which is the first evidence of an entrepreneurial dynamic at work. However, it could be that once they reach a protected market position (oligopoly), they might innovate more to sustain their competitive advantage, as shown by the higher frequency of innovation of micro-sized firms in oligopolistic markets.[8]

[7]The search for new modes for engaging customers and markets following the COVID-19 pandemic might be transitory or permanent. If transitory, in recent years we should detect a rebound in product and process innovation. If sustained, it can be an indication of an emerging way of doing business and innovation. We leave this question open to future research.

[8]In Figure A.2, we add information on: the frequency of innovation across sectors and the level of competition across sectors. Owing to the coarse definition of sectors in the SAFE survey, we do not detect any interesting features. However, we do believe that because sectors have an influence on the intensity of competition and on the ability/frequency of innovating, it would be of interest for future research to expand our work in this direction with more granular information.

Table 2. Descriptive statistics

Variable	Description	Obs.	Mean	Std dev.	Min	Max
Panel A: Dependent variables						
Competition	Variable from 1 (not at all) to 10 (extremely), corresponding to how much firms perceive competition pressures. [Survey question: Q0_b2]	15,351	6.265	2.449	1	10
Panel B: Innovation specifications						
Innovative: general	Dummy variable equal to 1 if a firm has introduced in the past 12 months one of the following innovation types: product, production process, organization management, way of selling goods or services; zero otherwise. [Survey question: Q1]	15,351	0.593	0.491	0	1
Innovative: product	Dummy variable equal to 1 if a firm has introduced in the past 12 months a new product; zero otherwise. [Survey question: Q1_a]	15,351	0.329	0.470	0	1
Innovative: production	Dummy variable equal to 1 if a firm has introduced in the past 12 months a new production process; zero otherwise. [Survey question: Q1_b]	15,351	0.275	0.446	0	1
Innovative: organization	Dummy variable equal to 1 if a firm has introduced in the past 12 months a new organization management; zero otherwise. [Survey question: Q1_c]	15,351	0.322	0.467	0	1
Innovative: marketing	Dummy variable equal to 1 if a firm has introduced in the past 12 months a new way of selling goods or services; zero otherwise. [Survey question: Q1_d]	15,351	0.248	0.432	0	1
Panel C: Firm characteristics						
Size	Variable equal to 1 for micro-firms (1–9 employees); 2 for small-firms (10–49 employees); 3 for medium-sized firms (50–249 employees). [Survey question: D1]	15,351	1.909	0.815	1	3
Age	Variable equal to 1 if the firm is less than 2 years old; 2 if a firm is between 2 and 5 years old; 3 if the firm is between 5 and 10 years old; 4 if the firm is 10 years or more. [Survey question: D5]	15,351	3.833	0.492	0	4
Turnover increase	Dummy variable equal to 1 if the firm's outlook with respect to sales and profitability improved in the past 6 months; zero otherwise. [Survey question: Q11c]	15,296	0.402	0.490	0	1
Subsidiary	Dummy variable equal to 1 if the firm's owner is another enterprise; zero otherwise. [Survey question: D6]	15,337	0.125	0.331	0	1
No exports	Dummy variable equal to 1 if the firm does not export goods and services. [Survey question: D7]	15,351	0.513	0.499	0	1
Finding customers	Variable from 1 (not at all) to 10 (extremely), corresponding to how difficult it was to find customers in the past six months. [Survey question: Q0_b1]	15,351	5.59	2.80	1	10
Skilled staff	Variable from 1 (not at all) to 10 (extremely), corresponding to how difficult it was to find skilled staff or experienced managers in the past six months. [Survey question: Q0_b5]	15,351	6.41	2.71	1	10

Control variables

Table 2 reports summary descriptive statistics. Panel A reports details on survey responses on perceived competition, while Panel B presents our key independent variables (innovation). Panel C presents firm control variables. We include firm size (Size), defined as a variable equal to 1 for micro-sized firms (1–9 employees); 2 for small firms (10–49 employees); and 3 for medium-sized firms (50–249 employees). We expect a positive correlation between firm size and competitiveness, as large firms are more capable of harnessing competitive strengths and moderate competitive weaknesses than small firms. We also control for firm age, defined as a variable equal to 1 if the firm is less than 2 years old; 2 if a firm is between 2 and 5 years old; 3 if the firm is between 5 and 10 years old; and 4 if the firm is 10 years old or more. The relationship between firm age and competitiveness is not clear-cut, as the empirical literature provides mixed results. On the one hand, positive learning effects may help the firm better position itself in terms of competitiveness. On the other hand, the costs associated with revising competencies could be greater than the marginal benefits generated from the learning process, therefore suggesting a negative relationship between a firm's age and its competitiveness (Bartoloni, 2016). We also include turnover increase (Turnover Increase): a dummy variable equal to 1 if the firm's outlook with respect to sales and profitability improved in the past 6 months and to zero otherwise. According to the firm efficiency view, efficient firms grow and capture large shares of the markets, therefore suggest-

ing a positive relationship between our two efficiency measures and firm competitiveness (Damanpour, 2010; Demsetz, 1973; Peltzman, 1977). We control for internationalization using the firm propensity to export (No exports), defined as a dummy variable equal to 1 if the firm does not export goods and services and to zero otherwise. Internationalization is a crucial factor affecting competitiveness at the firm level; however, the literature has provided mixed evidence about their relationship. Innovation trails exports and permits firms to better position themselves in terms of competitiveness (Aw et al., 2008; Chadha, 2009; Kirbach and Schmiedeberg, 2008), but operating in international markets causes firms to face additional costs owing to difficulties in complying with new customer requirements or local regulations. Finally, we control for firm ownership, defined as a dummy variable equal to 1 if a firm is a subsidiary (Subsidiary) of a group and to zero otherwise.

Empirical methodology

Summary statistics in Section Data and variable definitions document a different innovation activity across market segments, suggesting that firms in an oligopolistic market innovate less because of a better perceived positioning in the market. In this section, we formally present the empirical methodology to test if past innovation activity reduces perceptions of competition. To do so, we extract a panel of firms that are re-surveyed across contiguous waves of the survey and regress the change in perceived competition after the implementation of an innovation activity on a set of control variables and fixed effects.[9] Confining the analysis on a panel of firms surveyed in contiguous waves allows us to draw inference on how perceived competition changes after six months of the introduction of an innovation. To identify the differential impact of innovation on perceived competition based on the market to which a firm belongs, we split the sample into two: oligopolistic (firms that declare a perceived level of competition lower than 4) and competitive markets.[10] The empirical specification is a panel probit of the following form:

$$Competition\ decrease_{i,w} = \alpha + \beta Innovative_{i,w-1} + \gamma Z_{i,w} + \theta_s + \vartheta_c + \mu_w + \varepsilon_{i,w}. \quad (1)$$

Here i, w, s and c stand for: firm, wave, industry and country respectively. $Competition\ decrease_{i,w}$ is a dummy variable that switches to 1 when a firm declares a lower level of competition in comparison to the previous wave.[11] $Innovative_{i,w-1}$ is a dummy variable that shifts to 1 in the case that a firm introduced an innovation in the previous wave and is zero otherwise. $Z_{i,w}$ is a vector of firm controls. θ_c, ϑ_s, μ_w are country, industry and wave fixed effects, respectively.

In our paper, we test if innovation affects perceived competition. However, the other direction of the relationship is also true: perceived competition affects innovation (Aghion et al., 2005; Farè, 2022; Hall and Harhoff, 2012). Econometrically, this problem is called reverse causality and might bias our estimate. To make sure that our results are not driven by this effect, we exploit the COVID-19 shock and compare perceived competition across innovative (treated group) and non-innovative (control group) firms before and after the shock.

If innovative entrepreneurs can reduce competitive pressures, we should expect them to better navigate their firms out of the pandemic by promptly deploying innovative strategies and harnessing the struggle of their competitors to conquer market shares. To further refine the estimation, we also employ propensity score matching (PSM), in which we compare very similar firms (across various dimensions) to rule out the possibility that our results are not driven by industry dynamics and other effects that affect competition. The difference-in-difference (DiD) empirical specification is as follows:

$$Competition\ decrease_{i,w} = \alpha_i + \beta Innovative_{i,w-1} * Post_w + \gamma Z_{i,w} + \vartheta_s + \varepsilon_{i,w}, \quad (2)$$

where i, w and s stand for firm, wave and industry, respectively. Our dependent variable $Competition\ decrease_{i,w}$ is the same variable as used in Equation 1; *Innovative* is a dummy variable that switches to 1 if a firm undertook an innovation activity in wave 22 (pre-COVID). *Post* is a dummy variable that switches to 1 in the post-COVID period (wave 23); zero otherwise. $Z_{i,w}$ is a set of firm-level covariates; α_i are firm fixed effects employed to gauge time-invariant unobservable firm traits; ϑ_s are industry fixed effects employed to absorb time-invariant unobservable industry traits.

[9] Focusing only on a panel of firms surveyed in contiguous waves allows use to tease out the average effect on innovation on competition at the firm level, which is not possible to observe in the cross-section. This comes at the cost of slightly reducing the number of observations.

[10] We split the sample into two and not into three because we noticed that firms in monopolistic and perfect markets have similar levels of innovation activity, so the marginal effects of an innovation activity on future perception of competition should be similar.

[11] The dummy variable is equal to one if a firm declares a lower perceived competition in wave t in comparison to that declared in wave t-1; zero otherwise.

Table 3. Oligopolistic markets

	(1)	(2)	(3)	(4)	(5)
Innovative: general	0.094				
	(0.069)				
Innovative: product		−0.016			
		(0.071)			
Innovative: production			0.020		
			(0.077)		
Innovative: organization				0.127*	
				(0.074)	
Innovative: marketing					0.348***
					(0.083)
Size	0.075	0.078*	0.076	0.071	0.081*
	(0.047)	(0.045)	(0.048)	(0.046)	(0.046)
Age	0.089	0.095	0.088	0.114*	0.116*
	(0.068)	(0.065)	(0.068)	(0.067)	(0.067)
Turnover increase	0.124*	0.110*	0.129*	0.102	0.094
	(0.070)	(0.066)	(0.070)	(0.067)	(0.067)
No export	−0.063	−0.061	−0.073	−0.060	−0.057
	(0.075)	(0.071)	(0.075)	(0.072)	(0.072)
Subsidiary	−0.131	−0.180*	−0.115	−0.157	−0.131
	(0.110)	(0.103)	(0.110)	(0.106)	(0.106)
Country FE	Y	Y	Y	Y	Y
Wave FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Wald χ^2	36.59**	38.15**	34.80*	38.72**	47.51***
Log pseudolikelihood	−1559.6	−1631.1	−1573.7	−1637.7	−1622.7
Observations	2302	2404	2321	2,416	2407

This table shows the estimation results of the probit model of equation 2 using competition decrease as a dependent variable. The dependent variable is the logarithm of perceived competition. Regressions are confined on a subsample of firms that declared a perceived level of competition higher of 0 and lower than 4 (0–3) out of 10. See Table 1 for firm-level control variables description. Regressions use fixed effects (FE) as specified. Robust standard errors are reported in brackets.
***, **, * denote significance at the 1%, 5%, 10% level.

Results and discussion

Past innovation and perceived competition

The results of the estimation of Equation 1 are shown in Table 3 for firms operating in an oligopolistic market (those with a low level of perceived competition), and in Table 4 for firms operating in a competitive market. Column 1 of Table 3 shows that innovation in general has no effect on perceived competition for small firms in an oligopolistic market. In an oligopolistic market, a firm has a competitive advantage and thus the marginal gains of innovation are lower. The argument is confirmed in columns 2 and 3, in which we focus on product and process innovation. In comparison to in a competitive market, introducing new products in an oligopolistic market has a limited effect on future profits because the firm has already reached an advantage from its competitor and is able to act as a price taker in the market. This result is in line with previous empirical findings (Ganglmair et al., 2020; Geroski, 1990; Thakor and Lo, 2022) that document an Arrowian position in a market with lower levels of competition. In columns 4 and 5, we detect a positive and statistically significant sign for organization and marketing innovation. The result is in line with the literature emphasizing the crucial complementary role of organizational and marketing innovation to incremental product innovation, namely the continuations of existing products, methods, or practices – generally minor improvements made with existing methods and technology (Battisti and Stoneman, 2010; Damanpour, 2010), that pertains to firms with higher market power (Lee et al., 2019).

Table 4 reports the findings relative to the subsample of small firms in a competitive market. In this case, we find a positive and statistically significant relationship between past innovation (column 1 of Table 4) and competition. This finding suggests an effect of innovation on the competitive dynamics of markets. Previous works (Aghion et al., 2005; Crowley and Jordan, 2016; Moen et al., 2018; Farè, 2022) show that firms in competitive markets are more likely to innovate. Here we show that firms innovate to achieve a competitive advantage and that successful innovations help firms to navigate out of competitive markets. To seek to move out of a competitive market, firms are more likely to introduce product (column 2 of Table 4) and marketing (column 5 of Table 4) innovation. The introduction of a new product and/or a new way to promote products allow

Table 4. Competitive markets

	(1)	(2)	(3)	(4)	(5)
Innovative: general	0.059**				
	(0.029)				
Innovative: product		0.078***			
		(0.030)			
Innovative: production			0.026		
			(0.032)		
Innovative: organization				0.039	
				(0.029)	
Innovative: marketing					0.065**
					(0.031)
Size	−0.037*	−0.042**	−0.035*	−0.041**	−0.041**
	(0.020)	(0.019)	(0.019)	(0.019)	(0.019)
Age	−0.003	0.004	−0.002	0.004	−0.001
	(0.028)	(0.027)	(0.028)	(0.027)	(0.027)
Turnover increase	0.006	0.000	0.008	0.002	0.000
	(0.029)	(0.029)	(0.029)	(0.028)	(0.028)
No export	0.000	−0.004	−0.006	−0.011	−0.017
	(0.032)	(0.031)	(0.032)	(0.031)	(0.031)
Subsidiary	0.040	0.036	0.043	0.034	0.027
	(0.043)	(0.043)	(0.043)	(0.042)	(0.042)
Country FE	Y	Y	Y	Y	Y
Wave FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Wald χ^2	29.64	38.28**	25.44	33.14	37.35**
Log pseudolikelihood	−5483.6	−5832.0	−5541.7	−5871.4	−5852.1
Observations	12,871	13,621	12,980	13,686	13,664

This table shows the estimation results of the probit model of equation 2 using competition decrease as a dependent variable. The dependent variable is the logarithm of perceived competition. Regressions are confined on a subsample of firms that declared a perceived level of competition higher of 3 out of 10. See Table 1 for firm-level control variables description. Regressions use fixed effects (FE) as specified. Robust standard errors are reported in brackets.
***, **, * denote significance at the 1%, 5%, 10% level.

small firms to stand out from competitors. Marketing innovation is a complement of product innovation. The introduction of a new product could indeed require managers to develop new marketing strategies to build firm competitiveness through this synergy; as Lee et al. (2019) indicate, there is a positive moderating effect of marketing innovation on the relationship between product innovation and firm performance.

Overall, the findings of Table 3 support the view of the Schumpeterian process of creative destruction, in which the market power of dominant firms is eroded over time by innovations launched by new entrants (Schumpeter, 1911, 1934 and 1942) in competitive markets. Firms in less competitive markets do not remain in the same market for long, as they innovate less and are replaced by new entrants that set up new innovations to move away from competitive markets. The statement is corroborated by the lack of evidence of a relationship between product and process innovation and competition in oligopolistic markets (Table 3). Indeed, Schumpeter proposed that in the normal course of events, innovators may reap rents for prolonged periods; he also theorized that some firms may continue to reap rents for extended periods by establishing cultures of creativity that support innovation. Indeed, we find that established small firms are more innovative because of their distinctive traits such as their accumulated experience, their agility and flexibility, and their strong customer relationships, among others (Dolfsma and van der Welde, 2014).[12]

COVID-19 shock

In the previous section, we found that innovation reduces perceived competition and that this effect is particularly relevant for firms in competitive markets, while it is not significant for firms in oligopolistic markets. In this section, we provide a more precise test on the effect of innovation on perceived competition by leveraging the COVID-19 shock. The results of the estimation are displayed in Table 5. In line with baseline specifications, we document a positive and statistically significant relationship between innovative firms and the reduction

[12]Summary statistics in Table 2 show that most of the firms in our sample have more than 10 years. This argument is also corroborated in Figure A.3 in the appendix, in which we show the age of innovators across market segments.

Table 5. Competition and innovation: COVID-19 shock

	(1)	(2)	(3)	(4)	(5)
Innovative: general * post	0.077**				
	(0.033)				
Innovative: product * post		0.096**			
		(0.042)			
Innovative: production * post			0.080*		
			(0.048)		
Innovative: organization * post				0.127***	
				(0.042)	
Innovative: marketing * post					0.055
					(0.049)
Subsidiary	−0.470***	−0.381**	−0.469***	−0.379***	−0.376***
	(0.140)	(0.149)	(0.142)	(0.136)	(0.137)
Size	0.077	0.062	0.076	0.054	0.064
	(0.092)	(0.089)	(0.092)	(0.089)	(0.088)
Age	−0.036	−0.028	−0.041	−0.050	−0.043
	(0.079)	(0.081)	(0.081)	(0.077)	(0.081)
Turnover increase	0.021	−0.007	0.005	−0.014	−0.026
	(0.045)	(0.043)	(0.044)	(0.043)	(0.043)
No export	−0.015	−0.012	0.003	−0.017	−0.032
	(0.080)	(0.080)	(0.081)	(0.077)	(0.077)
Industry FE	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Adj. R^2	0.425	0.421	0.422	0.421	0.417
Observations	1498	1546	1504	1570	1566

This table shows regression estimates of equation 3. The dependent variable is the logarithm of perceived competition score (1–10). The sample is restricted to firms surveyed in both waves 22 (pre-COVID) and 23 (post-COVID). See Table 1 for firm-level control variables description. Regressions use fixed effects (FE) as specified. Robust standard errors are reported in brackets.
***, **, * denote significance at the 1%, 5%, 10% level.

in the perceived level of competition. This result is consistent across all innovation specifications. This clearly shows that innovation reduces perceived competition. It is important to note that in this specification we add firm fixed effects to control for unobserved heterogeneity at the firm level, such as, for example, the characteristics of the entrepreneur.

The changes that occurred in the business environment after the pandemic forced SMEs to engage in different innovative activities that covered every aspect of innovation as outlined by the specifications employed in this paper. Many studies have indeed emphasized the contribution to strategic flexibility of resilient SMEs provided by product-process innovations along with organizational agility and marketing innovation (Heinonen and Strandvik, 2020; Al-Omoush et al, 2020; Sharma et al., 2021; Clauss et al., 2022).

In addition, we enhanced the DiD by accounting for the possibility that observable firm characteristics might bias our results. We therefore used PSM to match firms that innovated before the pandemic with firms that did not innovate using the full set of firm characteristics as reported in Table 1. The propensity score is estimated using a probit model. Figure A.1 shows the kernel density function of propensity scores between the treatment and control groups pre- and post-matching, showing the enhancement of comparability between the two groups. The PSM DiD results are reported in Table 6. The results indicate a negative and statistically significant relationship between innovative firms and the perceived level of competition in line with the standard DiD, thereby confirming the appropriateness of baseline results.

In Figure 5, we investigate whether there are differences in innovative firms' responses to the pandemic in terms of lower perception of competition depending on the market structure in which they operate (oligopolistic or competitive markets). Therefore, we replicated the standard DiD approach over two subsamples considering only firms operating in oligopolistic and competitive markets, respectively. The results further corroborate the baseline findings of Tables 3 and 4 on a stronger positive relationship between past innovation and lower perceived competition for firms in competitive markets (blue dots), while the effect is not significantly different from zero for those operating in oligopolistic markets (red dots). Overall, the COVID-19 shock allow us to confirm our baseline results of Tables 3 and 4 and claim that innovation allow firms to move out from competitive markets. This might suggest that rents of innovators are Schumpeterian (transient phenomena) and resilient to severe external shocks.

Table 6. Propensity score matching

	(1)	(2)	(3)	(4)	(5)
Innovative: general * post	0.078**				
	(0.034)				
Innovative: product * post		0.080*			
		(0.044)			
Innovative: production * post			0.079*		
			(0.050)		
Innovative: organization * post				0.126***	
				(0.045)	
Innovative: marketing * post					0.063
					(0.052)
Control variables	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Adj. R-squared	0.424	0.422	0.421	0.426	0.421
Observations	1354	1354	1354	1354	1354

This table presents matching estimates for competition (logarithm of perceived competition) for treated firms (innovators) and control firms (non-innovators). The matching method uses a kernel-weighted propensity score to construct counterfactuals from control firms to compute the average treatment effect on the treated. The kernel is Epanechnikov. The propensity score is estimated using probit regression and includes: size, age, subsidiary, export in percentage of the total turnover, skilled staff, funding customers, turnover increase, country and sector indicator variables.

Table 7. Intensity of innovation and competition

	Innovation	Product	Production	Organization	Marketing
Panel A: Entire sample					
No innovation (0/2)	41.9%	64.3%	72.9%	64.9%	74.2%
Low intensity (1/2)	47.0%	29.1%	23.5%	30.1%	22.8%
High intensity (2/2)	11.1%	6.6%	3.5%	5.0%	3.0%
Panel B: Firms in oligopolistic markets					
No innovation (0/2)	48.0%	67.4%	74.4%	72%	83.5%
Low intensity (1/2)	44.7%	28.0%	23.4%	24%	15.6%
High intensity (2/2)	7.1%	4.6%	2.2%	4%	0.9%
Panel C: Firms in monopolistic competition					
No innovation (0/2)	40.4%	62.15%	71.4%	63.4%	73.0%
Low intensity (1/2)	47.0%	30.1%	24.5%	31.4%	23.4%
High intensity (2/2)	12.6%	7.8%	4.1%	5.2%	3.6%
Panel D: Firms in competitive markets					
No innovation (0/2)	41.5%	66.1%	74.4%	64.4%	72.6%
Low intensity (1/2)	47.8%	28.2%	22.4%	30.4%	24.6%
High intensity (2/2)	10.6%	5.7%	3.2%	5.2%	2.8%

This table shows the intensity of innovation for firms surveyed in three consecutive waves. Panel A shows the frequency for the entire sample. Panel B shows the intensity of innovation for firms in oligopolistic markets, panel C for firms in monopolistic markets and Panel D for firms in competitive markets.

Intensity of innovation

In this section, we present stylized evidence on how the frequency of innovation changes across market segments. To do so, we restrict the sample to firms interviewed in three consecutive waves and we calculate the frequency of intensity of innovation across market segments. The maximum value (high intensity) is two because the question on innovation is repeated every 12 months (not every 6 months as for other questions of the survey). Table 7 reports the frequency of firms that at the end of the three-year period have been innovative zero, one or two times over three years. Although firms are observed over a limited period and not necessarily in the same time-frame, a certain heterogeneity in the frequency of innovation across market segments and innovation modes emerges. Across innovation modes, there is a larger fraction of firms with a higher intensity of innovation in product and organization, while the intensity is lower for production and marketing. As expected, firms in oligopolistic markets have lower intensities of innovation. A very limited portion of firms declare a high intensity of innovation in the oligopolistic market. This evidence further supports the idea that innovation is bounded within entrepreneurial talent, as argued in the early works of Schumpeter. It is possible that such firms had built a culture of innovation that allowed them to sustain their market positions for a very

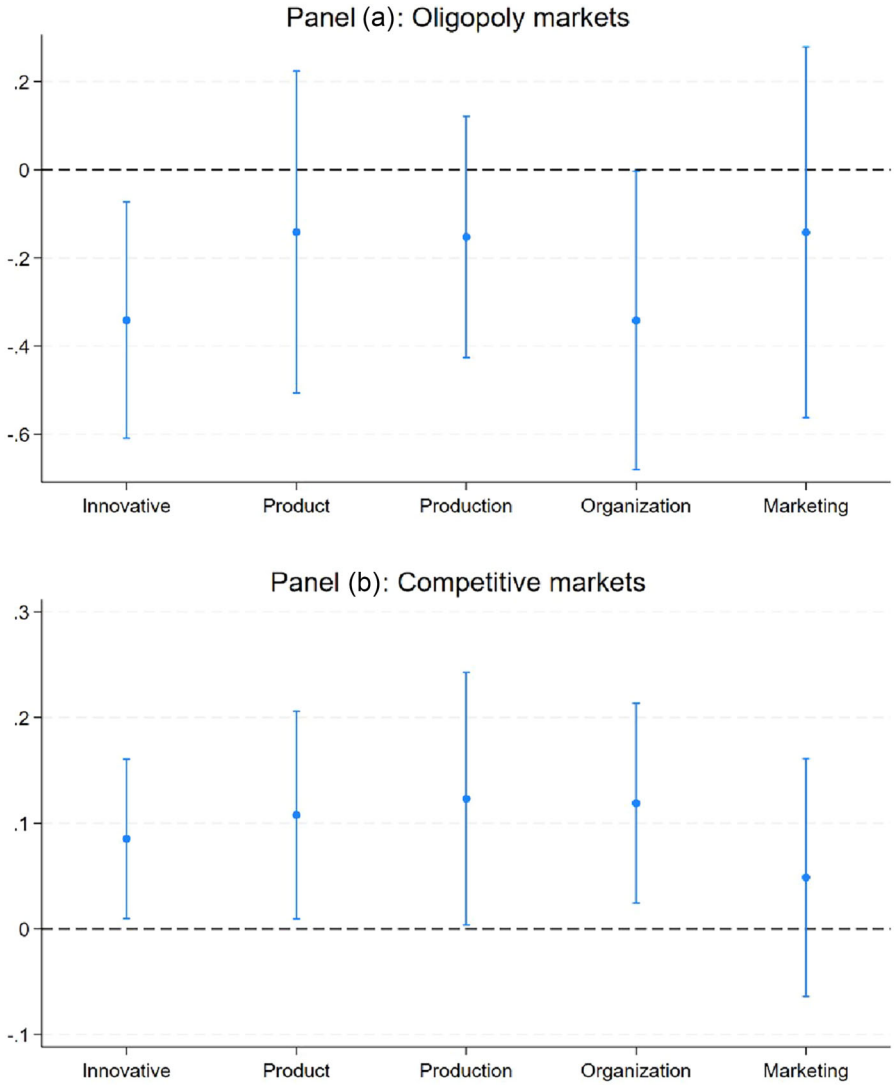

Figure 5. Competition and innovation: COVID-19 shock across market segments and innovation types.
*This figure plots the main coefficients of interest of equation 2 (Innovative * post) over subsamples of firms in: oligopolistic markets (Panel A) and competitive markets (Panel B)*

long period. Interestingly, the share of firms engaging in high intensity of innovation is lower in more competitive markets, possibly suggesting that firms in neck-to-neck industries are less incentivized to innovate to escape from competition (Aghion et al., 2005).

Conclusions

Economic theorists often assume that small businesses tend to operate in highly competitive markets and be marginal players in innovation. The literature on innovation and competition places a higher emphasis on how competition shapes innovation, most of the time in the context of large firms. With this paper, we contribute to the literature by examining whether and how small firms' innovation shapes market structures. Building from works on the relationship between competition and innovation and the earlier arguments of Schumpeter, we formally classified small firms into three market structures and provide insights on how innovation shapes market dynamics. Our main result is that firms in markets with higher competition (competitive market) innovate to move away from their competitors. The effect is not significant for small firms placed in markets with lower competition (oligopolistic markets) that have already reached a strategic position in the market. Among the different modes of innovation, we found that marketing innovation is effective in helping small firms to reduce competitive pressures in an oligopolistic market, whereas in competitive markets it emerges that product and marketing innovation are crucial in driving

down competition and moving away from competitors. Our results are confirmed for the onset of a disruptive event, such as the COVID-19 pandemic.

The results of the work have important implications for managers and policymakers. From a management perspective, our results point out the benefits of investing in innovation to move out from competitive pressures. Our results suggest that to sustain a competitive edge, entrepreneurs should foster a culture of innovation to maintain market positions and raise the bar for new competitors entering in the market. Innovation can position a small firm in an oligopolistic market in which a firm has some price setting ability and can expand market share. From a policy perspective, we show that small firms seek the protection of a market niche to avoid competition. Reaching the desired market niche limits the innovation potential. However, new entrants and firms in competitive markets continue to innovate to seek to replace them. Policies aimed at fostering innovation should consider that the intensity and the effect of competition are not unique across small firms, but vary at the firm level and are bounded within the entrepreneurial talent. As a final remark, innovation's benefit may diminish over time if complacency arises once a firm reaches an oligopolistic market, and therefore policymakers should emphasize continuous innovation and adaptability over market structures.

Limitations and future research directions

Several limitations should be addressed in future research. First, the SAFE questionnaire provides a rough distinction of sectors, as firms are partitioned into four broad sectors. To expand upon these directions, we are aware of the possibility and challenges of broadening the investigations to more specific industries with unique levels of technology and regulation. This will enhance the understanding of how different contextual elements influence the relationship and provide more detailed practical advice. For example, an examination of a highly technological and regulated sector – such as for example the Biotech industry – would provide a better understanding of how innovation can disrupt market structure.

Second, this paper acknowledges the use of innovation with a distinction between tangible (product and process) and intangible (organization and marketing) innovation. The distinction between radical and incremental innovation and further information on firms' innovation culture would be of interest to further expand research in the topic. Radical innovation might lead to a disruption of the market structure, leading to forced business model changes of competitors and the ability to preserve their rents of innovation for a longer period of time, whilst incremental innovation does not have such effects on competitors. Another related dimension would be deepening how the frequency of innovation allows entrepreneurs to navigate out from competitive markets. The culture of the entrepreneur is important in Schumpeter (1934) and has an influence on the frequency of innovation.

Third, the limited longitudinal panel limits the possibility of exploring the effect of different lags of innovation on perceived competition. It could be of interest to analyse if the effect of innovation on competition has a short- or long-term effect. In this direction, it would be important to assess whether tangible and intangible innovation had a short- or long-term run effect on lowering perceived innovation and how incumbents challenge firms that have employed innovation.

Fourth, another interesting point to address is related to the 'spillover effects' that an innovator in an industry can generate to its direct competitors. On this line, future research can combine the information on the relationship between innovation and direct competitors to analyse how competitors react. It might be that innovators spill over their innovative culture to their direct competitors, thereby creating positive welfare effects for the market.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section at the end of the article.