Recession and firm survival: is selection based on cleansing or skill accumulation?

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Abstract

Recessions are complex events that create highly unpredictable and unstable business environments. When faced with such events, firm survival depends only limitedly on production efficiency. Rather, it depends on the skills and ability to cope with such complexity. In particular, we expect firms adopting a corporate strategy that makes relatively large use of skills and capabilities to deal with environmental complexity to be less likely to exit during a downturn than firms that do not. We test this hypothesis on the whole population of Italian manufacturing corporations using an open panel that covers the period 2001-2013. The results provide strong support for our hypotheses in the full sample and in the subsamples of small firms, thus suggesting that skill development can successfully empower smaller and more vulnerable firms. Managerial and policy implications are discussed.

Keywords: *firm survival; corporate strategy; recession; cleansing; skill accumulation.*

JEL codes: **D22; L21; M21**.

1. Introduction

Recessions are periods of significant economic and social distress, which often increase firms exit rate. The standard economic literature explains such closures on the basis of the so-called *cleansing hypothesis*, namely the idea, which dates as far back as Schumpeter (1939, 1943), that during recessions small and less efficient firms are the first ones to exit the market. This hypothesis in turn rests on two important assumptions: first, that the process of firm selection occurs primarily on the basis of productivity differentials, i.e. small and less efficient firms have lower chances of surviving and growing than their more efficient counterparts (Jovanovic, 1982; Hopenhayn, 1992; Melitz, 2003; Asplund and Nocke, 2006; Melitz and Ottaviano, 2008; Metcalfe 1994); and second, that during downturns drops in aggregate demand raise the overall competitive pressure and thus make productivity differentials even more crucial in determining exit patterns (Hall et al., 1995; Caballero and Hammour, 1994; Gomes at al., 2001). The result, the argument goes, is that once the recession is over the production system turns out to be cleansed of the less efficient firms and a new cycle of aggregate productivity growth could eventually start.

The empirical evidence, however, suggests a relatively different picture. Some recent papers, in particular, highlight that the "cleansing" effect can be weaker than expected. Barlevy (2002, 2003), for instance, suggests that during downturns the cleansing effect may not hold in presence of credit market imperfections, because efficient firms may be hurt disproportionally due to their higher financial needs. Ouyang (2009) focuses on the uncertainty surrounding a firm's real quality and argues that recessions, rather than cleansing, may destroy potentially superior firms during their infancy. Hallward-Driemeier and Rijkers (2013) sustain that crisis, rather than raising the productivity threshold, drives out the business firms with little reference to productivity.

A common assumption in the literature on the *cleansing hypothesis* is that production efficiency is the main determinant of firm exit. In all these contributions firm selection is entirely explained by exogenously given firm-specific productivity levels, and when cleansing fails it is due to exogenously given market imperfections. As far as production units are concerned, these approaches entail a view of the firms as rather passive agents, whose chances of survival depend uniquely on the efficiency trait they are endowed with at their birth. This implies a conception of production during recession as a relatively static problem, where little role is left for firm's strategic orientation.

In this paper we extend this view in two ways: first, we consider productivity as an endogenous consequence of firm's strategic conducts; and second, we broaden the set of factors that contribute

to explain firm selection, especially during recessions. In our approach severe recession implies an increase in the uncertainty and complexity of the business environment. This raises the necessary skills to contain the costs of decision-making and to explore the surrounding environment. Consequently, the greater knowledge and skills accumulated by the firm, the greater the productivity of internalized resources and, above all, the greater the ability to react and adapt to the new context that the recession has determined.

In particular, we base our analysis on two main theoretical tenets. First of all, we study production activities through the lenses of the so-called capabilities view of the firm that has its roots in original contributions by Penrose (1959), Richardson (1972) as well as Nelson and Winter (1982). According to this view, which has found many applications in the field of strategic management (Barney, 1991; Peteraf, 1993; Mahoney and Pandian, 1992; Teece et al., 1997; Teece, 2007; Pitelis and Teece, 2010), firms are best represented not by standard production functions with exogenously given productivity levels, but rather as organizational units that blend in unique ways resources (*i.e.*, firm-specific and difficult-to-transfer assets that can be both tangible and intangible) and capabilities (*i.e.*, firm's abilities to learn and orchestrate assets in ways that markets cannot replicate) to build competitive advantages (Teece, 2017). While genuinely scarce, resources and capabilities are not merely given but have to be developed. Therefore, firm's activity is seen as a problem of creation and production of competitive advantages, which certainly depend on acquired productivity levels but also on more dynamics factors such as learning and skills accumulation. Moreover, the out-of-equilibrium perspective that inspires this view entails that high heterogeneity among strategic conducts may exist and persist, even within relatively narrow production contexts (Hodgson, 1998; Landini et al., 2020a).

Secondly, our analysis is based on a view of recessions as complex events that create highly perturbed and hostile business environment, *i.e.* environmental jolts (Meyer, 1982) (for a similar approach see Cefis and Marsili, 2019). During recessions, in fact, a contraction of consumer expenditures often goes along with an overall increase in uncertainty, which makes economic transactions more difficult to accomplish (Bloom, 2014). The relationships with buyers and suppliers become less reliable and more short-term oriented (Baldwin 2009; Accetturo and Giunta, 2019). Financial institutions lack sufficient information to correctly evaluate credit merit, with the consequent rise of credit constraints (Ivashina and Scharfstein, 2010). Industrial relations tend to be more conflictual and the management of human resources hard to plan (Zagelmeyer and Gollan, 2012). Market signals become ambiguous and highly volatile (Al-Suwailem, 2014). These factors raise the overall complexity of the business environment, making it more difficult for firms to sustain their productive endeavours. This in turn makes firm exit more likely to occur (Fort et al.,

2013).

Based on this theoretical framework, we investigate the role of strategic conducts in determining firm exit. In particular, we argue that during standard phases of the business cycles selection depends on the firm's ability to establish and sustain competitive advantage. Alongside productivity, competitive advantages are the result of multifaceted corporate strategies that aim at obtaining a good match between the organization's internal resources and the opportunities arising in the external environment (Grant, 1991). In particular, we contrast two typical corporate strategies. On the one hand, we consider firms pursuing a strategy of global engagement, whose main competitive priorities are long-term oriented and related to investments in innovation, human capital and entry into foreign markets (Bridges and Guariglia, 2008, Criscuolo et al., 2010; Arrighetti et al. 2015). On the other hand, we consider firms adopting a low-cost strategy, which aims at obtaining short-term advantages through the selection of the most profitable product lines often followed by downsizing, waiver of fixed capital investments and little investments in human capital (DeDee and Vorhies, 1998; Helper et al., 2012; Arrighetti and Traù, 2013). As long as these two strategies are grounded on adequate internal coherence, they can both rise profit above the survival threshold (at least in the short-term) and thus reduce the likelihood of exit.

During a recession, however, the contribution of strategic conducts to profit margins does not suffice to explain firm survival. When the complexity of the business environment increases, firm exit depends on the skills and capabilities to adapt to the new circumstances that firms have endogenously accumulated over time (*skill accumulation hypothesis*). In particular, the more a firm accumulates skills and capabilities that make it well accustomed to deal with complex events such as a crisis, the greater the responsiveness and adaptability of such firm to environmental jolts and thus the higher the likelihood of survival. Such skills and capabilities are not exogenously given, but depend on the learning patterns firms go through following their corporate strategy. In this sense, the resource-based view and some of the management literature have emphasized that, even within narrowly defined industry/technology regimes, strategic conducts can be highly heterogeneous and so are the patterns of skill accumulation (Barney, 1986, 1991; Rumelt, 1991; McGahan and Porter, 1997, 2002; Mauri and Michaels, 1998; Dencker et al., 2009; Brush et al., 1999; Nelson and Winter, 1982; Wernerfelt, 1984; Rumelt, 1991; Teece et al., 1997). Among the latter, those that contribute the most to increase the chances of survival are the ones that strengthen the dynamic and innovation capabilities of firms, as they both improve firm's adaptability (Makkonen et al., 2014; Cefis and Marsili 2019).

On this ground, we suggest that in presence of an economic recession the contribution of global engagement and low-cost strategy to firm survival differs. The adoption of a global engagement

strategy makes firms well accustomated to deal with highly uncertain and complex business environment, favouring learning processes oriented towards the accumulation of dynamic and innovation capabilities. Therefore, we expect this corporate strategy to reduce the likelihood of exit. On the contrary, the adoption of a low cost-strategy, although it can strengthen profitability in the short term, is often associated with the accumulation of skills and capabilities aimed at obtaining marginal improvements upon achieved market position and are not necessarily useful when dealing with rising environmental complexity. As consequence, we expect the contribution of this strategy to firm survival to weaken during recessions.

Our hypotheses are tested on the population of Italian manufacturing corporations using the Panel of Italian limited companies with employees provided by the Italian National Institute of Statistics (ISTAT) for the period 2001-2013. This data source allows us to include in the analysis the years of the so-called Great Recession (i.e. 2008-2013) and compare the effect of our focus variables on the probability of firm survival in the pre- and post-crisis periods. We find that during the recession there has been limited cleansing against firms with relatively low production efficiency, which on the contrary experienced a weakening of the selective pressure. With respect to corporate strategies we find that, controlling for productivity levels and firm size, while the adoption of a global engagement strategy increases the probability of survival during the crisis, thus enlarging the survival premium enjoyed in the pre-crisis period, a low-cost strategy (that in general tends to favour firm survival during standard phases of the business cycle) reduces the survival premium once the crisis begins. These results have strong managerial and policy implications, which we discuss below.

The remaining parts of the paper are organized as follows. Section 2 reviews the literature and discusses the research hypotheses. Section 3 presents the data and the empirical methodology. Section 4 discusses the results. Finally, Section 5 concludes.

2. Background and hypotheses

Most of the scientific and policy debates around the determinants of firm survival concentrate on productivity. The reason for this is twofold. First of all, in most formal models of industry dynamics productivity is assumed as the unique idiosyncratic factor that differentiate firm performance, leading to a *de facto* productivity-survival direct relationship (Foster et al., 2008). Secondly, several empirical contributions have documented that firms with higher productivity tend to grow faster and are more likely to survive than their less productive counterparts (for a comprehensive survey see

Syverson, 2011). Recent research, however, shows that these views are in many respects flawed. Foster et al. (2008), for instance, point out that productivity is only one of several possible idiosyncratic factors that determine firm performance, a key alternative being demand idiosyncrasies. Whenever the latter are sufficiently large, firms may survive even if they present significant productivity gaps (Landini, 2020). Similarly, profit, and thus the chance of survival, is often affected by the existence of idiosyncratic cost advantages, such as firm-specific factors (e.g. geographic location) that increase bargaining power over wages. Finally, most of the empirical research using productivity measures based on firms' microdata lacks information on firm-level prices and, thus, these measures are affected by price differences. As a result, the existence of a relationship between measured "productivity" and firm survival can in the ultimate instance be considered evidence in support of selection based on profit, not necessarily productivity (Foster et al., 2008).

The weakness of the standard economic approaches to explain firm exit (both in normal times and during recessions) requires more comprehensive views to be developed. In this paper we move in this direction by combining two complementary approaches: the evolutionary perspective on organizational survival (Nelson and Winter, 1982) and the resource-based theory of competitive advantages (Grant, 1991). The former posits that in presence of heterogeneous resource endowments firm selection operates primarily on profit differentials (Metcalfe, 1994). The latter locates the primary source of profit differentials not in naïve conceptualization of production efficiency but in competitive advantages, namely the firm's ability to earn economic rents (*i.e.*, above-normal returns, see Schoemaker, 1990). While earlier contributions in the field of strategic management linked the availability of such rents to the characteristics of the competitive environment (*e.g.*, market structure, see Porter, 1990), later contributions redirected attention into firm-specific resources and capabilities (Barney, 1986, 1991, Teece et al., 1997). These views see the origin of competitive advantage in the firm's ability to appraise the rent-generating potential of the available resources and capabilities and consider corporate strategies as the conducts that best exploit such potential relative to external opportunities (Grant, 1991).

In presence of differentiated consumer tastes, multiple markets (*e.g.,* local *vs.* international) and heterogeneous inputs corporate strategies can take a variety of forms. Here we focus on two stylized conducts that locate at the opposite ends of the quality-cost spectrum: global engagement and low-cost strategy. The former originates from a composite set of contributions showing that when active in foreign markets firms need to move away from competition based uniquely on costs and ground their competitive advantages on a resource base characterized by advanced technology and human capital (Aw et al. 2011; Criscuolo et al. 2010; Ma et al., 2014; Harris and Moffat, 2011; Baldwin

and Gu 2003; Lages et al. 2009; Andrews and Criscuolo, 2013; Ito and Lechevalier 2010; Love and Roper 2015). This conclusion is supported by the growing evidence on the pivotal role of knowledge and competences as competitive drivers (Baldwin and Gu 2003; Lages et al. 2009; Andrews and Criscuolo, 2013), the role of human capital (in terms of education and vocational training) in the management of innovation and the likelihood to become exporters (Ito and Lechevalier 2010), and the contribute of R&D and innovation experience to fuel the qualitative upgrading of the goods sold in international markets (Lages, et al., 2009; Love and Roper 2015).

Alternatively, firms may decide to pursue a corporate strategy that seeks to obtain cost, rather quality, advantages. The reasons can be manifold, including the risk and complexity involved in a strategy of global engagement. The adoption of a low-cost strategy is usually associated with retrenchment activities such as cost cutting, asset sales, and employee lay-offs at the expense of repositioning (Ghemawat 2009). Although deficient in terms of innovative output, such strategy can effectively sustain profitability in the short-term and to do so it must rely on appropriate resource position of the firm. For example, the ability to establish a cost advantage requires access to niche markets protected from low-cost competitors (in the case of manufacturing firms from advanced countries this involves competitors from developing and emerging countries), ownership of cheap capital equipment, and access to low-wage labour (DeDee and Vorhies, 1998; Helper et al., 2012; Arrighetti and Traù, 2013). The empirical literature indeed suggests that, especially in the short-term, a corporate strategy based on cost retrenchment can have positive effect on firm performance (Love and Nohria, 2005).

Although most contributions discuss the effect of global engagement and low-cot strategy on broadly defined measures of firm performance (Tubb, 2007; Dugal and Morbey, 1995, Morrow et al., 2004), there are reasons to believe that during standard phases of the business cycles they can increase the chances of survival as well (Bridges and Guariglia 2008). If well-orchestrated, namely ensuring an adequate fit between internal resources and external opportunities, both strategies may favour the creation of competitive advantages and thus sustain profitability. This may ultimately lead to a survival premium compared to firms adopting less coherent corporate strategies. For this reason, the first hypothesis that we put forward is that:

Hypothesis 1: During standard phases of the business cycle, the adoption of either global engagement or low-cost strategy increases the survival likelihood

During recessions, however, the drivers of firm selection partially change, and so does the contribution of different strategic conducts. Recessions are events that cause significant

modifications to the business environment, which becomes at the same time more complex and uncertain. Bloom (2014), for instance, provides wide empirical evidence that uncertainty appears to rise sharply during recessions. As a consequence, firms are not only exposed to greater financial constraints (Duygan-Bump et al., 2015), but they also have to take decisions that are riskier and more difficult to prioritize (Latham and Braun, 2011). Moreover, the relationships along the value chain with consumers, suppliers and competitors become more difficult to predict and manage (Baldwin 2009; Accetturo and Giunta, 2019). All these factors contribute to alter the selective environment creating new opportunities and challenges.

In this new context positional advantages accrued via established competitive advantages are not enough to reduce the likelihood of exit. Firms need to learn fast about the changed environmental conditions and adapt their behaviour. Along this lines, Bradley et al. (2011) argue that in the face of more complex and perturbed business environments adaptive skills become imperative and more important than positional advantages to determine firm performance. The management and economics literature associate adaptive skills with firm-level dynamic capabilities, *i.e.* the ability to integrate, build and reconfigure internal and external competences to address rapidly changing environment (Teece et al., 1997) as well as innovation capabilities, *i.e.* the ability to recognise and exploit commercially novel opportunities as firms engage in the process of introducing novel products, processes or practices (Nelson and Winter, 1982). Cefis and Marsili (2019) indeed provide empirical evidence supporting the role of innovation capabilities in strengthening firm's adaptive skills during recessions.

We extend this line of reasoning by arguing that adaptive skills, in the form of both dynamic and innovation capabilities, are ultimately the result of the learning patterns associated with specific corporate strategies. Strategic conducts affect the accumulation of skills via the set of competitive priorities that the firm decides to pursue. Based on related market outcomes, firms identify resource gaps and invest in replenishing, augmenting and upgrading the available resources and capabilities. In this process they develop skills that can be used to establish new competitive advantages (Teece, 2007). Clearly, the more a firm operates in contexts that require frequent renewal of resources and capabilities, *e.g.* due to competitive pressure or rapidly changing business environments, the stronger are the incentives to build dynamic and innovation capabilities, and thus the faster the accumulation of adaptive skills.

On this basis, we argue that the adoption of global engagement *vs.* low-cost strategy makes significant difference for the chances of survival during recessions. The global engagement strategy requires firms to get involved in activities characterized by large information asymmetries and highly uncertain outcomes, such as technological complexity, repositioning in international markets

and the coordination of highly skilled labour **(**Bridges and Guariglia, 2008, and Criscuolo et al., 2010; Ghemawat 2009; Latham and Braun 2011). To deal with the latter firms need to build dynamic and innovation capabilities that strengthen their reactiveness to external events (Aw et al., 2011; Criscuolo et al. 2010; Ma et al., 2014; Kuratko and Hodgetts, 1998), such as unexpected demand changes (Hayes and Pisano, 1996; Volberda, 1999; Scranton, 2006; Koren, 2010; Archibugi et al., 2013; Landini et al., 2020b) as well as technological and institutional shocks (Landini et al., 2020a). On the contrary, the low-cost strategy is often associated with the accumulation of skills aimed at obtaining marginal improvements upon established lines of business. The focus on protected niche markets and cost-based competition reduces the need for frequent and radical renewal of resources and capabilities, thus weakening the incentives to build dynamic and innovation capabilities. In sum, we expect global engagement to favour the accumulation of more adaptive skills than the low-cost strategy, leading only the former to enjoy a survival premium during recessions. In other words:

Hypothesis 2a: During recessions, the adoption of a global engagement strategy increases the survival likelihood compared to the pre-crisis period.

Hypothesis 2b: During recessions, the adoption of a low-cost strategy reduce the survival likelihood compared to the pre-crisis period.

3 Data and methodology

3.1 Data and variables

Our main data source is represented by the *panel data on the balance sheets of corporations with employees* (ISTAT), an integrated data source providing demographic and economic information on the population of Italian limited companies during the period 2001-2013. The dataset also contains annual information about import and export of goods and services and, thus, allows one to enlarge the analysis to a firm's internationalization patters. From the original dataset we select an unbalanced panel of almost 193000 manufacturing firms during a 13-year time span[1] (more than one million three hundred thousand observations), which encompasses the recent economic downturn.

[1] We do not consider the last year of the original panel due to the lack of full information about closure events.

The dependent variable is the survival time, indicating the uninterrupted number of years a firm survives between the starting date of our database, i.e. 2001, and firm exit. The unit of observation is represented by a dummy variable assuming the value of one in correspondence of the last year we observe a signal of genuine activity within the manufacturing sector, which is documented by balance sheet information[2]. This implies that we adopt a broader definition of firm exit which considers not only events classified as "real death" according to the methodological guidelines defined by Eurostat-OECD[3], but also other events such as critical situations related to firms involved in liquidation processes. These latter events may take years before producing a real event of closure, according to the standard definitions, nevertheless the typical activity of the firm may be heavily reduced if not confined to the administrative process leading to economic death.

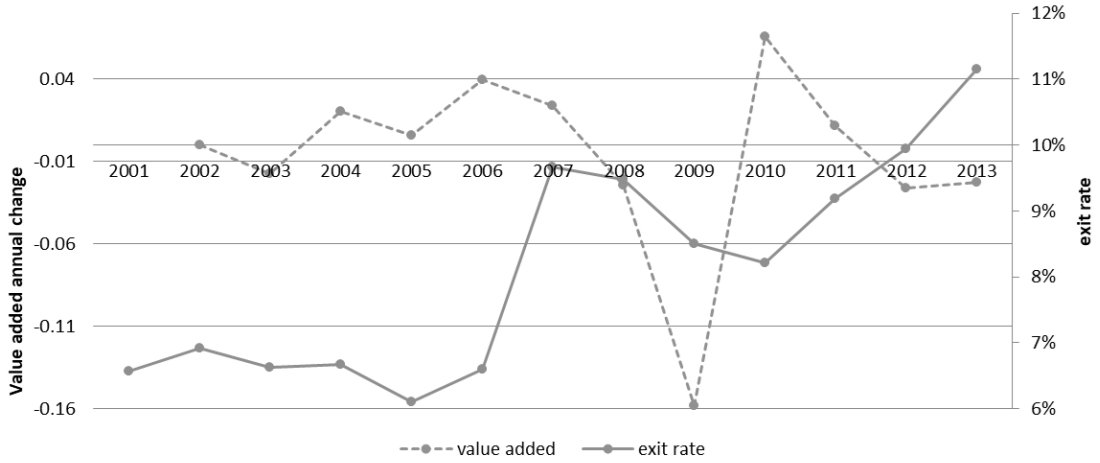
Figure 1 shows firm exit rate estimates together with the dynamic of value added in the manufacturing sector in order to better understand how industry dynamics correlates with the business cycle. During the Great Recession (*i.e.*, period 2008-2013) firm mortality picked up, going from an average 7% during the years 2001-2006 to a maximum of 11% in 2013. Interestingly, the exit rate started to increase substantially during 2007, thus signalling that some kind of selection pressures took place in advance with respect to the official start of the recession[4]. Correspondingly, the value added growth in the industrial sector started to slow down during 2007 and then dropped during 2008 and in the first part of 2009. The period of recovery up to 2010, that in Italy officially started during the second quarter of 2009, was somewhat anticipated by the slowing down of the exit rate in 2009 and 2010. This latter started to increase again during the following years when in the mid-2011 Italy entered the European sovereign debt crisis.

Figure 1 – Evolution of firm exit rate and value added in the industry sector

[2] In our data exit is considered a homogeneous event. We are not able to distinguish between different exit modes and, thus, to control for M&A. Although we recognize this data limitation, it is worth stressing that the number of M&A in Italy continues to be very limited. According to KPMG estimations (KPMG, 2015) in 2007 we had in Italy 459 M&A deals for a value of 148 billion euros. In 2009 the number dropped to 197 deals equal to 34 billion euros. A recovery has been registred durning following years with 381 deals in 2013 (31 billion euros).

[3] According to the Eurostat-OECD (2007) a real death, or an enterprise "is an independent event affecting only one enterprise, and involving the dissolution of a combination of factors of production. It involves the deletion of an enterprise reference on the (live) business register."

[4] Note that, according to official statistics, Italy entered the big recession in the mid-2007. Also, note that we only have yearly observations in the end of the period, thus we cannot evaluate intra-year changes.



Note: the exit rate is computed as the share of firms that exit the market over the total number of active firms in each year. Value added data are taken from ISTAT National Accounts series.

Regarding explanatory variables, our main focus is on the measures of corporate strategies. Not having access to qualitative information about firms' strategic planning and orientation, we must rely on balance sheet information in order to capture how different corporate strategies translate into observable firm-level strategic dimensions. In a dynamic capabilities perspective, being able to develop organizational and managerial capabilities requires firms to systematically generate and modify their operating routines (Zollo and Winter 2002). This implies the adoption of a longitudinal framework of analysis in which the above strategic dimensions may be observed over time. Unfortunately, much of the empirical analyses available so far are developed on a cross-section basis (Makkonen et al., 2014) and, thus, cannot adequately account for dynamic capabilities.

A relatively large body of research in the management literature identifies in technology, human capital and internationalization the key drivers of competitive advantages in contemporary capitalism (Bridges and Guariglia, 2008; Ito and Lechevalier, 2010; Golovko and Valentini 2011; Love and Roper, 2015). Such drivers are conceived as firm-level strategic antecedents that boost economic performances. In the present work, we follow a similar approach and classify firm's strategic actions along three dimensions: "capital intensity" (*CAPINT*), as measured by the tangible-assets-to-labour-costs ratio, which reflects a firm's propensity to carry out investments in technology and capital equipment; "average wage" (*WAGE*), as measured by the total labour costs to total number of employees ratio, which captures a firm's tendency to hire unskilled (skilled), and therefore cheap (costly), labour; and a firm's ability to cope with foreign markets (*INTERNAZ*), which is proxied by a dummy variable taking the value of one (zero otherwise) for the firms that

turns out to be both importers and exporters in at least half of the period under investigation. While the first two dimensions are based on yearly observations, this latter dimension reflects a firm's persistent exposure to international competition and, thus, its ability to continuously develop specific skills to manage foreign markets.

On the basis of these dimensions, we are able to identify two different strategic profiles: a *LOWCOST* profile and a *GLOBENG* profile. In the first case, both the *CAPINT* and the *WAGE* ratios are below their sectoral means and the *INTERNAZ* dummy is equal to zero. These firms, compared to their direct competitors, tend to invest less in technology, to hire relatively cheap labour and to operate within national borders. According to this profile, firms may still be profitable in the short-term but have little incentive to accumulate adaptive skills in systematic ways. In the second case, the *CAPINT* and the *WAGE* ratios are above their sectoral means and the *INTERNAZ* dummy takes value equal to one. Compared to the most direct competitors, these firms tend to invest more in (technological) capital equipment, to hire skilled and relatively costly labour, and tend to persistently operate in international markets as both importers and exporters. To be viable these firms must accumulate skills that allow them to manage complex operations in rapidly changing environments and should therefore be well-accustomed to deal with environmental jolts.

We include in our analysis a set of control variables. The first ones that we consider are the factors that directly relates to the cleansing hypothesis, *i.e.* production efficiency and size. We measure the former in terms of value added per employee (*i.e.*, labour productivity)[5] and size as the total number of employees. To test for cleansing we must select the firms that exhibit a clear efficiency and/or size gap with respect to their competitors, as in principle they should be the first ones to be selected during a recession. To do so we define two dummy variables: the first one that takes value equal to one if the firm belongs to the first quartile of the productivity distribution, zero otherwise (*LABPRODQ1*); the second one, following the "liability of smallness hypothesis" (Bruderl and Schussler, 1990), that takes value equal to one if the firm has less than 10 employees (*SIZE10*). In both cases the cleansing hypothesis predicts that the impact of such variables on the probability of firm exit gets stronger during the recession.

We also control for additional co-variates of firm exit. In particular, we include in our regressions demographic and performance variables, such as firm *AGE* (in years), operating

[5] Our choice of labour productivity instead of other measures of production efficiency such as total-factor-productivity (TFP) is justified on both empirical and theoretical grounds. The empirical justification is that our data do not allow us to obtain a reliable measure of TFP. On the theoretical ground, the use of TFP would force us to make strong assumptions about the nature of the production function. Some of these assumptions are not consistent with the interpretative framework used to derive our research hypotheses (i.e. capabilities-based perspective). Moreover, there is empirical evidence, based on international comparisons which included the Italian economy, suggesting that labour productivity and TFP tend to be highly correlated and have similar explicative power so far as industrial dynamics are concerned (Berlingieri et al., 2017).

profitability (*PROFIT*) as well as two dummy variables reflecting a firm's position in the third and fourth quartiles of the productivity distribution (*LABPRODQ3* and *LABPRODQ4* alongside *LABPRODQ1*, assuming the second quartile, *LABPROD2*, as the reference group). In this respect, an extensive literature suggests that such variables should have a positive effect on firm survival (Dunne et al., 1988; Audretsch, 1991; Agarwal and Gort, 1996, 2002; Sutton, 1997; Landini, 2020). Moreover, to control for finance as one of the transmission channel of the crisis we consider a set of financial indicators, which includes a leverage index *(LEV*) and a ratio indicating firms' interest burden (*IR*). In addition, a variable reflecting a firm's debt structure (*LDEBT*) is also included.

Finally, we control for localization effects through regional dummies (north-west, north-east, central or southern regions of Italy) and for technological effects through sectoral dummies based on OECD (Sandven et al., 2005). The full list of variables used together with descriptive statistics is presented in the Appendix 1.

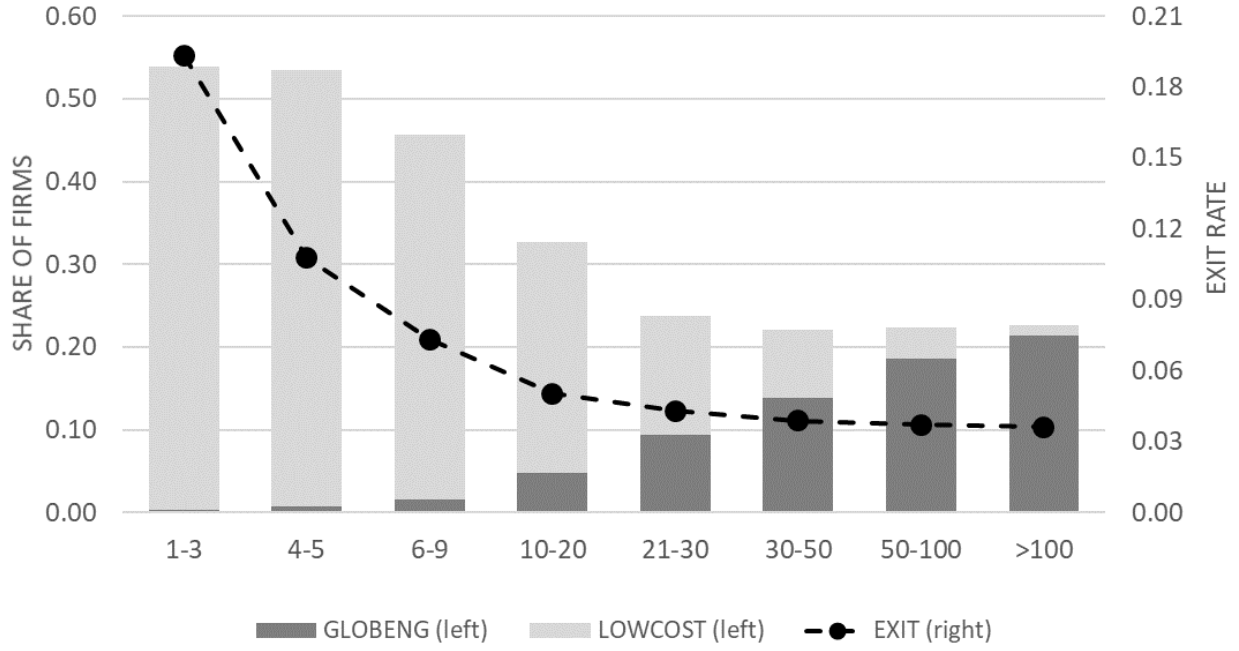
Before discussing the methodological issues, it is interesting to investigate in greater detail the characteristics of firms adopting different corporate strategies as they represent the focus of our analysis. Along these lines, Table 1 shows the distribution and the transition matrix of firms across strategic profiles during the period 2001-2013. Nearly one third of firms are classified as *LOWCOST*, while about 6% of firms are *GLOBENG,* which is a small but not trivial share of firms. This evidence confirms that in order to engage in this type of strategy firms must have a resource endowment that is relatively uncommon in most firms. Indeed, in line with previous findings (Landini et al., 2020a; ISTAT, 2013), the largest share of firms in the sample is classified neither as *GLOBENG*, nor as *LOWCOST* and this confirms the lack of a clear strategic orientation for a large portion of firms within the Italian manufacturing sector. In addition, the transition matrix shows that persistence is the dominant condition, thus suggesting that our classification indeed captures structural characteristics of the underlying population. The rate of persistence is higher in the *LOWCOST* group of firms (82%), while in the *GLOBENG* group the rate of persistence is equal to 75%. Also, the probability to switch from *GLOBENG* to *LOWCOST* and vice-versa is very low, although *GLOBENG* firms show higher propensity, compared to *LOWCOST* firms, to switch to the *OTHER* group.

Table 1 - Transition probabilities between business strategies (yearly averages 2001-2013)

	GLOBENG	LOWCOST	OTHERS	Total
GLOBENG	**76.94**	0.07	22.99	100
LOWCOST	0.03	**82.26**	17.71	100
OTHERS	2.47	7.78	**89.74**	100
Total	6.28	29.94	63.78	100

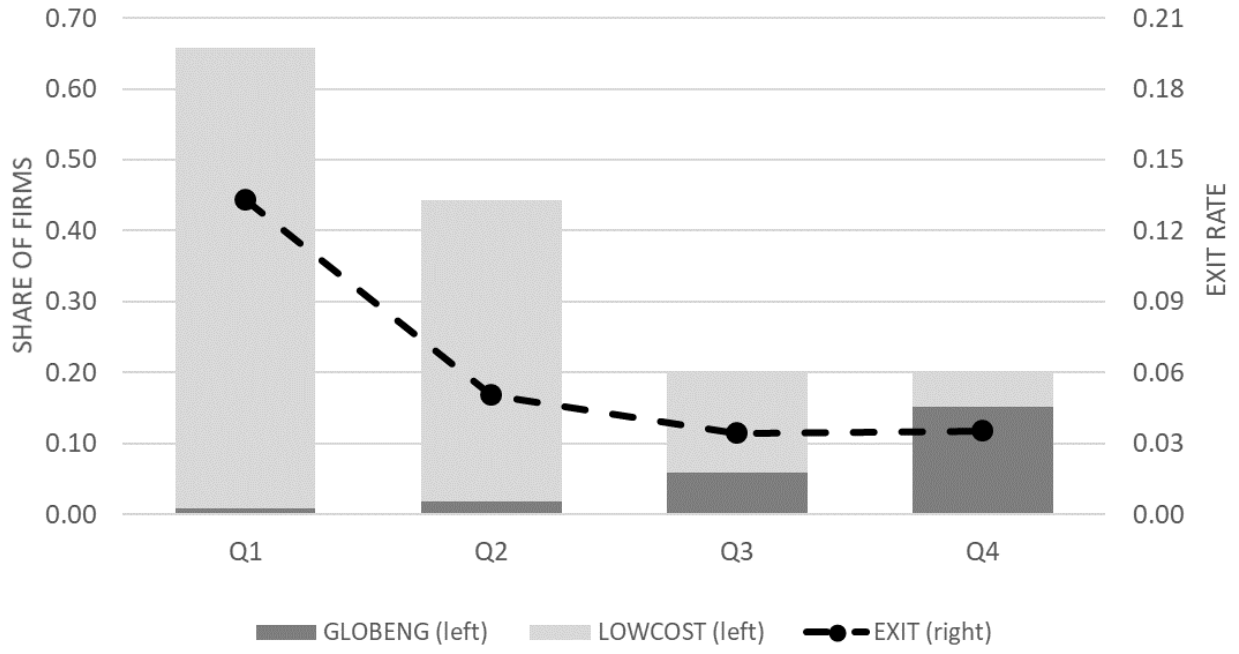
An important condition for strategic profiles to be useful in the analysis of firm exit is that they capture a significant share of the variability observed in the firm size and productivity distributions. Indeed, in most markets the largest part of firm selection takes place among relatively small firms, which are also less productive. It follows that in order to be able to account for at least part of this selection process, strategic profiles must exhibit some degree of differentiation even among small firms. This condition is indeed satisfied by our data. Figures 2 and 3 show the average distribution of strategic profiles (left axis) and exit rates (right axis) across different firm size (number of employees) and productivity classes (labour productivity quartiles). As we can see in the smallest size (up to 9 employees) and least productivity classes (first and second quartiles), where we observe the higher exit rates, most firms exhibit a *LOWCOST* strategy and the share of firms classified as *GLOBENG* is negligible. In the subsequent classes the share of *GLOBENG* firms tends to increase, even within the size groups with average exit rates far above zero. Such structure of the data allows us to estimates the impacts of strategic profiles on the probability of firm survival.

Figure 2 - Distribution of strategic profiles across firm size classes and exit rate



Note: the vertical axis on the left reports the share of firms per strategic profile across different firms size classes, while the vertical axis on the right reports the exit rate across different firm size classes.

Figure 3 - Distribution of strategic profiles across productivity quantiles and exit rate



Note: the vertical axis on the left reports the share of firms per strategic profile across different productivity quantiles, while the vertical axis on the right reports the exit rate across different productivity quantiles.

Finally, Table 2 shows some descriptive statistics for the year 2007, distinguished by strategic profile. In the last column we report the result of an F-test for the difference between the profile means. On average, *GLOBENG*-firms are larger than *LOWCOST*-firms and present smaller exit rates. In particular, while *GLOBENG*-firms have on average 92.3 employee (*SIZE*) and exit rates (*EXIT*) equal to 4.6%, the *SIZE* and *EXIT* of *LOWCOST*-firms is 9.8 and 12.8% respectively. With respect to firms' *AGE*, *GLOBENG*-firms are the oldest with an average value of 24 years, whereas *LOWCOST*-firms are significantly younger (7 years, on average). Important differences also emerge in terms of the dimensions we used to define the strategic profiles, *i.e.* the *CAPINV* and *WAGE* ratios and the export/import intensity *(EXPORT* and *IMPORT,* as measured as a ratio to total sales*)*. In fact, *GLOBENG*-firms present *IMPORT* and *EXPORT* intensities that are eight and fifteen times larger than *LOWCOST*-firms (0.33 *vs.* 0.04 and 0.15 *vs.* 0.01, respectively). Similar differences emerge in terms of the *CAPINV* and *WAGE* ratios. In addition, *GLOBENG*-firms present, on average, a higher labour productivity (*LABPROD*) and profitability (*PROFIT)*, than *LOWCOST*-firms (11.03 *vs.* 10.07 and 9.1 *vs.* 5.5, respectively). In terms of the financial structure, *GLOBENG*-firms are less indebted (*LEV*) than LOWCOST-ones, with a higher proportion of long-term debt (*LDEBT*) which is associated to a higher interest burden (*IR*). Overall, these statistics confirm that our strategic profiles are associated with significant differences in terms of firm-level economic performance and individual characteristics.

Table 2 - Descriptive statistics of strategic profiles: year 2007

	GLOBENG		**LOWCOST**		**OTHERS**		**F-Test**
	Mean	**St.Dev**	**Mean**	**St.Dev**	**Mean**	**St.Dev**	
EXIT	0.046	0.210	0.129	0.335	0.085	0.278	***
SIZE	92.348	481.632	9.809	14.767	34.825	142.177	***
AGE[a]	24.0	14.088	7.0	10.544	15.0	13.702	***
EXPORT	0.337	0.352	0.041	0.154	0.184	3.036	***
IMPORT	0.148	0.207	0.010	0.057	0.067	0.534	***
*WAGE (*log*)*	10.487	0.234	9.760	0.377	10.216	0.462	***
*CAPINV (*log*)*	1.013	0.558	-1.146	1.263	-0.278	1.532	***
LABPROD (log)	11.032	0.528	10.073	0.579	10.646	0.589	***
PROFIT	9.108	13.116	5.569	16.741	7.457	15.925	***
LEV	66.615	21.706	75.135	24.937	70.268	23.305	***
LDEBT	22.394	18.491	9.933	16.118	14.641	18.532	***
IR	2.743	2.393	1.850	2.214	2.281	2.579	***

Notes: *=sig. 10%, **=sig. 5%, ***=sig. 1%.
a) Median values are reported. Mean values for AGE: 24.0 (Globeng); 10.7 (Lowcost); 34.8 (Others)

3.2 Methodology

We model the hazard rate of exit by using a proportional hazard (PH) specification, *i.e.* we assume that (i) the baseline hazard function, which summarizes the pattern of duration dependence, is common to all firms and (ii) the set of firm-specific covariates represents a multiplicative scale for the common hazard. Although time is intrinsically continuous, our model treats time as a discrete variable, given that data are provided on a yearly base. In this context, a complementary log-logistic specification is appropriate. Our model incorporates time-varying covariates and controls for the existence of unobserved individual heterogeneity. The use of time-varying explanatories allows us to extend the analysis of the determinants of firms' survival beyond the time of entry, thus offering a dynamic perspective, whereas the consideration of unobserved firm specific heterogeneity (*i.e.* firms' intrinsic characteristics and specific capabilities not directly observed) which may affect the rate of exit independently of the specific timing of analysis is appropriate as might give rise to inconsistent estimates in the survival context when not adequately taken into account. The dependent variable is the survival time, indicating the uninterrupted number of years a firm survives. The unit of observation is a firm's death, according to the definition provided in the previous section.

Both right and left censoring characterize our panel data given that we do not observe firms during their entire lives. Right censoring is due to the fact that we do not control for the possible exit date of those firms which are still alive in 2014. Left censoring occurs because, although a firm's birth is known, we do not have economic information before year 2001.

Following Jenkins (2004), the methodological foundations of our analysis may be described as follows. Let T be a discrete random variable that takes the values $t_1<t_2<\ldots$ with probabilities $f(t_j)=f_j=Pr\{T=t_j\}$. Our intervals of time are of unit length (a year). This means that the interval boundaries are the positive integers $j=1, 2, 3, \ldots\ldots$, and the interval j is $(j-1, j)$. We define the survivor function at time t_j as the probability that the survival time T is at least t_j:

$$S(t_j)=S_j=Pr\{T \geq t_j\}= \sum_{k=j}^{\infty} f_j. \quad (1)$$

Next, we define the hazard at time t_j as the conditional probability of dying at that time given that one has survived to that point, so that:

$$\lambda(t_j)=\lambda_j=Pr\{T = t_j \mid T \geq t_j\}=f_j/S_j \quad (2)$$

An intuitive interpretation of the hazard would be: λ_j= number of firms who failed at time *t*/number of firms who have survived time *t-1*. The probability of survival until the end of interval *j* is the product of probabilities of not experiencing event in each of the intervals up to and including the current one. Hence, more generally, we have:

$$S_j = (1-\lambda_1)(1-\lambda_2)\ldots(1-\lambda_{j-1}) \quad (3)$$

The above expression implies that if we have an estimate $\hat{\lambda}_j$, will also have:

$$\hat{S}_t = \prod_{s=1}^{t}(1-\hat{\lambda}_j) \quad (4)$$

Under the PH assumption for the underlying distribution, the complementary log logistic model (cloglog) estimates the log-hazard. This model provides a discrete time representation of an underlying continuous time proportional hazard:

$$\lambda(t, x_{it})= \lambda_0(t)exp(b_0+b'X_{it}) \quad (5)$$

The above expression has the desirable property of satisfying the separability condition which is implied by the PH assumption, i.e., $\lambda_0(t)$ is the baseline hazard function, which depends on *t* (but not on the set of characteristics *X*) and summarizes the pattern of duration dependence, assumed to be common to all firms; $exp(b_0+b'X_{it})$ is a firm-specific function of covariates *X* which scales the baseline hazard function. Note that the PH assumption with time-varying covariates implies that the proportionality factor varies with survival time.

Applying the standard cloglog transformation we obtain the general model:

$$log(-log(1-\lambda(t_j|x_{it}))) = b_0+b'X_{it}+\alpha_j \quad (6)$$

or

$$\lambda(t_j|x_{it})= 1- exp (- exp (b_0+b'X_{it} + \alpha_j)) \quad (7)$$

where $\alpha_j = log(-log(1-\lambda_0(t_j)))$ is the complementary log-log transformation of the baseline hazard.

The term α_j summarizes the pattern of duration dependence in the interval hazard. We assume a non-parametric specification by creating interval-specific dummy variables, one for each spell year at risk.

In order to test for the presence of unobserved individual-specific risk factors we have to modify the general formulation provided by equation (7) as follows:

$$\lambda(t_j|x_{it},\ \eta_i) = 1 - \exp(-\exp(b_0 + b'X_{it} + \alpha_j + \eta_i)) \qquad (8)$$

This corresponds to the cloglog model with unobserved heterogeneity given by η_i, a random variable such as: $\eta_i \equiv ln(v_i)$ and being distributed independently of t and X. We examine two alternative distributions for v_i, the first is a normal distribution $v_i \sim N(0;\ \sigma_v^2)$, while the second is a gamma distribution $v_i \sim Gamma(1;\ \sigma_v^2)$, as proposed by Meyer (1990).

Note that with $\eta_i = 0$ the model reduces to the standard formulation without unobserved heterogeneity.

4. Results

4.1 Univariate analysis

In order to gain insights about the effect of the most relevant explanatory variables on firm survival (*i.e.*, corporate strategies as well as cleansing-related variables such as productivity and small size) , we perform a preliminary test of the equality of the survival functions across the relevant groups of firms under investigation. Table 3 reports results for the *log-rank test* (Mantel and Haenszel, 1959) and the *Wilcoxon test* (Breslow, 1970), which are two non-parametric statistical tests under the null hypothesis of no difference between the survival functions in each group of firms according to the characteristics that are intended to differentiate between the cleansing and skill accumulation hypotheses. Results reject the null hypothesis of equality of the survival functions across groups of firms for each of the group under consideration with a high significance level.

Table 3 – Non-parametric tests of equality of survival functions

Groups of firms	Events observed	Event expected	Log-rank		Wilcoxon	
			productivity level			
LABPRODQ1	42,208	25,708	chi2(3) =	23,346	chi2(3) =	19,413
LABPRODQ2	16,646	24,951	Pr>chi2 =	0.000	Pr>chi2 =	0.000

LABPRODQ3	11,218	24,286				
LABPRODQ4	32,609	27,736				
		size				
SIZE10=0	33,849	55,953	chi2(1) =	21,427	chi2(1)=	17,304
SIZE10=1	68,832	46,728	Pr>chi2 =	0.000	Pr>chi2=	0.000
		strategic profiles				
GLOBENG	2,528	5,572	chi2(2) =	10,114	chi2(2)=	8,766
LOWCOST	47,632	33,868	Pr>chi2 =	0.000	Pr>chi2=	0.000
OTHERS	52,521	63,241				

We also plot in Figure 3 the survival functions of the complete sample and by sub-groups of firms by using the Kaplan-Meier estimator. The K-M analysis is a familiar method used to examine changes over time to a specified event in presence of right-censored observations. This non-parametric test is appropriate because by providing a descriptive analysis about the patterns of duration dependence is also a useful tool in the choice of the parametric model.

For any K-M plot, the horizontal axis represents the time variable expressed in years. All firms start at the top of the vertical axis, which indicates the proportion that has not experienced an exit event. The Kaplan-Meier curve is not a smooth function, but is characterized by a one direction step-like appearance. The lengths of the horizontal lines along the horizontal axis represent the survival duration in years for each interval, while the vertical distances between horizontal lines correspond to the change in cumulative probability as the curve moves to the right; thus, drops in the plots are associated to failure events.

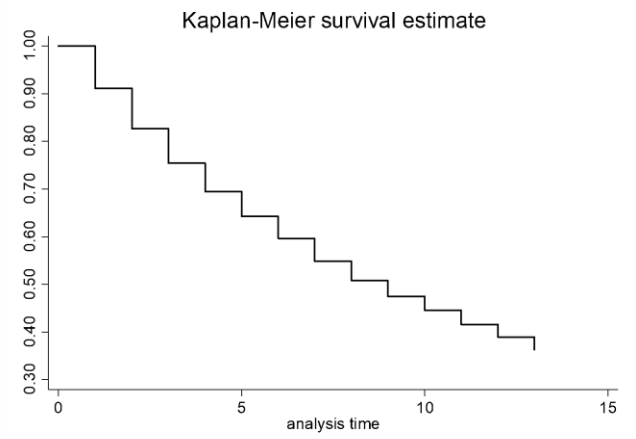
When we consider the complete sample (panel a) the K-M estimates show that the probability to survive till the end of 2007 is about 55%. At the end of the period under investigation surviving firms represent the 36% of the sample. This graphical representation is also a useful visual tool to test the validity of the proportional hazard assumption with reference to different groups of firms, as it compares survival functions among sub-groups. We note from panels b) to d) that the curves do not overlap, thus indicating that the proportionality assumption holds for these explanatory variables. Based on these K-M estimates we can expect that both firms operating in the lower part of the productivity distribution and micro enterprises (fewer than 10 employees) may experience lower survival chances than their counterparts, with an estimated gap which is higher in terms of size. The K-M estimates indicates that by the end of the period under investigation the less efficient firms will experience a failure risk equal to 84%, 35 p.p. higher than those operating in the median of the data , while in terms of firm size (small vs. large firms) the expected gap is equal to 35 p.p.

In terms of corporate strategies K-M estimates indicate that by the end of the period under investigation the probability to survive for a *GLOBENG* firm is about 42 p.p. higher than a

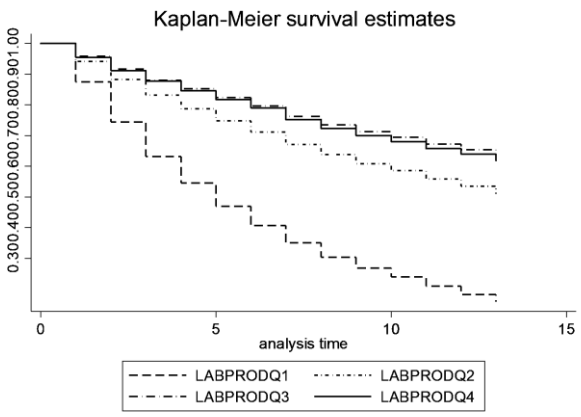
LOWCOST firm (64% vs 22%). At the end of 2007 the estimated probability to survive were, respectively, of 78% and 62%, thus signalling that the probability gap is expected to increase over time.

Figure 3 - Survival functions

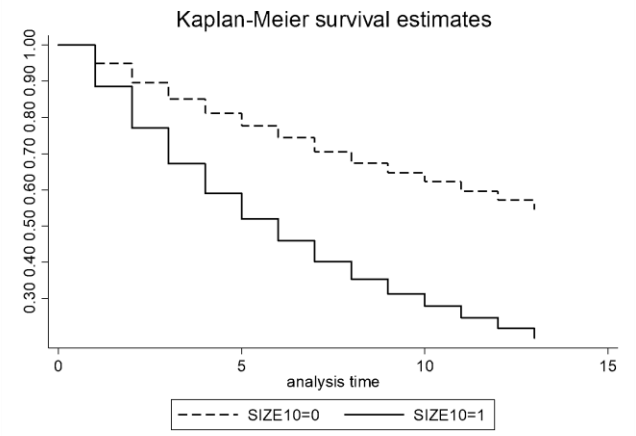
a) Full sample



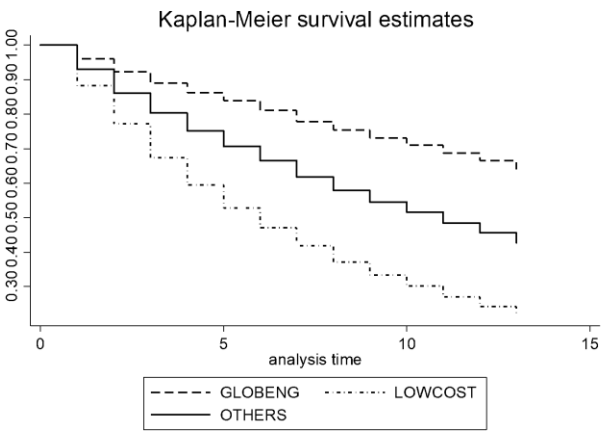
b) by productivity level



c) by size



d) by strategic profiles



4.2 Multivariate analysis

To capture the impact of the economic downturn we include in the *X* vector of covariates a dummy variable that takes value equal to one for the years 2008-2013, i.e. the crisis period (*d0813*). We estimate both a baseline model, where all the covariates are treated as individual terms, and an interacted model, where the crisis dummy is interacted with the set of firm-specific covariates. By allowing for interacted terms we are able to evaluate how hazard rates differ during the recession

compared to the pre-crisis period.

4.2.1 Baseline model

Table 4 reports the estimation results of the baseline model. The first column refers to a complementary loglog model without taking into account possible individual unobserved heterogeneity (IUH). Not doing so when the latter is present may yield biased regression coefficients, which can turns out to be under-estimated (Lancaster, 1990). In addition, the degree of negative duration dependence may result over-estimated. Thus, in the second and third columns of Table 4 IUH is controlled for by assuming, respectively, Gamma and Normal Random Effect (RE). The LR tests reported at the bottom of the table reject the null hypothesis of zero variance, thus indicating that taking into account unobserved heterogeneity is appropriate. In line with this result, it is worth noting that some of the coefficients are smaller in the specification without IUH than in the models where the latter is controlled for. In addition, in the specification without IUE the estimated coefficients for the set of duration dummies (not shown here for the sake of simplicity) are greater than in the models with IUH.

Table 4 - Log-logistic proportional hazard estimates - baseline model

Variable	**Without IUH**	**With IUH**			
		Gamma RE	**Normal RE**		
	All [1]	**All** [2]	**All** [3]	**<50 Empl[a]** [4]	**<20 Empl[a]** [5]
d0813	1.456***	1.510***	1.521***	1.544***	1.571***
	[0.0142]	[0.0163]	[0.0170]	[0.0178]	[0.0188]
AGE	0.881***	0.875***	0.869***	0.865***	0.862***
	[0.00495]	[0.0055]	[0.00576]	[0.00605]	[0.00642]
PROFIT	0.996***	0.995***	0.995***	0.996***	0.996***
	[0.000218]	[0.0002]	[0.000248]	[0.000256]	[0.000267]
LEV	1.011***	1.013***	1.014***	1.014***	1.013***
	[0.000178]	[0.0002]	[0.000232]	[0.000242]	[0.000252]
LDEBT	0.988***	0.987***	0.987***	0.987***	0.987***
	[0.000264]	[0.0003]	[0.000307]	[0.000319]	[0.000336]
IR	1.061***	1.066***	1.067***	1.066***	1.064***
	[0.00147]	[0.0017]	[0.00177]	[0.00184]	[0.00190]
LABPRODQ1	2.323***	2.453***	2.490***	2.481***	2.373***
	[0.0247]	[0.0280]	[0.0292]	[0.0299]	[0.0299]
LABPRODQ3	0.782***	0.765***	0.759***	0.768***	0.796***
	[0.0108]	[0.01090]	[0.0110]	[0.0115]	[0.0128]
LABPRODQ4	0.926***	0.901***	0.891***	0.902***	0.930***
	[0.0131]	[0.0135]	[0.0138]	[0.0148]	[0.0167]
SIZE10	1.586***	1.758***	1.821***	1.882***	1.879***
	[0.0140]	[0.0191]	[0.0218]	[0.0235]	[0.0249]

GLOBENG	0.832***	0.818***	0.810***	0.763***	0.771***
	[0.0211]	[0.0217]	[0.0220]	[0.0253]	[0.0346]
LOWCOST	0.911***	0.923***	0.929***	0.942***	0.955***
	[0.00852]	[0.0096]	[0.00992]	[0.0103]	[0.0108]
ML-TECH	1.008	1.001	0.998	0.992	0.978*
	[0.00968]	[0.0112]	[0.0116]	[0.0120]	[0.0124]
MH-TECH	1.075***	1.067***	1.067***	1.066***	1.074***
	[0.0110]	[0.0127]	[0.0132]	[0.0138]	[0.0145]
H-TECH	1.402***	1.473***	1.493***	1.485***	1.444***
	[0.0262]	[0.0327]	[0.0345]	[0.0364]	[0.0371]
NEAST	0.965***	0.959***	0.957***	0.962***	0.961***
	[0.0105]	[0.0119]	[0.0124]	[0.0132]	[0.0141]
CENTRE	1.049***	1.057***	1.063***	1.078***	1.100***
	[0.0119]	[0.0140]	[0.0147]	[0.0155]	[0.0166]
SOUTH	1.312***	1.379***	1.406***	1.440***	1.447***
	[0.0145]	[0.0181]	[0.0195]	[0.0208]	[0.0218]
constant	0.0204***	0.0230***	0.0178***	0.0166***	0.0164***
	[0.000803]	[0.0001]	[0.000781]	[0.000769]	[0.000826]
Obs	1,017,230	1,017,230	1,017,230	913,671	724,384
n. of firms	162,430	162,430	162,430	149,957	126,018
Log Likelihood	-219,855.27	-219,129.97	-219,523.8	-203,846.26	-174,366.36
Test for unobserved individual heterogeneity		LR test of gamma var.=0: chibar2(01) = 1450.60 Prob >= chibar2 = 0.000	LR test of rho=0: chibar2(01) = 662.95 Prob >= chibar2 = 0.000	LR test of rho=0: chibar2(01) = 668.07 Prob >= chibar2 = 0.000	LR test of rho=0: chibar2(01) = 433.31 Prob >= chibar2 = 0.000

Notes: Duration dummies included; variables PROFIT, LEV, LDEBT and IR are lagged one year; variable AGE is in log terms; a: evaluated in the first year of presence in the panel; *rho* is the fraction of total variance due to the individual component; *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors into brackets.

We do not observe any relevant difference in the estimates obtained from the two RE models, thus we decide to focus our analysis on the specification assuming Normal RE, which is computationally less demanding. In the last two columns of Table 4 this latter specification has been also estimated in the sub-groups of firms with less than 50 and 20 employees, respectively. This further breakdown is appropriate as a robustness check, given that small firms are more exposed to chances of exiting the market.

Coefficients are reported as hazard rates. This implies that a coefficient greater than one indicates a positive contribution to the probability of exit, whereas a coefficient smaller than one suggests a negative contribution. It is worth recalling that for a continuous variable, the hazard ratio is the change in the risk of exit for a unit change in that variable, while for a dummy variable, it is the difference in the rate of exit between firms with the characteristic described by the dummy variable and the rest of the population.

Estimates for the whole sample show that the adoption of a *GLOBENG* strategy reduces the probability of exit by 19%, with an even higher impact which ranges between -24% and -23% in the sub-groups of firms with less than 50 and 20 employees, respectively. Interestingly, the adoption of a *LOWCOST* strategy negatively affects the hazard, although with a much lower impact (- 7% in the full sample).

With reference to the set of control variables most of the results confirm the available evidence. The crisis (*d0813*), as expected, has a negative effect reducing the probability of survival by 52%. The magnitude of this effect becomes even stronger when we move to the subsample of smaller firms. Firms that belong to the first quartile of the productivity distribution (*LABPRODQ1*) have 2.5 times more chances of exiting the market than the rest of the sample. This effect is slightly reduced in the two sub-samples of small firms. Similarly, being a micro-firm (*SIZE10*) increases the probability of exit by 82% and the impact is higher if we move to the sub-samples of small firms. *PROFIT* and *AGE* contribute to increase the probability of survival and also in this case the effects are highly significant, regardless of the firm size threshold included in the analysis. Although of limited impact, the finance indicators show more nuanced results , with *LEV* and *IR* that rise the probability of exit by 1.4% and 6.7% respectively, and *LDEBT* that reduces the chances of exit by 1.3%. This latter effect may be interpreted on the ground that a higher long-term debt may indicate that the firm is more focused on strategic investments such as innovative activities that may increase a firm's survival chance.

Finally, the impact of geographic localization confirms previous stylized facts, with the firms localized in the central and southern regions experiencing a higher chance to exit compared to firms operating the northern regions. Also, industry technological opportunities are relevant, with firms operating in the medium-high technological sectors having a lower probability to exit compared to their low-tech counterparts. Nevertheless, being a high-tech firm and, thus facing higher competitive threats, tends to increase the chance to exit.

Overall, the results of the baseline estimates provide support for the available evidence on the determinants of firm exit. With respect to our main variables of interest, two results should be highlighted. The first one is that we do find evidence that having a clearly defined strategic behaviour is crucial for survival. In particular, both the firms adopting a global engagement strategy and the ones adopting a low cost strategy have higher chances of survival than firms that adopt neither of the two. Secondly, the existence of productivity and size gaps tends to have very strong negative impact on the chances of survival.

4.2.2 Model with crisis interactions

To isolate the impact of the recession, we estimate an alternative specification where we interact the covariates included in Table 4 with the crisis dummy (*d0813*) (Table 5). It is worth recalling the interpretation of an interacted term in non-linear model when estimating the effect in terms of hazard ratios (columns 2, 4 and 6). For a continuous variable it should be interpreted as the change in the relative risk due to a unit change of the variable that we observe during the crisis compared to what we observe in the previous period, holding all other variables at their reference values. For a dichotomous variable it is a measure of the difference in relative risk comparing the crisis period to the previous period for those firms having the characteristic captured by the dummy variable, holding all other variables constant. For each of the interacted variables, the non-interacted term labelled as *X* in the table indicates the contribution to the risk of exit in the pre-recession period. In order to obtain the contribution during the crisis we must multiply the interacted effect reported in the column labelled as *X*d0813* with the non-interacted term[6]. Thus, an interacted term higher than one means that the magnitude of the effect observed before the crisis is amplified during the recession, conversely an interacted term lower than one indicates that during the crisis the risk of exit is reduced compared to the pre-crisis period.

Table 5 - Log-logistic proportional hazard estimates - model with interactions and normal individual heterogeneity

Variable	**All**		**<50empl[a]**		**<20 empl[a]**	
	X	**X*d0813**	**X**	**X*d0813**	**X**	**X*d0813**
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**
d0813	1.578***		1.667***		1.711***	
	[0.0768]		[0.0840]		[0.0915]	
AGE	0.901***	0.920***	0.901***	0.916***	0.896***	0.923***
	[0.00762]	[0.0101]	[0.00799]	[0.0105]	[0.00847]	[0.0112]
PROFIT	0.995***	1.001**	0.995***	1.001**	0.995***	1.001**
	[0.000380]	[0.000498]	[0.000391]	[0.000513]	[0.000409]	[0.000535]
LEV	1.013***	1.001	1.013***	1.000	1.012***	1.001
	[0.000335]	[0.000406]	[0.000347]	[0.000420]	[0.000367]	[0.000445]
LDEBT	0.980***	1.011***	0.980***	1.011***	0.980***	1.011***
	[0.000481]	[0.000604]	[0.000503]	[0.000628]	[0.000535]	[0.000667]
IR	1.060***	1.011***	1.059***	1.011***	1.058***	1.008**
	[0.00255]	[0.00321]	[0.00264]	[0.00332]	[0.00274]	[0.00345]
LABPRODQ1	2.771***	0.838***	2.778***	0.829***	2.639***	0.839***
	[0.0496]	[0.0191]	[0.0512]	[0.0193]	[0.0517]	[0.0206]
LABPRODQ3	0.776***	0.962	0.788***	0.957	0.822***	0.947*
	[0.0175]	[0.0278]	[0.0186]	[0.0287]	[0.0213]	[0.0309]
LABPRODQ4	0.976	0.852***	0.997	0.843***	1.039	0.832***
	[0.0225]	[0.0253]	[0.0245]	[0.0266]	[0.0285]	[0.0291]
SIZE10	1.778***	1.051***	1.856***	1.025	1.895***	0.981

[6] In non-linear models the interaction effect of, say, X_1 and X_2 is the cross partial derivative of the expected value of the dependent variable with respect to the multiplicative term $X_1 x X_2$ (Buis, 2010).

	[0.0283]	[0.0200]	[0.0308]	[0.0202]	[0.0345]	[0.0214]
GLOBENG	0.893***	0.849***	0.844***	0.849**	0.869**	0.823**
	[0.0361]	[0.0449]	[0.0423]	[0.0550]	[0.0591]	[0.0725]
LOWCOST	0.908***	1.039*	0.926***	1.027	0.947***	1.010
	[0.0145]	[0.0213]	[0.0151]	[0.0214]	[0.0162]	[0.0220]
ML-TECH	0.998		0.993		0.979*	
	[0.0117]		[0.0120]		[0.0124]	
MH-TECH	1.068***		1.067***		1.075***	
	[0.0133]		[0.0138]		[0.0145]	
H-TECH	1.494***		1.482***		1.438***	
	[0.0347]		[0.0364]		[0.0369]	
NEAST	0.957***		0.964***		0.963***	
	[0.0125]		[0.0132]		[0.0140]	
CENTRE	1.064***		1.079***		1.100***	
	[0.0148]		[0.0156]		[0.0165]	
SOUTH	1.410***		1.441***		1.447***	
	[0.0197]		[0.0209]		[0.0218]	
constant	0.0191***		0.0173***		0.0168***	
	[0.000989]		[0.000942]		[0.000992]	
Obs	1,017,230		913,671		724,384	
n. of firms	162,430		149,957		126,018	
Log Likelihood	-219,245.38		-203,575.55		-174,138.63	
Test for unobserved individual heterogeneity	LR test of rho=0: chibar2(01) = 641.77 Prob >= chibar2 = 0.000		LR test of rho=0: chibar2(01) = 625.28 Prob >= chibar2 = 0.000		LR test of rho=0: chibar2(01) = 395.37 Prob >= chibar2 = 0.000	

Notes: Duration dummies included; variables PROFIT, LEV, LDEBT and IR are lagged one year; variable AGE is in log terms; a: evaluated in the first year of presence in the panel; *rho* is the fraction of total variance due to the individual component; *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors into brackets.

In line with *Hypothesis 1* we find that during the pre-crisis period the adoption of global engagement and low-cost strategy increases the chances of survival. In particular, being a *GLOBENG* firm ensures a survival premium of about +11% (compared to the reference group in the whole sample), whereas for *LOWCOST* firms the size of the premium is around +9%. When we consider the sub-samples of small firms, the effect of both strategic profiles remain positive and significant, although the magnitude of the effect differs. For instance, for firms with less than 20 employees, the adoption of a global engagement strategy rises the probability of survival by +13%, whereas for firms adopting a low-cost strategy survival likelihood increases only by +5%.

When we move to consider the contribution of corporate strategies in the post-crisis period, we find support also for *Hypotheses 2a* and *2b*. While being a *GLOBENG* firm significantly reduces the probability of exiting the market during the crisis compared to the pre-crisis period, the same result does not hold for *LOWCOST* firms. In particular, our estimates suggest that firms adopting a global

engagement strategy have a survival premium during the crisis of about +24% (0.893x0.849) in the whole sample. This effect becomes stronger (+28%) when we consider the subsample of firms with less than 20 employees. Conversely, *LOWCOST* firms see a reduction of their survival premium by nearly one-third during the recession, going from +9% before the crisis to nearly +6% (0.908x1.039) in the post-crisis period. For this strategic profile the interacted effect turns out to be not significant in the subsamples of small firms, where exit processes are particularly intense.

Interestingly, the results for the variables associated with the cleansing hypothesis confirm that the latter offers a relatively poor interpretation of firm selection during recession. In fact, rather than rising, the selective pressure over less efficient firms weakens in the post-crisis period. The coefficient associated with the interaction of *LABPRODQ1* with the crisis dummy (*d0813*) is smaller than one and highly significant even in the subsamples of small firms. With respect to firm size the result is somewhat more nuanced. Being a micro-enterprise (*SIZE10*) positively affects the probability of exiting before the downturn (+78%) and the impact turns out to increase during the downturn: +87% (1.778x1.051) in the overall sample. This result suggests that while during the economic recession there has not been significant cleansing operating on low efficiency firms, some cleansing has indeed taken place among very small firms. However, no significant effect is associated with the interaction terms in the subsamples of small firms, thus signalling that focusing the analysis on these specific sub-groups of firms does not unveil any further threat to the pre-crisis exit risk.

Finally, although a detailed analysis of the complete set of control variables goes beyond the scope of the present paper, it is worth noting that the positive contribution to the chances of survival that we observe in the pre-crisis period for some of them (see for example *PROFIT* and *LDEBT*) seems to vanish or, at least, to lose significance during the recession.

Overall, these results highlight two main points that are of relevance for the literature on firm survival. First of all, the skill accumulation hypothesis seems to do a much better work in explaining firm exit during recessions than the cleansing hypothesis. Secondly, the contribution of corporate strategies to the process of firm selection changes along the business cycle. While during standard phases of the business cycles global engagement and low-cost strategy have similar effects on survival likelihood, when the economy is hit by a recession the contribution of the two strategies differ. *GLOBENG*-firms have the adaptive skills necessary to face the environmental jolt, resulting in higher survival likelihood. *LOWCOST*-firms, on the contrary, adopt a defensive strategic conduct that turns out to be ill-suited to contrast the economic downturn.

6. Conclusions

Recessions offer unique opportunities to deepen our understanding of firm exit, a topic which has been widely studied but not definitively explained yet. While the interpretative hypotheses of the selection mechanisms are many, we are still far from conclusive results. In recent years, several works have focused on the so-called cleansing hypothesis, namely the idea that firm exit is primarily driven by exogenous factors, such as firm-specific productivity levels and/or imperfections in the markets for physical and immaterial inputs. Following this approach, a severe recession reduces product demand, squeezes price-costs margins of less efficient companies and exposes them to higher risk of exit. Accordingly, recessions should restore the hierarchy of efficiency/productivity among firms, that the factor market imperfections had distorted.

Alongside the cleansing hypothesis, this paper develops an alternative explanation that is based on *skills accumulation*. In our view, recessions are events that alter the cognitive patterns followed by firms, dramatically increasing uncertainty and amplifying the informative needs of firms. When confronted with such events, firm survival depends only limitedly on production efficiency. Rather, it depends on the ability to cope with the rising complexity of the business environment. Firms adopting strategic profiles that rely on the accumulation of skills that are useful to deal with environmental complexity are expected to proactively react to the recession, increasing the likelihood of survival. Firms focused primarily on cost retrenchment, on the contrary, are expected to lack such skills, being more likely to exit.

We test these hypotheses on the whole population of Italian manufacturing corporations using an open panel that covers the period 2001-2013. The structure of the data allows us to test our hypotheses comparing the probability of firm survival in the pre- and post-crisis periods and also focusing on smaller firms. We find that during the recession there has been no cleansing effect operating on relatively inefficient firms, which, on the contrary, experienced a weakening of the selective pressure. With respect to skill accumulation we find two main results. First of all, during standard phases of the business cycles having a coherent corporate strategy, being it either of the global engagement or low-cost type, increases the chances of survival compared to alternative less-coherent strategies. Secondly, during recessions the need for adaptive skills implies that only global engagement, which favours their accumulation, ensures a survival premium. The adoption of a low-cost strategy, on the contrary, reduces the chances of survival compared to the pre-crisis period. The evidence for subsamples of firms according to their size confirms these findings.

These results have strong managerial and policy implications. First of all, while investments in activities that favour the accumulation of skills such as worker training, entry into international

markets and knowledge acquisition are undoubtedly a cost that can stress the financial structure of a firm, they may also bring important benefits, especially in terms of survival. In particular, the evidence gathered in the paper suggests that such costs should be assessed - by the companies themselves, but also by the credit system - as an insurance against the worst effects of a recession and (possibly) as a lever to accelerate the post-crisis recovery.

Secondly, the above analysis has interesting policy implications related the limited impact of the cleansing mechanism. This implies that alongside the social costs due to increased unemployment and uncertainty, the recession can have also an economic cost associated with the survival of long tails of inefficient producers in the manufacturing industries. During the recovery such long tails can slow down the process of aggregate productivity growth and weaken the effect of standard market-based economic interventions. Therefore, demand-side economic policies to sustain economic growth (e.g. via public investments) may be needed.

Finally, our results have some implications also for the structure and management of inter-firm relationships and supply chain. Over the years the Italian manufacturing system has experienced an extended division of labour among firms and a marked vertical disintegration. In such a context, efficiency relies both on firm's internal resources and the management of the supply chain. The ineffectiveness of the cleansing process implies that firms with low productivity remain in business and this has negative repercussions, not only on horizontal competition (between competitors), but also on the efficiency of vertical exchanges between companies (between buyers and suppliers). Accordingly, firms should be encouraged to monitor internal efficiency, but also to align the whole supply chain with high productivity standards.

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Appendix.

Variable definition and descriptive statistics - Selected years

variable definition	type	variable description	Year 2002 N=87,643		Year 2007 N=100,595		Year 2013 N=97,419	
			mean	std. Dev	mean	std. Dev	mean	std. Dev
AGE	c	Firm's age in years	14.46	12.52	15.86	13.36	18.39	14.77
PROFIT	c	Return on sales. The ratio between gross operating profits and sales. An index of operating profitability (%).	6.68	17.16	6.95	16.08	4.31	19.91
LEV	c	The ratio of total debt to total assets. A measure of a firm's exposure to external financing sources (%)	71.84	24.33	71.61	23.89	67.03	30.75
LDEBT	c	Long term debt to total debt ratio. A variable reflecting a firm's debt structure (%)	11.37	15.52	13.58	18.06	12.23	15.39
IR	c	Interest rates to sales ratio. A variable reflecting a firm's interest burden	2.42	2.89	2.17	2.47	1.88	2.70
LABPROD*	c	Labour productivity. Value added to employees ratio	38,391	23,720	42,951	26,475	42,869	27,423
SIZE10	0/1	1 if the firm has less than 10 employees	0.42	0.49	0.43	0.49	0.47	0.50
GLOBENG	0/1	1 if the firm adopts a "global" strategy	0.05	0.22	0.05	0.23	0.06	0.24
LOWCOST	0/1	1 if the firm adopts a "low cost" strategy	0.31	0.46	0.32	0.46	0.32	0.47
OTHERS	0/1	1 if the firm adopts a "mixed" strategy	0.64	0.48	0.63	0.48	0.62	0.49
H-TECH	0/1	1 if in the low technology sectors	0.40	0.49	0.38	0.49	0.38	0.49
MH-TECH	0/1	1 if in the medium-low technology sectors	0.31	0.46	0.32	0.47	0.30	0.46
ML-TECH	0/1	1 if in the medium-high technology sectors	0.24	0.43	0.26	0.44	0.28	0.45
L-TECH	0/1	1 if in the high technology sectors	0.05	0.21	0.04	0.20	0.04	0.19
NWEST	0/1	1 if the firm is localized in the North-West	0.36	0.48	0.34	0.48	0.35	0.48
NEAST	0/1	1 if the firm is localized in the North-East	0.28	0.45	0.28	0.45	0.28	0.45
CENTRE	0/1	1 if the firm is localized in the Centre	0.20	0.40	0.20	0.40	0.20	0.40
SOUTH	0/1	1 if the firm is localized in the South	0.17	0.37	0.18	0.38	0.18	0.38

*p25: 24,355; p50: 35,394; p75: 49,927; p99: 142,896. Computed on the overall period.

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