Firm survival during economic downturns: is selection based on cleansing or skill accumulation?

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Abstract

Recessions are complex events that create perturbed and hostile business environments. When faced with such event, firm survival depends only limitedly on production efficiency. Rather, it depends on the skills and ability to cope with such complexity, which is itself a result of the firm's corporate strategy. In particular, we expect firms adopting a corporate strategy that makes relatively large (little) use of skills and capabilities to deal with environmental complexity to be less (more) likely to exit during a downturn than firms that do not. We test these hypotheses 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; efficiency, recession; cleansing.*

JEL codes: **D24; L11; L25**.

1. Introduction

Recessions are periods of significant economic and social distress, which often increase firms exit rate. The standard economic literature usually explains such closures on the basis of the so-called *cleansing hypothesis*, namely the idea, which dates as far back as Schumpeter (1939), 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); 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. A number of papers also suggest that labour market regulations and policies governing firm dynamics can be particularly relevant in distorting the process of firm selection in presence of negative shocks, because they allow relatively inefficient firms to survive (Haltiwanger et al., 2008; Collier and Goderis, 2009; Hallward-Driemeier and Rijkers, 2013).

A common assumption in this literature, which is the main motivation behind our paper, 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 provide an alternative interpretation of firm survival during recessions that is based on two main theoretical tenants. First of all, we base our analysis of production activities on 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, where learning and skills accumulation play a crucial role. 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., 2017).

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). Firms' 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).

Our hypothesis is that, when faced with such a degree of complexity, firm exit depends on the skills and capabilities that firms have endogenously accumulated over time (*skill accumulation hypothesis*). In particular, the more (less) a firm accumulates skills and capabilities that make her well (not) accustomed to deal with complex events such as a crisis, the greater (smaller) the responsiveness and adaptability of such firm to environmental jolts and thus the higher (lower) the

likelihood of survival. Such skills and capabilities are not exogenously given, but rather depend on the corporate strategy adopted by the firm, i.e., the set of choices that the firm implements over time in reference to the allocation of resources and the competitive priorities to be pursued. In this sense, the resource-based view and some of the management literature have highlighted the role of specific strategic and organizational variables that operate at the firm level (e.g. skills and experience) and that affect both performance and business survival (Barney, 1986 1991; Rumelt, 1991; McGahan and Porter, 1997, 2002; Mauri and Michaels, 1998; Dencker et al., 2009; Tornhill et al., 2003). From this perspective, firms are allowed to consider multiple options that can generate differentiated conducts, heterogeneous performance and dissimilar mortality rates (McGahan and Porter, 1997; Brush et al., 1999). Accordingly, knowledge and the variety of resources accumulated within the firm engender different competitive modes between different companies, even inside the same industry/technological regime (Wernerfelt, 1984; Rumelt, 1991; Teece et al., 1997). In addition, corporate strategy affects the specific types of skills and capabilities that the firm needs to acquire as well as the accumulation pattern it actually goes through. In particular, 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 strategies that lack such skills, on the contrary, are more likely to exit.

With respect to corporate strategies our focus is on the comparison of two main profiles. On the one hand, we consider firms that pursue a strategy of global engagement, whose main competitive priorities are related to investments in innovation, human capital and entry into foreign markets **(**Bridges and Guariglia, 2008, Criscuolo et al., 2010; Arrighetti et al. 2015). Being concerned with highly uncertain and complex productive endeavours, this strategic profile favours the accumulation of skills and capabilities that improve adaptability during a crisis and therefore reduce the likelihood of exit. On the other hand, we consider firms adopting a strategy of cost retrenchment, which is based on 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). Although it can strengthen profitability in the short term, such strategic profile 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 such, it therefore increases the chances of exit.

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 no cleansing operating on firms with relatively low production efficiency and small size, which on the contrary experienced a weakening of the selective pressure. With respect to corporate strategies we find that while the adoption of a global engagement strategy increases the probability of survival during the crisis compared to the pre-crisis period, a strategy of cost retrenchment (that in general tends to favour firm survival) actually reduces it. 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

Well-established streams of research in the economic literature argue that profit is the main driver of firm survival (Schumpeter, 1934, 1939; Nelson and Winter, 1982; Jovanovic, 1982; Hopenhayn, 1992; Melitz, 2003; Asplund and Nocke, 2006; Melitz and Ottaviano, 2008). However, most of the scientific and policy debates concentrate on productivity. The reason for this is twofold. First of all, while formal models usually stick to the assumption of a profit-survival link, productivity is often assumed as the unique idiosyncratic factor that entirely mediates such a link, 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). In presence of significant economic downturns, these findings imply that relatively small firms showing significant productivity gaps are the best candidate to be selected, corroborating the hypothesis that crisis will ultimately "clean" the system of the least efficient producers.

The existence of a direct productivity-survival link, however, is in many respects flawed. Foster et al. (2008) point out that productivity is only one of several possible idiosyncratic factors that determine profits, a key alternative being demand idiosyncrasies. Whenever the latter are sufficiently large, firms may survive even if they present significant productivity gaps (Landini, 2016). 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 is in the ultimate instance evidence in support of selection based on profit, not necessarily productivity (Foster et al., 2008).

Alongside productivity, small size is also considered a trait that increases the chances of being selected during downturns. The "liability of smallness hypothesis", for instance, suggests that affluence in resources does not only extend the time firms can initially survive but serves also as a buffer against misfortunes at any time (Bruderl and Schussler, 1990). It follows that small firms, which usually have access to less resources (e.g. they have a disadvantage in raising capital and are in a worse position to compete for qualified labour), are more likely to exit during recessions. This argument is also consistent with the idea that small firms are often young and may thus lack the time to achieve their production frontier via learning-by-doing. This makes them much more fragile and likely to die when a negative shock hit the economy.

However, during a recession the relationship between productivity and size on the one hand and survival on the other is likely to weaken for a number of reasons. First of all, as suggested by Landini (2016), the rising competitive pressure that follows a drop in aggregate demand may strengthen the role of demand idiosyncrasies, and the related competitive rents, as determinants of firm exit rather than productivity, especially for small firms located toward the lower end of the productivity distribution. Secondly, as shown by Fukuda and Nakamura (2011), recessions are associated with rising uncertainty concerning the actual evaluation of credit merit, which leads to a tightening of financial constraints that is often independent from firm-level productivity. Thirdly, and related to the previous point, in presence of stricter credit constraints, the use of internal financial resources may positively affect a firm's chance of survival and the former can sometimes be higher in firms that postponed productivity and growth-enhancing investments and/or adopt cautious investment conducts (Ericson and Pakes, 1995; Fernandes and Paunov, 2012).

For all these reasons, the first hypothesis that we put forward is the following:

Hypothesis 1: During economic downturns the negative relationship between, on one hand, productivity and size and, on the other hand, firm exit is weaker than during upturns.

Rather than productivity and size, we propose that the main driver of firm selection during recessions is related to the internal capabilities of firms to withstand and simultaneously react to uncertainty shocks. Bloom (2014), for instance, provides wide empirical evidence that uncertainty appears to rise sharply during recessions. Similarly, Stock and Watson (2012) state that uncertainty

shocks, when combined with financial frictions, are at the origin of the drop in output and employment during the Great Recession. The most important implication of this evidence is that during downturns not only firms are exposed to greater financial constraints (Duygan-Bump et al., 2015), but they also have to undertake strategic choices and investment decisions which are riskier and more difficult to prioritize (Latham and Braun, 2011). Consequently, in order to survive, a firm must be able to both efficiently combine inputs and cope with such uncertainty.

Following a capabilities-based perspective, such ability is crucially related to internal skills and resources that allow the firm to reduce the risk of exit, multiplying economic opportunities, increasing flexibility and improving the ability to select operational projects (Sapienza et al., 2006; Landini et al. 2019). Along these lines, Sirmon et al. (2007) stress the importance of knowledge-based resources as valuable assets that help dealing with uncertain environments. Similarly, Zahra and George (2002) focus on organizational learning as a key process that increases firms "strategic flexibility and the degrees of freedom to adapt and evolve". The accumulation of these skills and resources can ultimately be considered a function of the strategic profile adopted by the firm (Ben-Menahem et al, 2013).

Strategic profiles (see definition above) affect the accumulation of skills and resources through the set of competitive priorities that the firm decides to pursue. Different priorities imply different types of skills and resources that need to be accumulated in order to achieve them. On this respect, Maidique and Patch (1982) argue that firms differ in terms of competitive priorities and thus strategic profiles: some firms may focus on innovation and technological developments as key tools to stay ahead of competitors (first movers strategic profile), while others may put greater emphasis on cost reduction and improvement of operating efficiency (low-cost producer competitive strategy). Other intermediate strategic profiles may exist as well, which refer to companies in a transition phase or with less focused and univocal competitive priorities (Insch and Steensma, 2006). Each of these strategic profiles needs a differentiated set of skills and resources.

During an economic recession, strategies and related skills/resources that affect the firm's ability to cope with uncertainty and rising complexity are likely to have significant impact on the probability of survival. On this respect it is possible to compare two main orientations. On one hand, a firm's competitive priority may be focused on the supply of innovative products within a global market. This 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 need for high 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 accumulate skills and resources that strengthen their

reactiveness and flexibility to external events (Aw et al., 2011; Criscuolo, Haskel, and Slaughter, 2005; Ma, Yiu and Zhou, 2014; Gunday et al., 2011; Kuratko and Hodgetts, 1998), such as unexpected demand changes (Hayes and Pisano, 1996; Volberda, 1999; Scranton, 2006; Koren, 2010; Archibugi, Filippetti and Frenz, 2013), improve their efficiency (Harris and Moffat, 2011), and shield them from financial constraints so as to improve their performance and survival likelihood (Bridges and Guariglia 2008). The positive impact of such a strategy on firm's long-term economic performance is described in Tubb (2007) and Dugal and Morbey (1995). Therefore, we expect such strategy to be associated with the accumulation of skills to deal with economic complexity (high skills), leading to lower exit rates during recessions. In other words, we put forward the following hypothesis:

Hypothesis 2: During economic downturns firms adopting a global engagement strategy (high skills) are more likely to survive compared to upturns.

On the other hand, a firm' competitive priority may be focused on the reduction of costs, even to the detriment of the quality of output. This strategy involves retrenchment activities such as cost cutting, asset sales, and employee lay-offs at the expense of repositioning (Ghemawat 2009). Firms pursuing retrenchment/costs cutting strategies focus on the most profitable and certain product lines often followed by downsizing, waiver of fixed capital investments and containment of the quality and cost of labour (DeDee and Vorhies, 1998; Helper et al., 2012; Arrighetti and Traù, 2013). Such strategy can be effective in rising profitability in the short term, thus favouring survival during economic upturns. However, it is often correlated with the accumulation of skills and resources that are of little use in dealing with complex and unexpected events. Rather, they relate to the accomplishment of marginal improvements upon what the firm is already accustomed to do. In this sense, during the recession, firms adopting such strategy may lack the required degree of adaptability and reactivity, which limits their ability to seize the available market opportunities (low skills). As a result, exit is more likely to occur. On this basis we put forward the following hypothesis:

Hypothesis 3: During economic downturns firms adopting a low-cost strategy (low skills) are less likely to survive compared to upturns.

3 Data and methodology

3.1 Data and variables

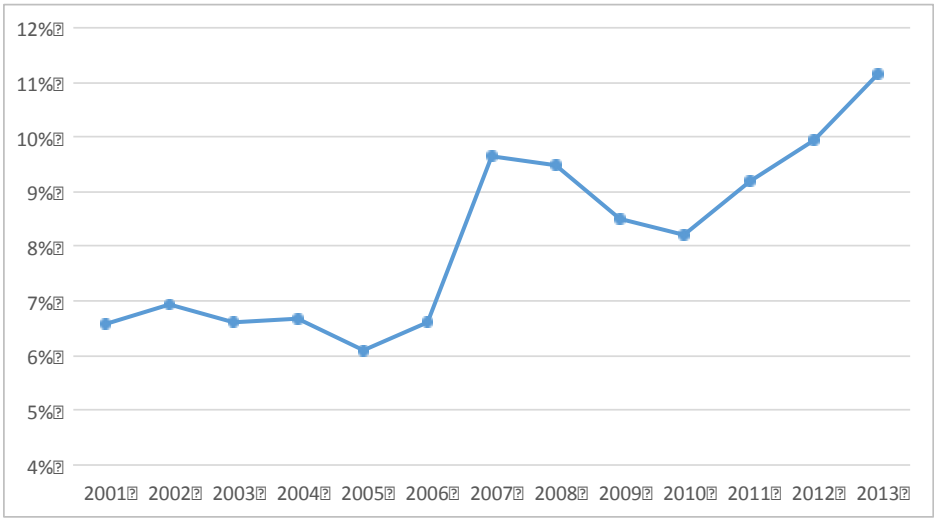
Our main data source is represented by the Panel data on the balance sheets of corporations with employees (ISTAT), an integrated data source providing demographic and economic information on the population of Italian limited companies during the period 2001-2014. The dataset also contains annual information 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 193 thousand manufacturing firms during a 13-year time span[1] (more than one million three hundred thousand observations), which encompasses the recent economic downturn.

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 firms' 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. 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[2], 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 estimates of the firm exit rate using our data. 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 rise some years before the official breakup of the global financial crisis, which signals that some selection process among Italian manufacturing firms took place in advance with respect to the recession.

[1] We do not consider the last year of the original panel due to the lack of full information about closure events.
[2] 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."

Figure 1 – Evolution of firm exit rate, 2001-2013



Note: in every year the exit rate is computed as the share of firms that exit the market over the total of firms that remain active.

Regarding explanatory variables, our main focus is on factors that directly relates to the cleansing hypothesis, i.e. production efficiency and size, as well as corporate strategies. With respect to the former we measure production efficiency in terms of value added per employee (i.e. labour productivity) and size as the total number of employees. To test for (the lack of) 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 (*LABPROD25*); 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 our hypothesis is that the impact of such variables on the probability of firm exit gets weaker (rather than stronger) during the recession.

For strategic profiles and the related skills, we have not access to detailed information about firms' strategic planning and orientation and, thus, we must rely on alternative proxies in order to capture how different corporate strategies translate into observable firm-level characteristics. In particular, we focus on three main 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 goods; "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. This latter dimension reflects a firm's continuous exposure to international competition and, thus, its ability to 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 but are inclined to accumulate those skills that are inadequate to deal with rising complexity in the business environment. 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 relatively complex operations and should therefore be well-accustomed to deal with environmental jolts.

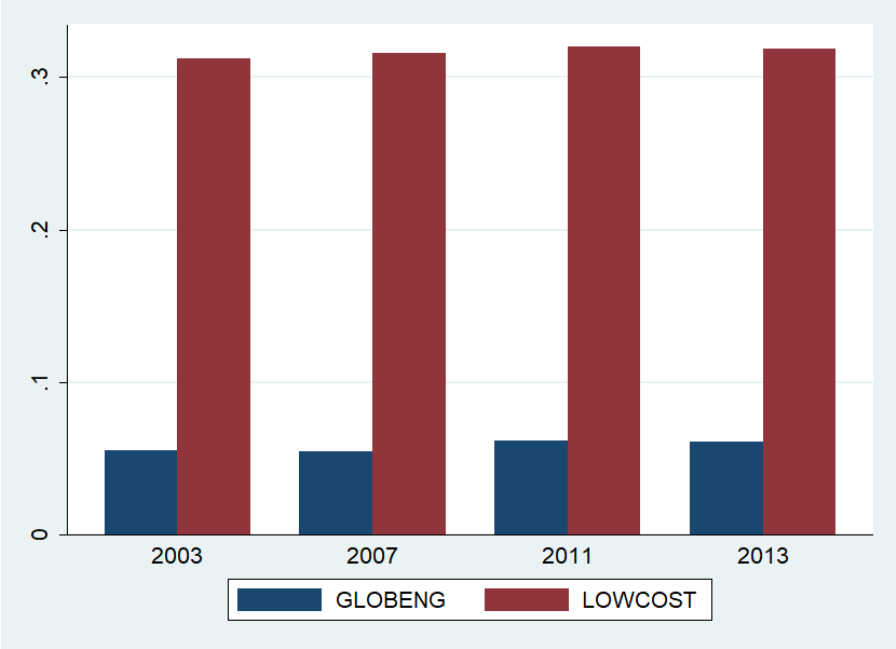
We consider in our analysis also a set of control variables that should be correlated with firm exit. The latter include demographic and performance variables, such as firm *AGE* (in years) and operating profitability (*PROFIT*). In this respect, an extensive literature suggests that both variables should have a positive effect on firm survival (Dunne et al., 1988; Audretsch, 1991; Agarwal and Gort, 1996, 2002; Sutton, 1997; Landini, 2016). 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, Figure 2 shows the distribution of firms across strategic profiles. Nearly one third of firms are classified as *LOWCOST*, while between 5% and 6% of firms are *GLOBENG*. The first interesting aspect is the stability of the distribution across time, which suggests that our classifications indeed capture structural characteristics of the underlying population. Moreover, it is

interesting to notice that the share of firms characterized by a global engagement strategy, although small, is not trivial. This evidence confirms that in order to engage in this type of strategy firms must have a competence-endowment that is relatively uncommon in most firms. Indeed, the larger share of firms in the sample is classified neither as *GLOBENG*, nor as *LOWCOST*. This evidence confirms previous findings about the lack of a clear strategic orientation for a large portion of firms within the Italian manufacturing sector (Landini et al., 2017).

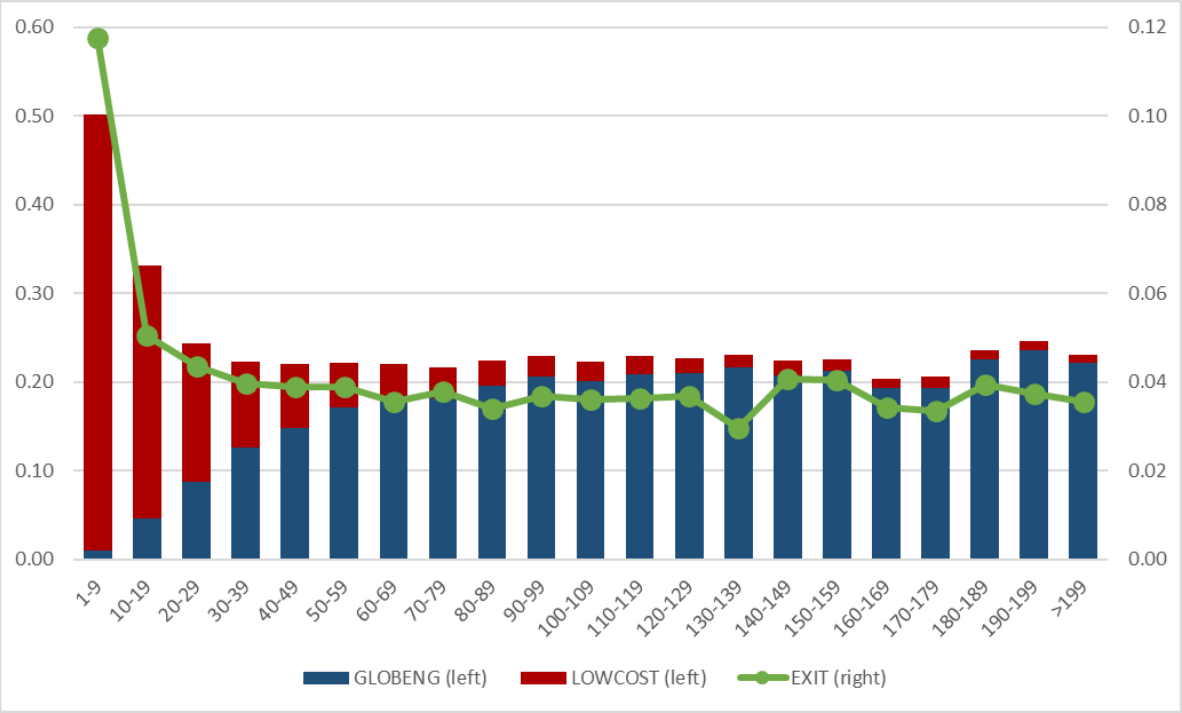
Figure 2 - Distribution of firms across strategic profiles: comparison across time



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 distribution. Indeed, in most markets the largest part of firm selection takes place among relatively small firms. 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. Figure 3 shows the average distribution of strategic profiles (left axis) and exit rates (right axis) across different firm size classes (size classes are defined on the basis of the number of employee). As we can see in the smallest size class (between 1 and 9 employees), where we observe the highest exit rate, most firms exhibit a *LOWCOST* strategy. Nevertheless, the share of firms classified as *GLOBENG* is not 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 3 - 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.

Finally, Table 1 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 of 24 years, whereas *LOWCOST*-firms are significantly younger (10.7 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 1 - 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	24.044	14.088	10.711	10.544	17.743	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	***

Note: *=sig. 10%, **=sig. 5%, ***=sig. 1%.

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:

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

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

We plot in Figure 4 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.

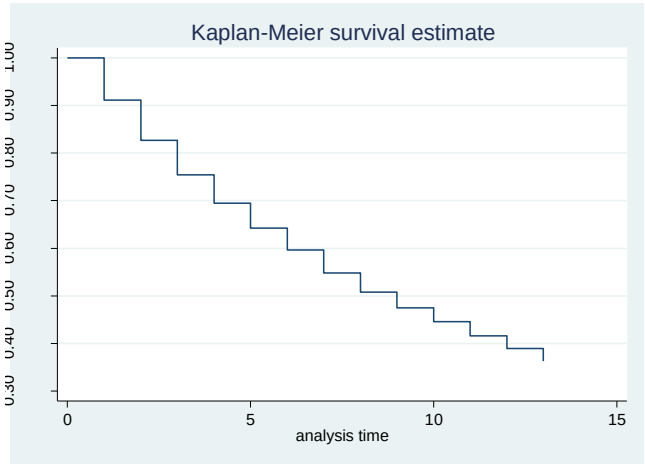
For any K-M plot, the horizontal axis represents the time variable expressed in years. All firms start at the top of the vertical axis, which indicates the proportion that has not experienced an exit event. The Kaplan-Meier curve is not a smooth function, but is characterized by a one direction step-like 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 tool to compare survival functions among groups of firms. Groups here are identified considering those firm specific characteristics which are intended to capture the cleansing effect and firms' strategic profiles. 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%, 32 p.p. higher than their counterpart, while in terms of firm size (small vs. large firms) the expected gap is equal to 35 p.p.

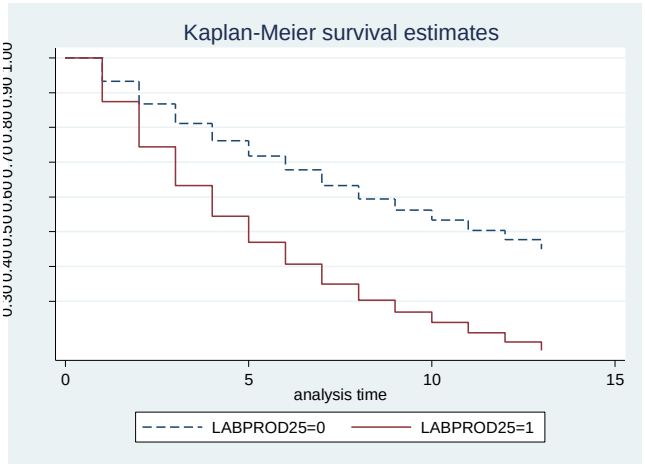
In terms of strategic profiles K-M estimates indicate that by the end of the period under investigation the probability to survive for a *GLOBENG* firm is about 42 p.p. higher than a *LOWCOST* firm (64% vs 22%). At the end of 2007 the estimated probability to survive were, respectively, of 78% and 62%, thus signaling that the probability gap is expected to increase over time.

Figure 4 - Survival functions

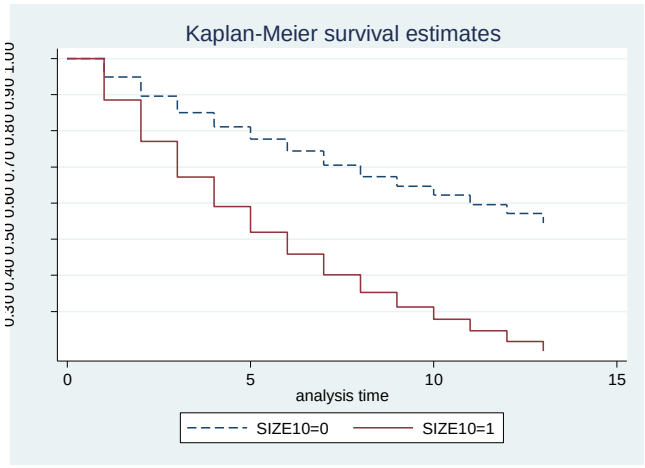
(a) Full sample



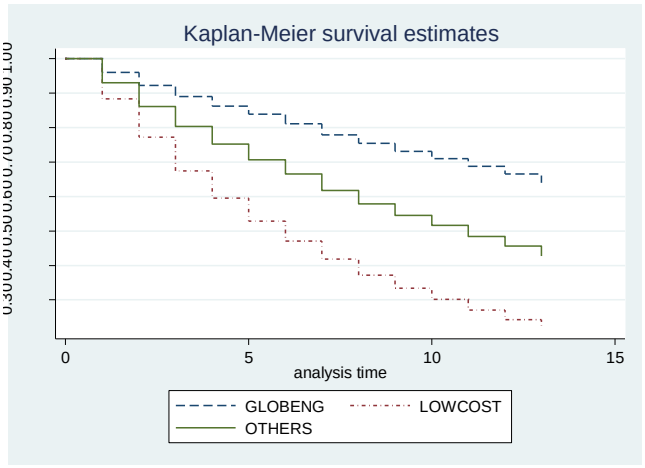
(b) by productivity level



(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 2 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 2 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, and this is true especially for those models that are relevant for testing our *Hypothesis 1*. 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 2 - Log-logistic proportional hazard estimates - baseline model

Variable	**Without IUH**	**With IUH**			
		Gamma RE	**Normal RE**		
	All	**All** [2]	**All** [3]	**<50 Empl[a]** [4]	**<20 Empl[a]** [5]
d0813	1.463***	1.521***	1.534***	1.558***	1.588***
	[0.0142]	[0.0165]	[0.0174]	[0.0181]	[0.0192]
AGE	0.872***	0.865***	0.857***	0.853***	0.851***
	[0.00489]	[0.00549]	[0.00576]	[0.00605]	[0.00643]
PROFIT	0.995***	0.995***	0.995***	0.995***	0.996***
	[0.000217]	[0.000243]	[0.000249]	[0.000257]	[0.000268]
LEV	1.011***	1.013***	1.014***	1.014***	1.013***
	[0.000178]	[0.000220]	[0.000236]	[0.000245]	[0.000256]
LDEBT	0.988***	0.987***	0.987***	0.987***	0.987***
	[0.000264]	[0.000297]	[0.000310]	[0.000323]	[0.000339]
IR	1.061***	1.067***	1.069***	1.067***	1.065***
	[0.00147]	[0.00172]	[0.00179]	[0.00186]	[0.00192]
LABPROD25	2.409***	2.575***	2.628***	2.598***	2.445***
	[0.0219]	[0.0258]	[0.0277]	[0.0281]	[0.0277]
SIZE10	1.593***	1.776***	1.851***	1.914***	1.914***
	[0.0141]	[0.0194]	[0.0226]	[0.0244]	[0.0257]
GLOBENG	0.828***	0.809***	0.797***	0.749***	0.759***
	[0.0208]	[0.0213]	[0.0216]	[0.0248]	[0.0340]
LOWCOST	0.939***	0.959***	0.968***	0.979*	0.988
	[0.00861]	[0.00982]	[0.0103]	[0.0106]	[0.0110]
ML-TECH	0.865***	0.851***	0.845***	0.839***	0.834***
	[0.00824]	[0.00950]	[0.00994]	[0.0103]	[0.0107]
MH-TECH	0.884***	0.870***	0.866***	0.862***	0.877***
	[0.00899]	[0.0103]	[0.0108]	[0.0113]	[0.0120]
H-TECH	1.242***	1.295***	1.310***	1.306***	1.284***
	[0.0232]	[0.0288]	[0.0306]	[0.0324]	[0.0334]

NEAST	0.969***	0.962***	0.960***	0.966**	0.963**
	[0.0105]	[0.0120]	[0.0126]	[0.0134]	[0.0143]
CENTRE	1.070***	1.082***	1.090***	1.106***	1.127***
	[0.0121]	[0.0144]	[0.0152]	[0.0161]	[0.0172]
SOUTH	1.341***	1.416***	1.450***	1.485***	1.491***
	[0.0147]	[0.0187]	[0.0205]	[0.0219]	[0.0229]
constant	0.000459***	0.000328***	0.0000456***	0.0170***	0.0169***
	[0.0000]	[0.0000]	[0.0000]	[0.000780]	[0.000845]
Obs	1,017,318	1,017,318	1,017,318	913,744	724,452
n. of firms	162,446	162,446	162,446	149,972	126,031
Log Likelihood	-220,453.0	-219,699.4	-220,088.3	-204,364.9	-174,787.0
Test for unobserved individual heterogeneity	-	LR test of gamma var.=0: chibar2(01) = 1507.19 Prob >= chibar2 = 0.000	LR test of rho=0: chibar2(01) = 729.39 Prob >= chibar2 = 0.000	LR test of rho=0: chibar2(01) = 734.65 Prob >= chibar2 = 0.000	LR test of rho=0: chibar2(01) = 487.60 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

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 2 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 probability for a unit change in that variable, while for a dummy variable, it is the difference in the probability between firms with the characteristic described by the dummy variable and the rest of the population.

Estimates for the whole sample show that firms that belong to the first quartile of the productivity distribution (*LABPROD25*) have 2.6 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 85% and the impact is higher if we move to the sub-samples of small firms.

At the same time, the adoption of a *GLOBENG* strategy reduces the probability of exit by 20% in the whole sample, with an even higher impact which ranges between -25% and -24% 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 (- 3%). This effect is, however, weakly significant for smaller firms.

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 52-53%. The magnitude of this effect becomes even stronger when we move to the subsample of smaller 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. The results related to the finance indicators are somewhat more nuanced, with *LEV* and *IR* that rise the probability of exit by 1.4% and 6.9% 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 intermediate 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 focus variables, there are two main results that should be highlighted. The first one is that the existence of productivity and size gaps tends to have very strong negative impact on the chances of survival. At a first level of analysis this result is in line with the cleansing hypothesis, although what really matters for the latter to hold is if and how such average effects are strengthened during the recession. Secondly, 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 (although for the low cost strategy such positive effect tends to vanish when we consider only small firms). In this case two, however, what matters for the test of our hypotheses is whether or not this average effect holds also during the recession.

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 2 with the crisis dummy (*d0813*) (Table 3). 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. The non-interacted variables, which are also included in our specification, must be interpreted as the contribution to the exiting probability in the pre-recession period.

Table 3 - 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	1.482***		1.565***		1.612***	
	[0.0689]		[0.0754]		[0.0824]	
AGE	0.890***	0.917***	0.890***	0.913***	0.886***	0.920***
	[0.00760]	[0.0102]	[0.00797]	[0.0105]	[0.00846]	[0.0112]
PROFIT	0.995***	1.001*	0.995***	1.001*	0.995***	1,001
	[0.000383]	[0.000501]	[0.000394]	[0.000515]	[0.000412]	[0.000538]
LEV	1.013***	1,001	1.013***	[0.000351]	1.012***	1,001
	[0.000339]	[0.000409]	[0.000351]	1,001	[0.000371]	[0.000448]
LDEBT	0.980***	1.011***	0.980***	1.012***	0.980***	1.011***
	[0.000486]	[0.000609]	[0.000508]	[0.000633]	[0.000541]	[0.000672]
IR	1.060***	1.013***	1.059***	1.013***	1.058***	1.010***
	[0.00258]	[0.00325]	[0.00267]	[0.00336]	[0.00278]	[0.00348]
LABPROD25	2.911***	0.846***	2.882***	0.843***	2.685***	0.856***
	[0.0451]	[0.0166]	[0.0460]	[0.0169]	[0.0452]	[0.0180]
SIZE10	1.789***	1.073***	1.873***	1.044**	1.920***	0.994
	[0.0289]	[0.0205]	[0.0315]	[0.0207]	[0.0353]	[0.0218]
GLOBENG	0.905**	0.809***	0.857***	0.803***	0.891*	0.769***
	[0.0364]	[0.0424]	[0.0427]	[0.0517]	[0.0605]	[0.0674]
LOWCOST	0.920***	1.090***	0.936***	1.076***	0.953***	1.058***
	[0.0145]	[0.0220]	[0.0150]	[0.0221]	[0.0160]	[0.0225]
ML-TECH	0.844***		0.839***		0.834***	
	[0.01000]		[0.0103]		[0.0107]	
MH-TECH	0.865***		0.862***		0.878***	
	[0.0109]		[0.0113]		[0.0120]	
H-TECH	1.311***		1.305***		1.280***	
	[0.0308]		[0.0324]		[0.0332]	
NEAST	0.961***		0.967**		0.965**	
	[0.0127]		[0.0135]		[0.0143]	
CENTRE	1.091***		1.106***		1.127***	

	[0.0154]	[0.0162]	[0.0172]
SOUTH	1.454***	1.486***	1.490***
	[0.0207]	[0.0220]	[0.0229]
constant	0.0201***	0.0185***	0.0181***
	[0.00102]	[0.000988]	[0.00105]
Obs	1,017,318	913,744	724,452
n. of firms	162,446	149,972	126,031
Log Likelihood	-219.803	-204.091	-174.561
Test for unobserved individual heterogeneity	LR test of rho=0: chibar2(01) = 712.36 Prob >= chibar2 = 0.000	LR test of rho=0: chibar2(01) = 695.43 Prob >= chibar2 = 0.000	LR test of rho=0: chibar2(01) = 447.66 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

In line with *Hypothesis 1* we find that the selective pressure over less efficient firms weakens during the recession. In fact, the coefficient associated with the interaction of *LABPROD25* with the crisis dummy (*d0813*) is smaller than one and highly significant even in the subsamples of small firms. With respect to small size the result is somewhat more nuanced. Being a micro-enterprise (*SIZE10*) positively affects the probability of exiting before the downturn (+79%), and the impact turns out to increase during the downturn: +7.3% in the overall sample and +4.4% in the subsample of firms with less than 50 employees. No significant effect, however, is associated with the interaction of *SIZE10* and *d0813* in the subsample of firm with less than 20 employees. 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 small firms.

When we move to consider the role of corporate strategies, we find strong support for our research hypotheses. In line with *Hypothesis 2* being a *GLOBENG* firm significantly reduces the probability of exiting the market during the crisis compared to the pre-crisis period. In particular, our estimates suggest that firms adopting a global engagement strategy, which already enjoy a survival premium in the years preceding the recession (+10% compared to the reference group in the whole sample), have a probability to exit during the crisis that is almost 20% lower than in the pre-crisis period. This effect becomes even stronger (-23%) when we consider the subsample of firms with less than 20 employees. This suggests that *GLOBENG*-firms have the skills necessary to face the disruptive changes brought about by the recession, resulting in an extremely positive survival performance.

With respect to *LOWCOST*-firms we find that, in line with *Hypothesis 3*, firms adopting such

strategic profile are more likely to exit during the recession. The interacted coefficient indicates a probability to exit that is 9% higher during the crisis than in the pre-crisis period although the magnitude of this effect slightly reduces when we move from the whole sample to the subsample of firms with less than 20 employees. It is interesting to notice that, in line with the results of the baseline model, during the pre-crisis period firms having a low-cost strategy enjoy a survival premium (+8%) with respect to the reference group. This suggests that during standard phases of the business cycles there is a well-grounded economic rationale behind the adoption of such corporate strategy. The problem emerges when the economy is hit by a recession, as *LOWCOST*-firms lack the skills and resources that are necessary to deal with the rising complexity of the business environment.

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.

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 that, while the adoption of a global engagement strategy that requires high skills increases the probability of survival, a strategy of cost retrenchment, which in general favour firm survival, tends to reduce it during a downturn. 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 implication 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 name	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
LABPROD25	0/1	1 if in the lower labour productivity quartile (the sectoral first quartile)	0.25	0.43	0.25	0.43	0.25	0.43
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

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