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Are exporters and multinational firms more resilient over a crisis? First evidence for manufacturing enterprises in Italy

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Abstract

The 2008 crisis has called to further investigate the impact of global engagement on firm performance. We focus on the link between Italian firms' involvement in international activities and their heterogenous performance in terms of survival in the context of the recent crisis. This topic has been investigated in the literature comparing foreign and domestic firms, neglecting the behaviour of exporters and of domestic multinationals (DMNEs). Our paper tries to fill this void checking for the impact on firm survival of three different forms of firms global engagement: exporting, investing abroad and being a foreign affiliate. We examine firm failure in Italy before the recent crisis (2002-2007) and after it (2008-2010) using an original database, obtained by matching and merging three firm level datasets: Capitalia, AIDA and Mint-Italy for the period 2002-2010. We estimate a conditional Probit of exit of firms according to their global activities, controlling for a wide range of other relevant firm and industry specific variables (size, age, productivity, financial status). In our results, multinationals appear more volatile, while exporting firms experience reduced exit probabilities. Our results do not support the hypothesis of a stabilising role of multinationals, in line with other studies (Varum and Rocha, 2011; Alvarez and Görg, 2011; Godart et al., 2011). Age, productivity, financial health are also important to understand the firm-level impact of the crisis.

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1. Introduction

The specific contribution of this paper is to investigate whether in the context of the recent international crisis Italian firms engaged in global markets by exports and foreign direct investment (FDI) exhibited different survival performance with respect to firms not involved in these activities.

The analysis of the determinants of firm survival and growth has long been a key topic of research in different fields of economics. The specific impact that participation into foreign markets, both through exports and FDI, has on firm survival is at the core of a recent but already large literature (see the reviews by Greenaway *et al.*, 2008, and by Wagner, 2011 and 2012). However, much more restricted is the literature which has investigated how global engagement influences firm performances in the specific context of an economic slowdown. The existing contributions only focused on the role that foreign multinationals (FMNEs) play in an economic crisis, expecially within the Asian financial crisis (McAleese and Counahan 1979; Desai *et al.* 2004 and 2008), or in past country specific slowdowns such as in Chile at the end of the 1990s (Alvarez and Görg 2011) and in Portugal in the early 1990s and 2000s (Varum and Rocha 2011). Three recent papers have also answered the same question for the recent global crisis, in a cross national framework (Tong and Wei 2010; Alfaro and Chen 2011) and at national level (Godart *et al.* 2011 for Ireland). However, an overlooked issue in this literature is the behaviour of exporters and domestic multinationals (DMNEs) in a crisis context.

The main contribution of our paper is to enrich the existing literature focusing on exit of Italian firms within the context of the recent international crisis using three different measures of global engagement (being exporters, domestic or foreign multinational enterprises). More specifically, we wish to test whether, once controlling for several determinants of firm exit, there is a specific impact of different forms of global engagement over the crisis.

A second contribution of our study is to the rising firm level literature on the impact of the international crisis on firms' performance in Italy, one of the EU countries most affected by the 2008 global crisis.[1]

We build an original database by matching and merging three firm-level datasets: Capitalia, AIDA and Mint-Italy. The dataset we obtain in this way contains a wide set of firms' level microdata and allows a longitudinal analysis over a long time span (2002-2010). The peculiarities of firm behaviour are investigated both in aggregate, by statistical comparisons, and in more detail, by an econometric testing, exploring firm heterogeneities within single firm characteristics, controlling for many different firm and industry level variables.

To preview the most important results, we find different characteristics for surviving and exiting firms before and after the crisis shock. More specifically, our results show that during the crisis exporters perform much better than non exporters, while DMNEs and FMNEs show a pattern not significantly different with respect to national firms. The analysis supports conclusions about the importance of a positive "exporting effect", and conversely the lack of a positive "multinationality effect" *per se* in the framework of adverse economic conditions.

The paper is structured as follows. In section 2 we lay out the theoretical background and the research hypotheses. In section 3 we sketch out the dataset construction, the variables used and some descriptive statistics. Finally, in section 4, the econometric methodology and our results are presented.

2. Globally engaged firms and survival during an economic slowdown: a brief survey

In the recent literature on firm survival, export activities and international production are the most debated factors. However, despite there is now a growing theoretical and empirical literature on the relationship between firm global activities and firm performance (Görg and Strobl 2003; Kimura and Fujii 2003; Bernard and Sjöholm 2003; Ozler and Taymaz 2007; Esteve Pérez *et al.* 2004; Alvarez and Görg 2009; Ferragina *et al.* 2010 and 2011; Wagner 2011 and 2012) there are still few investigations on how these relationships work during an economic slowdown.

[1] Within this literature, no study has explored and compared so far the effects of different forms of internationalisation on Italian firms performance.So far, the empirical evidence on the performance of Italian firms over the recent crisis has dealt with the role of firm efficiency (Monducci *et al*, 2010), the impact of product and process innovation (Antonioli *et al.*, 2011) and the mechanisms of firm labour cost adjustment processes (Cingano *et al*. 2010; Fabiani and Sabbatini 2011). Evidence on the role of global engagement is only provided by Bugamelli *et al.* (2009) which explored the impact of export intensity on firm sales.

Why should we expect that globally engaged firms behave differently in the context of an economic crisis? In the following we sketch out some theoretical arguments to answer this question.

a) To be exporter during an economic slowdown

Following the *New-New Trade Theory* exporting firms are more productive, have higher technological, managerial and human capabilities and, therefore, have higher capacity to face adverse external conditions (Melitz, 2003). Besides, exporting can be considered a form of risk diversification through spread of sales over different markets with different business cycle conditions or in a different phase of the product cycle. Therefore, exports might provide a chance to substitute sales at home by sales abroad when a negative demand shock hits the home market. Besides, exporters should exhibit better financial health and less bankruptcy risk than non exporters. Therefore, as a result of higher financial stability they should also face less liquidity constraints (Bridges and Guariglia 2008; Greenaway *et al.* 2007). However, there are also reasons to expect exporters to be more vulnerable to the negative effects of an economic crisis, especially if this is global and does not allow to take advantage of different market conditions. For instance, exporters might be especially affected by higher sunk costs and be more concentrated on economies of scale and as such less flexible in adapting to an economic downturn. Furthermore, due to their scale of operation they might be more reliant on credit and bank lending and if perceived as more exposed to international risk conditions they might be paying higher interest rates. As a result the predictions are ambiguous: exporting firms might be more able to sustain their survival and employment level and counteract the negative effects of a crisis, helping to stabilize the economy, but on the contrary they might also be more vulnerable. The empirical evidence on these matters is still scarce. Bridges and Guariglia (2008) focusing on the impact of financial constraints on firm survival, find that failure probabilities of exporting firms are less sensitive to financial variables than those of purely domestic firms. This would confirm the hypothesis that global engagement help mitigating financing constraints. Focusing on small and medium firms, Sato (2000) and Wengel and Rodriguez (2006) reach the conclusion that exporting firms were better able to adjust to the East Asian financial crisis.

b) To be a multinational enterprise (MNE) during an economic slowdown

There are ambiguous a priori also on the way MNEs react to an economic shock. Why should we expect a more resilient behaviour from multinationals with respect to national firms? First of all, MNEs have access to both internal and international financial markets, which allows them to diversify their sources of financing and the associated risks and also allows foreign affiliates to be less dependent on host capital markets in their operations as they may obtain credit from their multinational parents. This is crucial especially under a credit tight imposed by a global financial crisis. Secondly, because MNEs enjoy less bankruptcy risk and adopt international standards in terms of product quality, they find it easier to gain access to domestic banks (Bridges and Guariglia 2008; Harrison and McMillan 2003; Colombo 2001). Thirdly, there is the argument of substantial sunk costs of investing abroad, and the strong investment in long-term relationships and accumulation of firm-specific skills in foreign markets, which may also explain why MNEs are unlikely to reply to short term changes in host country conditions (Fukao 1991; Wang *et al.* 2005). However, there are also reasons to expect MNEs to be more reactive to the negative effects of an economic crisis, and therefore, act as "unstabilising agents". First of all, having an international production network, they can move production facilities easily between different countries (the "footloose behaviour" hypothesis). Secondly, they are also less linked to the host country by means of input sourcing from local upstream firms. Besides, the local market is often less important for their sales, being multinationals generally more export intensive than domestic firms (Godart *et al.* 2011).
There is a certain amount of empirical evidence on the specific reaction of foreign firms in terms of both exit behaviour and growth patterns over a crisis. According to the role played by MNEs, these studies can be summerized into three different groups, which respectively find: 1) a stabilising role 2) a destabilising role; 3) no evidence of a (de) stabilising role (see table 1).

Table 1. **Literature on the potential impact of foreign MNEs over a crisis**

Results	References
FMNEs as "stabilizing" agents	Fukao, 2001; Athukorala, 2003; Wang *et al.* , 2005; Blalock *et al.*, 2005; Chung & Beamish, 2005; Narioko & Hill, 2007; Desai, *et al*., 2004 and 2008; Alfaro& Chen, 2011; Tong & Wei, 2010;
FMNEs as "unstabilising" agents	Flamm, 1984; Lipsey, 2001; Görg &Strobl, 2003; Alvarez &Görg, 2009
No evidence of a (de)stabilizing role of FMNEs	McAleese & Counahan, 1979; Varum & Rocha, 2011; Alvarez & Görg, 2011; Godart *et al.*, 2011;

A discrete number of studies find that MNEs exhibit a better reaction to crises than domestic firms (*stabilising role*). Many of them stress upon the financial issues. Desai *et al.* (2004) show that multinational affiliates substitute internal borrowing for costly external finance when facing adverse capital market conditions. In a more recent paper, Desai *et. al*. (2008) also find that US multinationals located in emerging markets increase operations more than domestic firms in the presence of a currency crisis and they argue that this is due to multinationals being less financially constrained than domestic firms. Blalock *et al.* (2008) show that, after the 1997 East Asian financial crisis, Indonesian exporters with foreign ownership were able to significantly increase their investment, while domestically owned exporting firms were unable to do so due to financing constraints. Focusing on the recent crisis, with data on 3,823 firms in 24 emerging countries, Tong and Wei (2010) find that exposure to FDI alleviated liquidity constraints. Fukao (2001) and Wang *et al.* (2005) emphasise the role of substantial sunk costs in investing abroad, in addition to investment in long-term relationships and accumulation of firm-specific skills, as the reasons why foreign firms are unlikely to reply to short term changes in host country conditions. Alvarez and Görg (2011) point to the same conclusion in their investigation of the response of multinational and domestic firms to an economic downturn in Chile: lower employment reductions over the economic crisis with respect to domestic firms (although they are more likely to exit). These results are in line with a recent literature which has found evidence that globally engaged firms, being less sensitive to financial constraints than purely domestic firms, get better performance (Guariglia and Mateut 2005; Blalock *et al.* 2008; Greenaway *et al*, 2007; Bridges and Guariglia 2008; Görg and Spaliara 2009). A less optimistic view on multinational behaviour over a crisis (*destabilising role* as a result of *"footloose behaviour"*) is supported by the pioneer study of Flamm (1984) where offshoring firms in US semiconductor industry are shown to introduce higher volatility because are more sensitive to the perception of risky production locations. A higher exit behaviour in multinational companies is also found: in Lipsey (2001), for US manufacturing affiliates over three financial crises in Latin America, Mexico and East Asia, in Görg and Strobl (2003), for Ireland, and in Alvarez and Görg (2009 and 2011), for Chile during the late 1990s, when these economies experienced a massive slowdown. Finally, there is a third group of studies that do not find any particular difference in the behaviour of MNEs compared to domestic firms during a slowdown. McAleese and Counahan (1979) for Ireland and Varum e Rocha (2011) for Portugal both find no significant difference in employment growth between domestic and foreign firms. Godart *et al.* (2011) find that foreign firms did not behave differently than Irish firms in terms of survival during the recent crisis.

To sum up, the empirical evidence is mixed up but broadly it supports more the hypothesis that foreign multinationals are less affected by an economic crisis and able to act as stabilizer in an economy rather than the opposite hypothesis of footloose behaviour of foreign multinationals in a crisis.

3. Data, variables and preliminary empirics

In this section we present the dataset (section 3.1), the variables specification, the theoretical *a priori* and some descriptive statistics (section 3.2).

3.1 Dataset construction

The empirical analysis has been conducted using a firm level database for the period 2002-2010 resulting from the intersection of three different sources: IXth Survey on Manufacturing Firms, by Capitalia, AIDA (Analisi Informatizzata delle Aziende) and Mint-Italy, both by Bureau Van Dyck.[2]
The Capitalia database was a survey in 3-years waves which provided micro evidence about manufacturing companies on a sample of more than 4,000 firms drawn from Italian manufacturing. The samples were stratified and randomly selected (it reflected sector's geographical and dimensional distribution of Italian firms) for firms with 11 to 50 employees and by census for firms with more than 50 employees.[3] We use the IXth Capitalia survey, i.e. the wave 2001-2003 of the survey which has been run in 2004 through questionnaires distributed to a sample of 4289 firms with more than 10 employees. In order to catch the crisis years and to have a long panel we build a *catch-up* panel, where the Capitalia dataset units of analysis are located in the present by subsequent observations drawn from another dataset, AIDA, which collects annual accounts of Italian corporate enterprises and contains information on a wide set of economic and financial variables, such as sales, costs and number of employees, value added, fixed tangible assets, start-up year, leverage, indebtedness, as well as legal and ownership status.[4] By matching all firms in the 2001-2003 Capitalia dataset with AIDA information we have obtained a longitudinal sample of 4066 firms for 2002-2010 (that is 94,8 per cent of the Capitalia sample, which includes 4289 firms)[5] .
Variables about internationalization activity of firms are drawn from AIDA, Capitalia and Mint-Italy. In particular, using the ownership status variable in AIDA, we define *domestic multinationals* (DMNEs) as non foreign-owned firms with a share of direct ownership greater/equal to 10 percent in firms located in countries other than Italy; *foreign multinationals* (FMNEs) are defined as Italian firms whose ultimate beneficial owner is foreign. Information related to the export activity of the firms is drawn from a merge between Capitalia and Mint-Italy. This latter is a firm level database of Italian companies, banks and insurance companies with variables on export and import activities. More specifically, the merge between Capitalia and Mint-Italy allowed us to identify the firms in the sample that were exporters over the entire period 2002-2010.
We consider as exited firms whose legal status is failure, liquidation, inactivity. We further control firm status by also considering AIDA information on the type of procedure a firm is undergoing.[6] By using this detailed information on exit, we avoid to a great extent the problem of "the catch-all meaning of the exit events recorded in business registries" (Bottazzi *et al.* 2011) i.e. the fact that these events are often associated with a simple relabelling of the economic subject, following changes of ownership, incorporations, change of sector or province. We do not consider as exited firms which change denomination due to a process of Merger and Acquisition or to change of location or sector, hence we catch the "true exit", which might still correspond to both negative (bankruptcy) and positive (voluntary liquidation) outcomes.[7]

3.2 Variables specification, expected signs and descriptive statistics

Following the literature on the determinants of firm survival, in this section we describe the specification and the expected sign for the set of variables which we use in our empirical analysis (more details are shown in table 2).

[2] The firm level dataset AIDA is supplied at the University of Salerno by the commercial data provider Bureau Van Dyck, while access to the Bureau Van Dyck Mint-Italy dataset and to the Capitalia 2001-2003 database were given confidentially and exceptionally to the authors. Questions related to how access the firm level data used can be forwarded to the authors.
[3] The following selection bias of the Capitalia dataset must be taken into account. More than 90 percent of observed small firms (below 50 employees) are "società di capitali" (entrepreneurs have limited liability) while in the universe of Italian small firms this share is much lower and unlimited liability is widespread. When interpreting empirical results we must therefore consider that we are analysing the subset of Italian small and medium sized firms with the most advanced form of corporate governance, a potential selection bias.
4 AIDA data set reports the unconsolidated balance sheets of corporate firms with a value added of more than 800.000 euro.
[5] Firms which did not have complete records on some of the variables fundamental for our analysis were dropped, Moreover, the dataset was carefully cleaned excluding firms with abnormal values.
[6] Failure, Voluntary liquidation, Administrative/juridic. Liquidation, Liquidation, Extraordinary administration, Cancellation from business registry, Closing due to failure/liquidation, Insolvency, End of activity, Closure agreement.
[7] However, liquidation and bankruptcy represent the most common legal status we observe. Therefore, we can say that our main focus is on the firms' death as a consequence of firm business failure, not voluntary exit.

Table 2. Definition of variables, data sources and expected relationships with firm exit

Category	Variables	Description	Source	Exp. sign
Firm structure and perform-ance variables	SIZE	Firm size measured by the number of employees.	Aida	-
	AGE	Firm age measured by the number of years since establishment.	Aida	-
	PROD	Firm productivity measurerd by value added per employee	Aida	-
Financial variables	PROFIT	Firm profit before tax over turnover (%)	Aida	-
	SOLVENCY	Company's post-tax net profit and depreciation divided by the quantity of long-term and short-term liabilities (%)	Aida	-
	COLLATERAL	Firm ratio of its tangible assets to its total assets (%,)	Aida	-
	DEBTS WITH BANKS OVER TURNOVER	Firm short and long term debts with banks over turnover (%)	Aida	+/-
Internationalisation Variables	INWFDI	Foreign ownership dummy that takes on the value 1 if the firm is foreign-owned, 0 otherwise	Aida	+/-
	OUTFDI	Domestic multinational ownership dummy that takes on the value 1 if the firm is an Italian owned-MNE, 0 otherwise.	Aida	+/-
	EXPORT	Dummy variable equal to 1 if the firm exports over the entire period	Mint-Italy	+/-
	SPEC	Dummy =1 if 3 digit Ateco Lafay index of specialisation > 0 otherwise =0	OECD	-
Innova-tion vari-ables	RD	R&D intensity defined as the ratio of R&D expenditure on sales	Aida	+/-
	PAVITT	*PAVITT p-1* macrosector dummies *(p=1,..,4*) for firms belonging to Traditional, Specialised, Scale and High-Tech industries	Capitalia	+/-
Further in-dicators	LOCATION DUMMY	Dummy = 1 for firms located in Southern areas* and 0 other-wise.	Aida	
	ATECO SECTORS	2 digit Ateco 2002 classification	Istat	

In table 3 we describe the mean characteristics of firms with different types of global engagement (exporting, non exporting, foreign multinationals, domestic multinationals, purely domestic). We observe several superior characteristics of globally engaged firms with respect to non exporting firms (higher size, age, productivity and profit margin, lower collateral and indebtedness and higher solvency). Furthermore, table 3 contains the mean of our sets of variables distinguished by three groups of firms: a) firms which do not fail over the whole period (2004-2010), b) firms which exit before the crisis (2004 – 2008), c) firms which exit during the crisis (2008-2010). The test of mean differences between surviving and failing firms show that more than 50% of surviving firms are exporters, while only 14 and 2% respectively within the two groups of failed firms on average are exporters. The mean difference is significant across the three firms groups. Also the share of affiliates of foreign firms (inward FDI dummy) among the surviving firms is significantly higher that the share which fail both before the crisis and during it; as for domestic multinationals (outward FDI dummy) the share on surviving firms is significantly higher that the share on firms failing before the crisis, while it is not significantly different than the share of firms failing over the crisis. Besides, it appears that on average firms failing during the crisis are younger, smaller, with lower R&D, higher debts and lower collaterals, solvency and profits, with respect to not failing firms. Besides, firms failed over the crisis, compared with those failed before it, show a significantly higher debt with banks and a lower solvency.

Table 3. Descriptive statistics: variable means (2007)

	Exporting firms	Non exporting firms	Foreign multinationals	Domestic firms	Domestic multinationals	Surviving firms (0)	Firms exited over 2002-2008 (1)	Firms exited over 2009-10 (2)	Difference in mean test (t statistics) (0)-(1)	Difference in mean test (t statistics) (0)-(2)	Difference in mean test (t statistics) (1)-(2)
Age	29.64	27.82	28.20	28.69	33.21	28.95	25.76	26.82	2.00**	2.56***	-0.59
Size	164	118	508	126	455	147.02	30.13	96.41	1.96**	2.05**	-2.05
Productivity	84151	60180	192796	67396	152742	62744	14517	42188	7.25***	6.37***	-4.12***
Profit margin	3.24	1.47	3.64	2.29	5.65	3.99	2.98	-16.04	0.19	8.87***	1.04
Collateral	0.76	0.75	0.67	0.76	0.51	0.76	0.75	0.71	0.34	3.84***	0.88
Debts with banks over turnover	22.56	23.54	6.90	23.71	22.69	22.11	15.44	35.39	1.73**	-9.49***	-4.11***
Solvency ratio	28.80	28.21	29.83	28.45	33.39	29.60	29.06	15.77	0.14	2.58***	11.24***
Export dummy	-	-	-	-	-	0.52	0.02	0.14	9.71***	14.61***	2.11**
Inward FDI dummy	-	-	-	-	-	0.04	0.01	0.02	1.45*	2.11**	-0.52
Outward FDI dummy	-	-	-	-	-	0.04	0.00	0.03	2.13**	1.07	-1.82*
Specialisation index	0.55	0.57	0.58	0.56	0.66	0.43	0.38	0.44	0.98	-0.20	0.98
RD	0.004	0.005	0.002	0.005	0.004	0.005	0.002	0.01	1.18	-3.64	-2.05
Pavitt 1	0.46	0.44	0.16	0.46	0.35	0.43	0.55	0.55	-2.20**	-4.13	0.04
Pavitt 2	0.19	0.16	0.30	0.17	0.33	0.18	0.20	0.13	-0.53	2.27**	1.67*
Pavitt 3	0.29	0.35	0.39	0.32	0.20	0.33	0.22	0.26	2.25**	2.83***	-0.77
Pavitt 4	0.06	0.05	0.14	0.05	0.11	0.06	0.03	0.06	1.03	-0.58	-1.20
Centre-north area	0.88	0.80	0.89	0.83	0.94	0.84	0.81	0.80	0.80	2.23**	0.30
Southern area	0.12	0.19	0.10	0.16	0.06	0.16	0.19	0.20	-0.80	-2.23**	-0.30

***significance at the 1% level; ** significance at the 5% level; * significance at the 10% level.

In the next section we turn to a conditional analysis of firms' failure and growth to check for the determinants related to global engagement holding all the other factors constant.

4. Econometric methodology and results

4.1. Estimates of the exit rates by probit

In this section we estimate if globally engaged firms reacted differently to the severity of the economic crisis compared to other firms along the intensive margin of adjustment, *i.e.* exit. Hence, we estimate the probability of "failure" of a firm (exit dummies) before 2008 and during the crisis (2008-2010) as a function of firm international engagement, controlling for a wide set of firms' and sector characteristics taken at the beginning of the period in which the failure occurred. In line with previous studies (e.g., Greenaway *et al.* 2008; Zingales 1998) we use a maximum likelihood probit model of the firm's survival prospects, as we consider it the most appropriate in our case. If on the one hand, firm survival is a continuous variable (i.e.,a firm could exit after two and a half years), on the other hand, since our data are grouped by years due to balance sheet reporting, we have annual observations on firm exit. Therefore, we prefer estimate firm exit by a discrete method: probit, rather than by the Cox proportional hazard model. The latter would imply a risk of biased estimation of coefficient and standard errors.

We observe the company status variable (y_{it}), which is either failure ($y_i = 1$) or survival ($y_i = 0$), but we define the dependent variable as a latent variable y^*, the underlying response variable, which is the probability of failure as a function of the vector of the determinants of failure:

$$y_i = 0 \; if \; y_i^* = 0.$$
$$y_i = 1 \; if \; y_i^* > 0$$
$$y_i^* = \alpha_i + \alpha_t + x_{it}^{'}\beta + \delta_s + \varepsilon_{it} \qquad [1]$$

We follow the theoretical model by Clementi and Hopenhayn (2006) based on a repeated moral hazard model (where the Modigliani-Miller proposition does not hold). The model predicts that the failure rate decreases with size and age and the conditional probability of survival increases with the value of the firm's equity. First of all, like in this model, we include among the explanatory variables firm's size and the age (Audretsch and Mahmood, 1995; Geroski, 1995 and Dunne *et al.*,1988). Small firms may face higher restrictions on capital markets leading to higher risk of insolvency and illiquidity and consequently a higher risk of failure compared to their counterparts. Furthermore, we include a variable defined as the current age (AGE) of firm i at time t. New entrants face a greater risk of failure compared to older firms because of the "liability of newness" effect, which might be explained by noisy selection models (Jovanovic, 1982). In line with the theory, a large number of empirical papers have shown that younger firms are more likely to fail (e.g., Audretsch and Mahmood 1995; Disney *et al.* 2003 and Mata and Portugal 1994). Thus, we should expect the age of the firm to be positively related with the probability of survival. Our data do provide us with detailed information on firm's financing requirements. Main firm level financial variables we tried are: solvency ratio, short term and long term debts with banks over turnover and collateral ratio, given by the ratio of tangible assets to total assets, like in Guariglia and Bridges (2007).[8] The profitability ratio is defined as the ratio of firm's profits before interests and tax to its total assets. Following Bridges and Guariglia (2008) and Bunn and Redwood (2003) we anticipate a positive relationship between profitability and the likelihood of survival. As an additional financial indicator we use the solvency ratio (shareholder's funds/total assets), which is an indicator of the liquid assets of the firm. Low solvency indicates the need to raise funds due to low shareholder's equity (Mateut *et al.* 2006). As less liquid firms show greater demand for external funds compared to more liquid firms which have substantial internal sources, we expect to find that more solvent firms face a lower likelihood of failure. Then we use the debt with banks over turnover, measured as the firm's short and long-term debt with banks to turnover. A higher ratio is associated with a worse balance sheet situation, which would increase moral hazard and adverse selection problems, and lead to the inability of firms to obtain external finance at a reasonable cost. Bridges and Guariglia (2008) and Zingales (1998) use a similar variable, named leverage (built by the firm's short-term debt to assets ratio), and find that higher leverage results in higher failure probabilities. Should this effect prevail, one would expect a negative relationship between leverage and the probability of survival. However, a high rate of leverage can also be seen as an indicator of a good credit standing and high borrowing capacity of firms. In that case we should expect a positive relationship with the probability of survival. Finally, we use the collateral variable given by the ratio of firm tangible assets to its total assets. This is an indictor of borrowing capacity which should lower credit crunch problems.

A set of dummy variables is adopted to measure internationalisation which measure the impact of firm exporting activity and foreign and domestic investment on the likelihood of survival and also the role of country specialisation. A control for labour productivity and R&D expenditure are also adopted in our estimates. We expect both to exercise a relevant negative impact on firm exit.

In addition, our model includes location and Pavitt dummies and a full set of time dummies accounting for common trends and business cycle effects and a full set of industry dummies (calculated at the 2-digit level) to control for fixed effects across industries.

4.2. Results of the estimates of firm exit

In column 1-2 of table 4 we present the estimation results. In order to provide some interpretation of the estimated coefficients we only report the marginal changes, evaluated at the sample means for each independent variable.[9]

[8] We also tried further variables such as: liquidity ratio, degree of coverage of passive interests, interests over turnover (like in Gorg and Alvarez, 2007), and a proxy for leverage (like in Becchetti and Trovato 2002; and Guariglia and Bridges 2007) obtained by dividing the short term and long term debts with banks over total assets. However, these variables were less robust.

[9] For a continuous variable the marginal effects show the increase in the predicted probability when there is a one-unit increase in the covariate (when the values of all variables in the model are at the mean of the sample used for the estimation of the model). The marginal effect associated with a dummy tells us the change in the predicted probability of failure when the variable changes from zero to one (when the values of all the other exogenous variables in the model are fixed at the sample mean).

Table 4. The likelihood of exit before and after the crisis: Probit model

	Probit model	
	Firm exit pre-crisis	Firm exit post-crisis
Size	-0.0018	-0.0021
	(-1.79)*	(-0.58)
Age	-0.0038	0.0155
	(-2.42)**	(2.06)**
Prod	-0.0086	-0.0137
	(-4.13)***	(-1.99)**
Export	-0.0328	-0.0584
	(-6.58)***	(-7.07)***
Inwfdi	0.0032	0.0053
	(0.37)	(0.24)
Outfdi	0.0042	0.0149
	(0.72)	(0.83)
Collateral	-0.0086	-0.0107
	(-1.65)*	(-0.69)*
Profit	-0.00001	-0.0002
	(-0.33)	(-0.57)
Solvency	-0.0002	-0.0010
	(-2.42)**	(-3.81)***
Debt with banks/turnover	0.00003	0.0006
	(0.50)	(4.04)***
Specialisation	0.0012	0.0196
	(0.41)	(2.16)**
R&D	0.0494	0.0799
	(0.98)	(0.67)
Pavitt traditional	0.0012	0.0094
	(-0.13)	(0.29)
Pavitt scale intensive	-0.0061	-0.0012
	(-0.80)	(0.04)
Pavitt high-tech	-0.0163	-0.0680
	(-6.34)***	(0.96)
South location dummy	-0.0030	0.0094
	(-1.10)	(0.91)
Industry dummies (2 digit Ateco)	Yes	Yes
Const	33.564	0.1194
	(2.66)*	(0.11)
Number of observations	2582	2461
Log likelihood	-285.10	-482.69
Pseudo R2	0.20	0.18
Pred. P (at x bar)	0.0070	0.0365

Robust t-statistics are presented in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. ***significance at the 1% level; ** significance at the 5% level; * significance at the 10% level.

Focusing on firm internationalisation activities via exports, we observe that exporters experience exit probabilities by 3.2 percentage points lower over the pre-crisis period, and by 5.8 lower over the crisis period. Conversely, both the affiliates of a foreign firm and Italian multinationals exhibit no different exit probabilities than domestic firms both before and after the crisis. Looking at the control variables, our results show that a 1% increase in the number of employees reduces the firm's probability of failure by 0.2 percentage points. This marginal impact, compared with the predicted probability of exit, evaluated at the mean of the independent variables, which is 0.7, implies a reduction in the predicted exit probability by 25% (0.2/0.7). Hence, larger firms, before the crisis shock, are significantly more likely to experience lower exit. Firm age also returns negative coefficients with a significant impact on failure risk reduction of 0.3 percentage points, i.e. a reduction in the predicted exit probability by 42% (0.3/0.7). However, over the crisis larger firms have not benefited of higher chances of survival[10], while older firms even experience a higher failure risk. Productivity shows a more consistent sign and significance: it reduces the risk of failure both before and over the crisis period with a quite high marginal effect (0.8 and 1.4). The profit margin displays a not significant association with the probability of failure, a result which is confirmed in the crisis period. Conversely, having higher collateral and solvency is as-

[10] With respect to the size and survival nexus the results in literature are quite mixed. Some studies show the relevance of size for survival (Dunne *et al.* 1989; Mata and Portugal 1994 to quote the milestone studies), while other studies such as Audretsch *et al.* (2000) and Wagner (1994), and more recent studies on firms financial default and size (Bottazzi *et al.* 2011a and 2011b), find no clear-cut nexus between size and the probability of survival.

sociated with a lower exit risk both before and after the crisis shock, and higher levels of debts with banks over turnover, although not significant before the crisis, is a highly significant determinant of firm exit over the crisis, which suggests liquidity constraints and more serious financial tights. Innovation of firms, measured by R&D over turnover, turns out to be a weakly significant factor of risk failure, however, belonging to a high technology sector (according to the Pavitt taxonomy) is a significant determinant of lower exit before the crisis (1.63 percentage points lower) with respect to firms belonging to the reference category (specialised suppliers). Finally, the sectors of national specialisation are more at risk of failure over the crisis. In both samples, the strongest evidence is of a negative relationship between export status and exit hazard and also between solvency and exit hazard.

5. Conclusions

One of the most visible effects of the 2008 financial and real crisis is the closure of firms and the resulting employment and sales losses, which have hit particularly hard the Italian economy. We looked at the impact of the recent crisis on Italian firms' exit, controlling for the role of several firms characteristics (size, age, productivity, financial health and innovation) and industry variables (specialisation, Pavitt classes), using a panel of 4066 Italian firms over the period 2002-2010

Our paper adds to the existing literature as no previous work explored the effects of different forms of internationalisation under a crisis setting. No study in particular has been carried out on firm behaviour in Italy over the recent crisis addressing specifically the relevance of different forms of firm globalisation.

We find different characteristics for surviving and exiting firms before and after the crisis shock. More specifically, our results show that during the crisis exporters perform much better in terms of exit than non exporters, while DMNEs and FMNEs show an exit pattern not significantly different with respect to national firms. We also find evidence that surviving firms have higher collateral and solvency and are less indebted with banks. To conclude, foreign multinational firms did not act as stabilizers in Italy, unlike in other contexts of crisis (Desai *et al.* 2008; Blalock 2008; Tong and Wei 2010; Alfaro and Chen 2011). Further research is needed though to control for other relevant characteristics to better explain the heterogeneous response of exporters, multinationals enterprises and affiliates of foreign firms to the impact of a crisis. Firms behaviour is influenced by a complex network of relationships and responses of firms to changes in their domestic and international environment are not only a function of firm characteristics but also depend on complex ties and local and international linkages. In particular, the affiliates' position in the MNEs' network, the country of origin of investors and the investment motivations in a specific host economy may indeed determine different outcomes. The position of exporters within the international production networks, the diversification in terms of markets and of products, the persistence in international markets, are also crucial factors of exporters' behaviour. Further research should point to a better disaggregation of the chain of connections, both productive and financial, behind the exporters' and multinationals' responses.

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