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Agglomeration economies in Italy: Impact on heterogeneous firms' survival

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Preliminary draft (Not to be quoted!)

Agglomeration economies in Italy: impact on heterogeneous firms' survival

Anna M. Ferragina^{*}, Fernanda Mazzotta

Abstract

The purpose of this contribution is to shed light on the role of agglomeration economies as drivers of firm survival in Italy over the period 2002-2010. We analyze agglomeration economies related to the geographical context by using a multidimensional analyses at firm, industry and province level checking whether effects on survival are robust to different estimators (Probit, Cox hazard models, Heckman Probit) and to different assumptions about inter-and intra-regional spillovers. In order to also taking into account firm heterogeneity we study the local drivers of firm survival comparing the exit behavior of firms with global investment and of purely national firms. To this purpose, we split our sample into foreign investors in Italy, domestic firms investing abroad and domestic non multinationals and we take into account different patterns of firm behavior with respect to external economies controlling for firm and industry variables and correcting for sample selection. We get evidence on the heterogeneity of firm exit dynamics with respect to: 1) impact of urbanization economies; 2) benefits from geographically and industry bounded specialization; 3) Industrial districts economies impact; 4) Diversification economies relevance, distinguishing intra-industry and extra-industry (i.e. unrelated) variety. These topics have strong policy implications. Firm persistence in agglomerated contexts such as local industrial clusters and urban areas are crucial issues in Italy.

Keywords: Duration Analysis; Multinationals; Spatial Distributions of Regional Economic Activity; Agglomeration economies; Variety; Spillovers.

JEL: C41, F23, L11, R12, R32, L25.

1. Introduction

The purpose of this contribution is to shed light on the role of agglomeration economies as drivers of firm survival in Italy over the period 2002-2010. We analyze agglomeration economies related to the geographical context by using a multidimensional analyses at firm, industry and province level and checking whether effects on survival are robust to different estimators (Probit, Cox hazard models, Heckman Probit) and to different assumptions about inter-and intra-regional spillovers. In order to also taking into account firm heterogeneity we study the local drivers of firm

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survival comparing the exit behavior of firms with global investment and of purely national firms. To this purpose, we split our sample into foreign investors in Italy, domestic firms investing abroad and domestic non multinationals and we take into account different patterns of firm behavior with respect to external economies controlling for firm and industry variables and correcting for sample selection.

Firm survival/mortality is one of the most debated issues in industrial organization. The literature has mostly focused on firm-and industry specific determinants (see the seminal papers by Dunne, *et al.*, 1988; Audretsch, 1991; Santarelli and Vivarelli, 2007). A large recent literature has also explored the relationship between firm dynamics and global activities related to FDI and trade (see the survey by Wagner, 2011). However, location specific determinants have been quite neglected in this literature with few exceptions.

The determinants of the spatial differences in the rates of new enterprise creation and business failure have been the subject of studies carried out at regional or province level for UK (Keeble and Walker, 1994; Fotopoulos and Louri, 2000), Germany (Gerlach and Wagner, 1994; Fritsch *et al.*, 2010¹) and USA (Acs *et al.*, 2007). As for Italy, there is a very restricted literature that focuses on the spatial differences in survival rates. Some papers have focused on new venture creation at regional level (Audretsch and Vivarelli, 1996; Carree *et al.*, 2009), and other on death rates at province level (Verheul *et al.*, 2008; Santarelli *et al.*, 2010; Cainelli *et al.*, 2012).

Our analysis is in the wake of these studies. The novelty with respect to them is twofold. First of all, we fill a gap in the literature bringing together three different dimensions: the firm, industry and province- specific determinants of firm mortality. To this purpose we use a large and newly built unbalanced micro-panel data set made up of more than 742,000 observations concerning Italian manufacturing corporate firms disaggregated by sector and by 103 provinces over a long span of time (2002-2010), built by matching different data sources (AIDA dataset primarily, ISTAT 2001 “Italian Industrial census” and yearly series of “Provincial Accounts”, and the “Movimprese Archive” by Unioncamere). Secondly, we assess the effect of firm internationalization by foreign direct investment to take into account potential sources of heterogeneity of firm exit behaviour with respect to external economies (correcting for sample selection). To pursue this aim, we study the patterns of survival of foreign investors in Italy and of domestic firms’ investing abroad *vis-à-vis* purely domestic firms. No other study to our knowledge has explored whether and how the local drivers of firm dynamics play a different role on firms according to their ownership status. Hence, the two key questions investigated in this paper will be the following: how far different types of agglomeration/diversification economies mitigate firm failure? Is the role of local external drivers of performance different for multinationals, foreign and domestic, with respect to purely domestic firms?

There are several reasons calling for a deeper investigation on the role of agglomeration economies on firm survival in Italy. First, spatial agglomeration has been traditionally an important source of positive externalities in Italy due to the fact that it is the host of a specific type of localisation economies: the industrial districts (IDs).² These socio-economic interactions (Becattini, 1990; Dei Ottati, 1994) enabled in the past firms to survive over negative economic conditions. However, several recent empirical studies have shown how district firms do not show the resilience they had in the past (CENSIS, 2010; Bugamelli *et al.*, 2009; Iuzzolino & Micucci, 2011; Cainelli *et al.*, 2012). The benefits of territorial proximity have weakened over the last decade also as a consequence of the changing international competitive scenario and the upsurge of delocalisation

¹ Fritsch *et al.* (2010) are the only to have carried out a firm, industry and regional level analysis.

² In the model by Duranton and Puga (2001) two types of organizations coexist: the most diversified areas, producing new products, and the highly specialized ones, where the most standardized productions are concentrated. This separation is able to fit quite well with the peculiar industrial structure of Italy where there strong urban areas coexist with clusters like the industrial districts based on a very high sectoral concentration of production and a high share of small and medium enterprises.

where local competitive advantages associated with the informal system of socio economic relations, which are a feature of the IDs, have become less important.

The question of the impact of local economies on firm dynamics has become even more crucial in the context of the recent economic crisis as industrial demography effects have shown strong local specificities, with some locations experiencing a long term decline marked by increasing productivity gaps, rising regional firm mortality and unemployment and loss of competitiveness on the international markets (Di Giacinto *et al.*, 2012).

The role of foreign investors in clustered contexts is another key topic of investigation we pick up. Dunning (2009) argues that geographical clustering and networking of related value-added activities are playing an increasing role on the choice of location by multinational enterprises. Some studies on Italy have also shown how FDI location choices have started to include also local industrial systems especially for high value added functions (knowledge or technology sourcing) (De Propris *et al.*, 2005; Mariotti *et al.*, 2010; Menghinello *et al.*, 2010).

The probability of firm exit is modeled in our analysis as a function of different variables related to agglomeration economies. We take into account five different agglomeration indicators related to the geographical context: 1) External economies available to all local firms arising from urban size, population and economic density (urbanization economies); 2) External economies arising from the spatial concentration of firms in the same industry (Glaeser *et al.*, 1992); 3) local production systems (Industrial districts); (where 2 and 3 both give rise to the so called “localization economies”); 4) External economies available to all local firms stemming from the agglomeration of firms in different but related industries as this relatedness of the local industrial structure favour intra- and inter industry knowledge spillovers i.e. Jacobs externalities (Jacobs, 1969); 5) externalities due to “unrelated” variety to capture the portfolio effect arising from the spatial concentration of firms belonging to different and non-complementary industries (Frenken *et al.*, 2007).

The localisation and agglomeration variables are measured by considering at province level: population, economic density, local industrial clusters, industry specialization (normalised Balassa index by Ateco 2 digit sectors), intra-industry and inter-industry variety (Theil entropy indeces). We also control for other standard variables in duration models at firm (size, productivity, capital intensity, labour cost), industry (export and FDI intensity, market barriers to entry such as minimum efficient scale and market concentration, Pavitt clusters and sector technology classes) and province level (death rate, start up rates, innovation, export propensity, wage costs, labour productivity, value added growth, employment share in manufacturing, production share, unemployment rates). We employ two types of models: probit discrete models and semi-parametric continuous Cox hazard models that are specifically designed to analyze duration phenomena by explaining the time period between a firm’s start-up and its cessation of economic activity. The variables related to firm internationalization, outward and inward foreign direct investment, proxied by Italian multinationals and foreign multinationals dummies³, are used to split our sample across firm subsamples which allow us to take into account their heterogeneity of behavior and to understand how the multinational status of firms not only modify the impact of firm and industry characteristics but also that of local agglomeration and diversification economies.

The following section (Section 2) provides an overview on the literature hypotheses and empirical evidence with regard to the factors that may determine the survival of businesses. Section 3 introduces the data, section 4 the estimation procedure, as well as the basic definitions of variables and the expected signs. The results of the empirical analysis are presented in Section 5 and the final section (Section 6) concludes.

³ Domestic multinationals (DMNE) are Italian firms with affiliates in foreign countries; foreign multinational (FMNE) are Italian firms whose ultimate beneficial owner is a foreign firm. We compare these firms to non multinational domestic firms (Non MNE).

2. Background of the literature

The spatial agglomeration effects have been largely investigated in the past in the regional growth and urban development studies (Glaeser *et al.*, 1992; Henderson *et al.*, 1995). The empirical evidence is rather mixed. The spatial agglomeration of firms has been found an important source of both positive and negative externalities. The literature on firm survival and agglomeration also provides mixed conclusions. The impact of agglomeration as such is unclear as these economies can be of different types and they may be related to proximity of firms that are in the same industry (so called localization economies) or to diverse kind of actors, industries and institutions (giving rise to so called Jacob economies). Some studies found evidence for positive effects on firm survival from being located in an agglomeration. Keeble and Walker (1994) find positive effects of urban agglomeration on new firm death rates. Fotopoulos and Louri (2000), also focusing on new firm formation, consider industrial structure and concentration and find relatively lower levels of both firm births and deaths rates as a result of localization economies. Acs *et al.* (2007) also concentrate on new-firm survival across regions. Controlling for human capital, they find that the new-firm survival rates are negatively related to service sector specialisation and positively related to all-industry intensity, suggesting that city size and diversity may be an important determinant of new-firm survival. Other studies identified a significant negative impact. Audretsch and Vivarelli (1996), studying new firm formation across Italian provinces, find that environmental factors such as the degree to which entrepreneurial networks already exist, reduce the degree to which new firms are started. Fritsch *et al.* (2010) analyze business, industry and region-specific survival determinants for all German manufacturing businesses in the 1992-2005 period. Their results suggest higher hazard rates in agglomerated areas with a rather specialized regional industry structure.⁴

A scant literature on Italy (Carree *et al.*, 2008, Verheul *et al.*, 2009; Santarelli *et al.*, 2010; Cainelli *et al.*, 2012) disentangles across different sources of agglomeration economies and also provides mixed conclusions according to the different (specialization/diversification) economies. Carree *et al.* (2008) investigate firm entry, exit and net entry in Italian provinces and try to explain how unemployment impact on these market dynamics in six different sectors, including manufacturing, construction, commerce, hotels and restaurants, transport and financial services. They control for several other regional factors, among which the effects of districts and large cities (in addition to patenting activity, economic growth, economic welfare, tourism) and find that while belonging to IDs increase exit in manufacturing being in a large city reduces it.

Verheul *et al.* (2009) analyse the determinants of new venture creation across industries and locations for 103 Italian provinces between 1997 and 2003 allowing for differences in regional opportunities across industries, taking into account a range of factors, including policy initiatives. Their results show that regions with industrial districts are characterized by higher start-up rates in manufacturing. Firm entry in commercial sectors appears to be higher in large cities and areas with strong economic progress. Santarelli *et al.* (2010) investigate a range of determinants of the exit rates for twelve different sectors in the Italian provinces for a period of eleven years. The analysis shows considerable variation in the firm exit rates across the 103 provinces in Italy, where the presence of industrial districts diminishes exit, especially in some manufacturing sectors (Food and Clothing, Commerce and Transport). Cainelli *et al.* (2012) study the role agglomeration economies in affecting firm mortality in local production systems (LPS). Their empirical evidence on 103

⁴ Being in higher capital-intensive industries, in industries with a high minimum efficient size and with high labor-unit costs also increases the risk of failure. Likewise, the probability of survival is lower for small, young and for relatively mature establishments. Conversely, a relatively high start-up size, an above average share of highly qualified employees in the establishments as well as a high qualification of the regional workforce has a positive effect on survival.

Italian provinces over the period 1995-2007 confirms that agglomeration economies are able to significantly affect the firm mortality of the industries in the Italian provinces. In particular, the role of urbanization economies, industry specialization (up to a certain point), the variety of the specialization patterns of the LPS reduce firm mortality in the provinces. However, they find that the industrial district degree is not able to reduce it, unless there is a low variety in the industries.

It is important to interpret the results of these studies in the light of the theories of agglomeration and spillover effects. Urbanization economies reflect external economies passed to enterprises as a result of savings from the large-scale operation of the agglomeration independent from industry structure. Relatively more densely populated areas are more likely to house universities, industry research laboratories, and other knowledge generating facilities. Quite different are the localization economies which may rise from industry specialisation and from the Marshall-Arrow-Romer (MAR) externalities. These latter are external economies available to the local firms within the same sector and may consist of labour market pooling, the creation of specialized suppliers, the concentration of customers, and the emergence of knowledge spillovers. Firms are expected to learn more from other firms in the same industry on the basis of *intra-industry* knowledge spillovers (Porter, 1998).

While the Marshall-Arrow-Romer model focuses on spillovers among firms within an industry conversely, Jacobs (1969) indicated that diversity of industries and knowledge spillovers *across* geographically close industries promotes innovation and growth via economic knowledge *inter-industry* spillovers (Acs *et al.*, 2007). Specialisation economies are external to the firm but internal to the industry, Jacobs externalities are external to both firm and industry and arise from the diversity and variety of the regional economic structure.

The analysis of variety has been recently enriched by some studies which have stressed the relevance of distinguishing between related and unrelated variety. The underlying idea is that the transmission of knowledge requires a common and complementary competence base *i.e.* it is not variety *per se* that matters, but the geographic concentration of firms in different but complementary or related industries (Frenken *et al.*, 2007; Boschma and Iammarino, 2009; Cainelli and Iacobucci, 2012). The related variety occurring within sectors is the best measure to capture Jacobs externalities. On the other hand, the presence of unrelated variety may be viewed as a portfolio strategy to protect a region from external shocks in demand *i.e.* asymmetric or idiosyncratic shocks that hit only one or few sectors (such as oil price shocks, a trade war, an innovation) (Attaran, 1986; Cainelli *et al.*, 2012).

The death/survival of firms may be influenced positively by both intra-industry and inter-industry knowledge spillovers. Given that there are different potential sources of spillovers, the question is whether spillovers on firm survival occur when a region is specialized in a few sectors (localization economies), or diversified into a large variety of sectors (Jacobs externalities), or whether it is related to city size and density *per se* (urbanization economies). In principle, all these three types of agglomeration economies can produce spillovers on survival. However, the benefits from these different sources of spillovers and the transmission mechanisms are likely to be different. The benefits accruing to firms operating in areas with intense activities, like urban areas, are strongly based on a selection effect (Meltiz and Ottaviano, 2008). The impact of localization economies is expected to originate from similar firms producing similar products and hence the crucial mechanism is expected to be via product and process innovation which should have positive effects on firm survival. Jacobs externalities are expected to facilitate radical innovation and product innovation, likely to spur the creation of new markets, new ideas and higher employment rather than to lead to productivity increases (Frenken *et al.*, 2007). A key question with respect to variety is whether related or unrelated diversification is most conducive to firm survival. It can be expected that related industries more often have correlated demand shocks. Therefore, spreading risk over unrelated sectors is to be preferred if the aim is to pursue a portfolio strategy and if there are

negative sector-specific shocks of technological or demand nature. A low risk diversification applies to specialization economies, which according to Cainelli *et al.* (2012) might determine a downside effect on firms survival

Another crucial issue is the relevance of industrial districts (ID) for firm survival. In a large literature the IDs have been pictured as efficient local clusters of production, allowing higher firm export propensity and productivity. Most of the models which analyze the agglomeration economies and the vast Industrial district literature focus on showing a positive “district effect” on productivity, where the small firms are those which benefit the most by agglomeration effects. The clusterisation of activities and local performance in Italy have been recently investigated in a research by the Bank of Italy (Alampi *et al.*, 2012). Important changes in the international competition mechanisms appear seriously affecting the survival of Italian industrial clusters. The analysis emphasis how the network of social and economic relations typical of the district area and their competitive advantages have been seriously threatened by global competition, which have undermined the occurrence of a positive “district effect”. Besides, the inter-firm production linkages, quite strong in these economic agglomerations, if on the one hand may facilitate inter-firm credit relationships, and act as a risk-sharing mechanism, on the other hand may act as a crisis contagion mechanism (Battiston *et al.*, 2007; Gallegati *et al.*, 2008; Cainelli *et al.*, 2012). Finally, other factors of vulnerability have generally been associated with the higher local competition/selection of these conglomeration of firms, especially in terms of the cost of resources (e.g. labour).

To sum up, based on the theoretical arguments above, we expect a positive impact of both specialisation and variety on firm survival. However, as for variety, we expect a more positive impact of unrelated variety and a more ambiguous effect of related variety on survival. We do not have clear-cut predictions on the role of the clustering of activities in a district on survival. The predictions on the effect of urbanisation economies are also quite mixed due to the strong competition/selection effect.

The literature investigating the local determinants of firm survival has neglected to consider the heterogeneity between national and multinational firms. We take this difference into account also disaggregating multinational firms between Italian and foreign multinationals, which are quite different in terms of characteristics and strategies. With respect to these different firm types, we may put forward different hypotheses. On the one hand, non multinational firms should depend on local knowledge spillovers and agglomeration effects more than multinationals as these latter, adopting “global sourcing”, outsourcing and networking strategies, should be less reliant on local economies for their survival. On the other hand, the most internationalized firms thanks to more internal resources and global connections might be able to better exploit local knowledge externalities and enhance their success in highly agglomerated areas, where competition both internal and external has become more fierce. More in general, there are several reasons to expect a higher resilience of multinationals in highly agglomerated areas. Following the New-New Trade Theory multinational enterprises are more productive, have higher technological, managerial and human capabilities and, therefore, have higher capacity to face adverse external conditions (Melitz, 2003; Ferragina *et al.*, 2012). Secondly, as they invest in several country they are able to spread sales over different markets with different business cycle condition and this can be a form of risk diversification. Besides, MNEs have access to both internal and international financial markets, which allows them to diversify also their sources of financing and the associated risks. This means that they are less dependent on host capital markets in their operations. Furthermore, they are also less linked to the host country by means of input sourcing from local upstream firms and the local market is often less important for their sales, being multinationals generally more export intensive than domestic firms (Godart *et al.*, 2012). Based on these features, we not only expect a different impact of local determinants on firm survival of multinational firms with respect to survival of

purely national ones but also a higher capability of multinationals to exploit advantages from localisation in highly agglomerated areas.

3. Data

We draw our dataset on different sources. Our main information come from the commercial data provider Aida (by Bureau Van Dick) which provide balance sheet data.⁵ We also use the “2001 Italian Industrial census” of the Italian National Statistical Institute (ISTAT), the yearly series of “Provincial Accounts” (Conti Provinciali) of ISTAT, and “Movimprese Archive” of the Italian Chamber of Commerce (Uniocamere).⁶ The analyses are restricted to the manufacturing sector since the service industries represent a different case that should be analyzed separately. Further information on international activities, such as FDI, export, import information at industry level, are drawn from aggregate databases by Eurostat and ISTAT and by the Italian Patent Office.

In about 30% of our sample in the balance sheet data the information on the number of employees is missing. We followed two ways to solve this problem. First, as the info on the total labour cost is almost always available it was used to fill the missing values on the employees, considered as employees full time equivalent. The method consists of taking the median cost per employees per year, sector and province. The number of employees is then derived by the relationship between total labour cost and median cost per employee.⁷ However, we were not happy with the results we got from this filling procedure as it entailed undervalued imputation of employees in the domestic firms and distorted (overestimated) variables built upon employees (such as productivity for domestic firms). Hence we adopted a second procedure for imputing missing: the Multiple Imputation by Chained Equations (MICE procedure).⁸ We also cleaned the dataset by excluding firms which reported negative values on value added, production, cost of labor.

We build up a large unbalanced panel of data of 742,939 (Table A.1) observations for the manufacturing sector, disaggregated by firm, sector and province, covering 9 years (from 2002 to 2010), including both new firms and incumbent ones. The sample collects balance sheet data for 98,839 firms (of these 64,465 are present in all years and 95,559 in 2010) and allows us a wide coverage of Italian manufacturing corporate enterprises, representative of firm distribution by size, geographical areas and districts.⁹

⁵ We took the unconsolidated balances hence information are referred to the singles plant and not to the consolidated results, in case of firms with different plants. This characteristic is crucial to evaluate the territorial effects.

⁶ We considered 103 province, the number of province in 2002, although in 2010 they were 110: hence the new provinces are attributed the same value as the former province of affiliation. The province in object are Monza from 2007, Barletta, Fermo, Olbia, Ogliastra, Carbonia, Campodano from 2009.

⁷ This procedure is proposed by Accetturo *et al.* (2013) and also adopted by Buccellato and Santoni (2013) in Manzocchi, Quintieri and Santoni (2013).

⁸ Stata's program MICE written by Patrick Royston fills in missing values in multiple variables iteratively by using chained equations, a sequence of univariate imputation methods with fully conditional specification (FCS) of prediction equations. The imputed values are generated from a series of univariate models, in which a single variable is imputed based on a group of variables. One advantage of the MICE approach is that it does not assume a multivariate normal distribution, so it can easily be used to impute a variety of different types of variables (i.e. categorical, counts, etc.). A second advantage of the MICE approach is that because it estimates a series of univariate models, it can sometimes accommodate larger imputation models than the multivariate normal approach. One disadvantage of the approach is that, in comparison to the multivariate normal model, it lacks strong theoretical underpinnings. An additional disadvantage is that specifying MICE models can be tedious, especially when the imputation model is large.

⁹ To check for the significance of the difference in the regional, sectoral, size and ownership distribution of our sample we applied a ptest on two groups distributions, our sample AIDA and ISTAT universe. We checked both the z value and the confidence interval to see whether we should reject the null hypothesis of not significant differences across the two samples distribution by size, sector, region and ownership. We did not reject the Ho hypothesis in all the tests we made. See tab. A.2. and A.3.

Tab. 1 describes our sample splitted by firm size, geographical areas, Pavitt sectors and district in the provinces, for three types of firms ownership status: domestic non multinational, multinational foreign and multinational domestic.

Tab. 1. Distribution of our sample by size, territorial areas, Pavitt sectors and IDs disaggregated by ownership types (2002-2010)

| | Domestic non multinationals | | Foreign Multinationals | | Domestic Multinationals | | All sample | |
|--------------------------------------|------------------------------------|--------------|-------------------------------|-------------|--------------------------------|-------------|-------------------|---------------|
| | a.v. | % | a.v. | % | a.v. | % | a.v. | % |
| Size | | | | | | | | |
| Micro (1-9) | 256,842 | 46.3% | 247 | 0.0% | 414 | 0.1% | 257,503 | 46.5% |
| Small (10-49) | 229,249 | 41.4% | 924 | 0.2% | 1,752 | 0.3% | 231,925 | 41.8% |
| Medium (50-249) | 51,157 | 9.2% | 1,332 | 0.2% | 3,632 | 0.7% | 56,121 | 10.1% |
| Large (250 and more) | 6,473 | 1.2% | 605 | 0.1% | 1,692 | 0.3% | 8,770 | 1.6% |
| Territorial area | a.v. | % | a.v. | % | a.v. | % | a.v. | % |
| North West | 195,557 | 35.3% | 1,741 | 0.3% | 3,281 | 0.6% | 200,579 | 36.2% |
| North East | 157,953 | 28.5% | 861 | 0.2% | 3,030 | 0.5% | 161,844 | 29.2% |
| Center | 106,372 | 19.2% | 376 | 0.1% | 875 | 0.2% | 107,623 | 19.4% |
| South | 64,382 | 11.6% | 119 | 0.0% | 240 | 0.0% | 64,741 | 11.7% |
| Islands | 19,457 | 3.5% | 11 | 0.0% | 64 | 0.0% | 19,532 | 3.5% |
| Pavitt Taxonomy | a.v. | % | a.v. | % | a.v. | % | a.v. | % |
| Supplier dominated | 241,109 | 43.5% | 686 | 0.1% | 2,718 | 0.5% | 244,513 | 44.1% |
| Specialized suppliers | 96,404 | 17.4% | 900 | 0.2% | 2,003 | 0.4% | 99,307 | 17.9% |
| Scale intensive | 174,648 | 31.5% | 1,013 | 0.2% | 2,133 | 0.4% | 177,794 | 32.1% |
| Science based | 31,560 | 5.7% | 509 | 0.1% | 636 | 0.1% | 32,705 | 5.9% |
| District area in the province | a.v. | % | a.v. | % | a.v. | % | a.v. | % |
| Not | 110,380 | 19.9% | 440 | 0.1% | 985 | 0.2% | 111,805 | 20.2% |
| Yes | 433,341 | 78.2% | 2,668 | 0.5% | 6,505 | 1.2% | 442,514 | 79.8% |
| Total | 543,721 | 98.1% | 3,108 | 0.6% | 7,490 | 1.4% | 554,319 | 100.0% |

Note: Percentage values are expressed on the cleaned total sample. (a) North West includes Liguria, Lombardia, Piemonte and Valle d'Aosta; North East includes Emilia Romagna, Friuli-Venezia Giulia Trentino-Alto Adige and Veneto; Centre includes Lazio, Marche, Toscana and Umbria; South includes Abruzzo, Basilicata, Calabria, Campania, Molise and Puglia; Islands are Sicilia and Sardegna. (b) Number of employees defining the category is given in parentheses.

According to the figures, domestic non multinationals (NMNEs) represent the largest percentage of Italian firms (more than 98 percent), which are primarily smaller firms (i.e., firms with less than 50 employees account for approximately 88 percent of total firms). The number of both domestic and foreign MNEs is rather low (0.5 per cent and 0.14 per cent of total sample). The geographical distribution of the sample is stable all over the period considered and strongly reflects the industrial characteristics of Italy confirming how the geographical dimension matters in analysing firm performance. There is a high polarisation of the sample in terms of territorial areas, more than 65 per cent are located in the North and more than 79 per cent of firms operate in provinces with IDs. The distribution by sectors is quite persistent over the period and strongly unbalanced towards supplier dominated and scale intensive sectors (more than 76 per cent and 31 per cent respectively).

More detailed sectoral (by Ateco 2007) and geographical (by region) distribution over the period considered are presented in table A.2 and A.3. We find a high concentration of firms in Lombardia, Emilia Romagna, Veneto and Toscana. The regional distribution is highly consistent with Istat data. The most represented sectors in our sample are metal products (25%), textile, clothing and leather (13%), machinery (11%), food (7%), while oil and pharmaceuticals are of very little importance.

Fig. A.1 and A.2. in Appendix show two geographical maps which portraits the pattern of firm localisation in our sample and the firms' exit rates in 2010. In the Italian economy, the geographical distribution of firms is historically characterized by a persistent socio-economic dualism between the more advanced North and Centre and the backward and less industrialised South. Three if not four distinct 'economies' can be detected: two areas in the industrial North (East and West); the Third Italy industrial districts economy in the North-East and in the Centre; the more rural South with a more backward model of production. Fig. A.1 matches quite well with the peculiarity of the Italian production structure where different models of production coexist. It is quite evident a strong firm agglomeration which reflects both industrial districts areas and the presence of urbanised areas. The economic activity is highly concentrated in the North of Italy but there is also an important presence of firms in the IDs Adriatic area, while the South is hosting a very low share of firms.

Before showing firm death rates by provinces, a few words are needed to explain the procedure we adopted to identify firm exit. We consider a firm to have exited if its legal status variable in the AIDA dataset is failure, liquidation, or bankruptcy. We consider the time of exit as the time when a firm enters a liquidation or bankruptcy process, whichever starts earlier.¹⁰ Then, $Exit_{it} = 1$ in the year when the firm exits and 0 in all prior years, and the firm is missing in the years following its exit.¹¹

Fig. A.2. shows pronounced differences in the death rates at province level which strongly indicate the importance of local factors. The survival rates in 2010 were much lower in the southern part of the country. Particularly high death rates are found in the Campania region around Naples, in Sicily (almost spread equally across the provinces), Calabria (here with some bright area), Abruzzo (almost entirely), Puglia (Gargano). This spatial pattern seems to strongly confirm a North-South divide while the difference East-West is not so clearcut. Death rates appear to be lower in urbanized areas such as Milan, Florence, Genova.

4. Estimation methodology

The focus of our work is to examine domestic firms' probability of exit

$$Exit_{ijkt} = f(\mathbf{Y}_{ijkt}, \boldsymbol{\theta}_{jt}, \mathbf{K}_{jt}) \quad [1]$$

where subscripts i, j, k , and t denote "firm", "industry", "province" and "time". Hence, exit of firm i in industry j in province k at time t is related to:

\mathbf{Y}_{ijkt} a vector of firm characteristics;

¹⁰ We rely on the start (rather than the end) of these processes, as a firm ceases to operate freely on the market once it enters any such process. To accurately identify the timing of any legal cessation of a firm's activity, we complement these variables by checking the balance sheet data. We assign firm exit as the year in which the firm reports its last sales. Also, we allow for a two-year prior exit window to incorporate reporting delays or mismatches between calendar and fiscal years. For example, if a firm began a liquidation process in 2009 but its last reported sales are in 2007, we assume that the firm exited in 2007.

¹¹ We further control for firm status by also considering AIDA information on the type of procedure a firm is undergoing. This last piece of information allows us to avoid counting firms with changes in categories due to mergers, acquisitions, or changes in location or sector as exited, and ensures that our data represent "true exit".

θ_{jt} a vector of industry characteristics

K_{jt} a vector of province/industry characteristics

The regressions are performed clustering standard errors at both firm and province level (103 units), which is the geographical unit considered in the analysis. Hence the error term is composed of an idiosyncratic component and a component specific of the province k . Standard errors are also adjusted for heteroskedasticity. The period is 2002-2010. Dummies for time (to capture business cycle and common trends effects), Pavitt sectors, technology (OECD taxonomy), geographical areas (North-East, North-West, Centre, South, Isles) are added.

We estimate firm exit using two parametric specifications of exit decision function: first, a maximum likelihood probit model¹² of the firm's exit prospects and then a Cox proportional hazard model of the exit hazard. Duration models allow to control for both the occurrence of an event (i.e., the failure of a firm) and the timing of the event (i.e., the elapsed time till the failure took place)¹³.

Firstly, a probit model specification of exit decision function is given by:

$$\Pr(\text{Exit}_{ijkt} = 1 | \mathbf{X}_{ijkt}) = \Phi(\mathbf{X}_{ijkt}\boldsymbol{\beta}) \quad [2]$$

where Exit_{ijkt} is the dependent binomial variable, which takes the value of 1 in the year of a firm's exit and 0 for all previous years, and $\mathbf{X}_{ijkt} = (\mathbf{Y}_{ijkt}, \boldsymbol{\theta}_{jt}, \mathbf{K}_{jt})$

In the probit estimate we observe the company status variable (y_{ijkt}), which is either failure ($y_{ijkt} = 1$) or survival ($y_{ijkt} = 0$), 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:

$$y_{ijkt} = 1 \text{ if } y_{ijkt}^* > 0$$

$$y_{ijkt} = 0 \text{ if } y_{ijkt}^* \leq 0$$

The probability that a firm fails ($y_{ijkt} = 1$) can therefore be written as:

$$\Pr(y_{ijkt} = 1) = \Pr(y_{ijkt}^* > 0)$$

$$\Pr(y_{ijkt} = 1) = \Pr(\mathbf{x}'_{ijkt} \mathbf{b} + e_{ijkt} > 0)$$

$$\Pr(y_{ijkt} = 1) = \Pr(\varepsilon_{ijkt}/\sigma > -\mathbf{x}'_{ijkt} \mathbf{b}/\sigma)$$

Given that $\varepsilon_{ijkt}/\sigma$ follows a standard normal distribution (mean zero and variance of unity) and the probit distribution is symmetric the probability of failure can be evaluated using the standard normal distribution function, $\Phi(\cdot)$.

The response variable y^* is defined by the regression relationship, with slope parameters given by the vector \mathbf{b} and a normally distributed error term e_{ijkt} .

The second estimation strategy adopted is based on hazard firm-level panel model estimates which take into account the evolution of the exit risk and its determinants over time. The advantage of the hazard models is that they are able to address the presence of censored data. Since in most cases, a number of firms in the sample will not have failed during the period of analysis, the information on their life-span is incomplete and right censored. In this case, applying conventional statistical

¹² Following Jenkins (2005), any standard model for binary dependent variables can be applied to estimate discrete time hazard models. The choice of a discrete model is in line with a few previous studies (e.g. Greenaway *et al.* 2008; Zingales, 1998).

¹³ The second method takes into account that firm survival is a continuous variable (i.e., a firm could exit after two and a half years), although our data are grouped by years due to balance sheet reporting.

methods may result in biased and inconsistent estimates (Mata & Portugal, 1994). The hazard model is specifically designed to deal with this problem. We specifically use a continuous Cox's proportional hazard models (CPHM) which is quite commonly used in the literature on firm survival (see Audretsch and Mahmood, 1995 and other seminal studies such as Görg and Strobl, 2003; Mata and Portugal, 1994).

The hazard function $h_{ijk}(t)$ is given by:

$$h_{ijk}(t) = h_j(t) \exp(\mathbf{X}_{ijkt} \boldsymbol{\beta}) \quad [3]$$

This function defines the probability of exit in period t given that it has survived until $t-1$ and conditional on a vector of time varying covariates, where $h_j(t)$ is the industry-specific baseline hazard function, X , is a vector of explanatory variables, and β is a corresponding vector of coefficients. The β parameters are estimated by the maximisation of the partial likelihood function, which does not require the specification of $h_j(t)$. Subscripts i, j, k and t denote “firm”, “industry”, “province” and “time”, respectively. Note that the Cox proportional hazards model estimates the probability of the hazard, i.e., exit. Time is measured after entry, i.e., the time is equal to the age of the firm. The change in the hazard rate with age is incorporated into the underlying non-parametric hazard function, $h_j(t)$. The underlying assumption of Cox's model is that the hazard function $h_{ij}(t)$ of a firm i , i.e., the rate at which firms exit at age t given that they have survived up to age $t-1$, depends only on the time at risk, $h_j(t)$ (the so-called baseline hazard), and on explanatory variables affecting the hazard independent of time, $\exp(X_{ijkt}\beta)$. The Cox proportional hazard model imposes the restriction that the hazard functions for different values of the explanatory variables are proportional to each other and that their coefficients are constant over time (“firm age” in our case, as we consider age length as the spell length). We tested the proportional hazards assumption for each explanatory variable using the Schoenfeld test and found that the hypothesis of proportional effects is not rejected.

We estimate the probability of “failure” of a firm (exit dummies) between 2002 and 2010 controlling for a wide set of firms, sector and province characteristics.

The focus of our investigation are the industrial characterizations of phenomena of geographical proximity at province level. Firstly, the role of Industrial Districts (ID), distinct from the other agglomeration determinants because of the pivotal role social elements have in ID (Mazzanti, Montesor, & Pini, 2009). Besides, urbanisation, specialisation and diversity economies, i.e. whether firms get advantages from the proximity to firms in the space, controlling for whether they are related to the same industry (localization and Marshallian specialisation economies) or to diversity of actors (Jacobian economies).

Besides, our model also includes firm and industry level variables. This is a quick list of the variables we include in our regression (described in detail in the Appendix tab. A.4):

- Firm level variables:
 - size measured by four classes of firm's total sales (*sales 4_1*, *sales 4_2*, *sales 4_3*, *sales 4_4*)¹⁴, age, productivity, labor cost, capital intensity, profit margin;
 - outward and inward foreign direct investment measured by Italian multinationals and foreign multinationals (dummies) respectively¹⁵;

¹⁴ The size classes are built to avoid classifying most firms as “small”, because of the high skewness of the Italian firms' distribution.

¹⁵ Following recent empirical contributions on the determinants of firm productivity differentials under the hypothesis of firm heterogeneity (Castellani and Giovannetti, 2010), to catch innovativeness and R&D activities a dummy variable captures whether the firm invested in R&D activity in the period were included in the regressions. These variables for innovativeness and R&D activity were not significant.

- Industry level variables:
 - Industry export intensity, FDI intensity in the sector, FDI intensity in the region
 - Minimum efficient scale, Herfindhal index of concentration
 - Pavitt clusters dummies, technology classes dummies (OECD taxonomy: low, medium-low, medium-high, high)
- Province (industry) level variables:
 - Firm death and start up rates in the Ateco 2 digit sector in the province in year t.
 - Share of manufacturing employment, unemployment rate, innovation (patents)¹⁶
 - Agglomeration economies measured by different indicators related to the geographical context identifying five main sources of agglomeration or external economies:
 1. Urbanisation economies, which are external economies available to all local firms arising from urban size and density. We measure them with three indicators: *population density* in 2002-2010 (number of inhabitants per square kilometer); dummy for the presence of Urban Local Labour Systems in 2002-2010 (*sll_urb*); *spec*, a continuous variables for economic density which varies both at province and sector level built as number of active firms in the Ateco 2007 2 digit sector divided by the province extension in squared Km in 2002-2010.
 2. Industrial Districts measured by three variables: dummy for the presence in the province of an Industrial District based on the classification adopted by Istat (Sforzi classification)¹⁷ in 2002-2011 (*dist_sforzi*); dummy if the firm belongs to the same sector as the main sector of specialization of the District in 2002-2011 (*dist_sett_sforzi*); ; districtualization degree of the province in 2001 (*ind_dist_sforzi*), measured by the number of workers employed in a Local Labour System (provided by Istat, based on Sforzi classification), divided by the total manufacturing employment in the province in 2001.
 3. Specialisation economies measured by the normalised Balassa index of sector specialization in the province in 2001 (*normalbalassa*) to capture the knowledge spillovers arising from localisation economies.¹⁸ We also tried the variable squared to check for potential non linearity of the specialization effects.
 4. Jacobs externalities based on two measures of variety: the agglomeration of firms in different but related industries measured by the index of related variety (*rel_var*), and by that of intra-industry variety (*H*).
 5. Diversification or unrelated variety (*un_var*) measured by the spatial concentration of firms belonging to different and non-complementary industries. The unrelated variety capture the portfolio effect arising from the spatial concentration of firms belonging to different and non-complementary industries which operate protecting the region from sector-specific shocks (Frenken *et al.*, 2007).

¹⁶ We also tested value added growth, unit labour cost, labour productivity, export and import propensity at province level but they were not included in the final specification either because not significant or because correlated with other variables.

¹⁷ The industrial districts are quite complex to define and several definitions have been adopted in the literature. The most common is the definition introduced by Sforzi (1990), which is based on the characteristics of the Local Labour Systems (LLS), in terms of sectoral specialization and concentration of small and medium firms. We have used as indicator of district degree the share of employees in the districts on the total of regional employees. The Sforzi algorithm excludes the LLS localised in large urban areas and those which are mostly based on large firms. As in these areas we cannot exclude the presence of agglomeration economies we have introduced in our estimates the indicator of urbanisation and economic density.

¹⁸ Following Antonietti and Cainelli (2012), localisation externalities are measured using a specialisation index (SI) à la Balassa, calculated on two-digit level employment data, for the 103 Italian provinces. The standardised IS (SIS) is used in the regressions and is constrained within the interval (- 1,+1) (Paci and Usai, 2000; Bronzini, 2004).

While the indicators on urbanization, districts and specialization are quite common in the literature on agglomeration economies the two indicators related to diversification have been less investigated. We follow the methodology which has specifically been applied in the context of related and unrelated diversification both at the firm (Jacquemin and Berry, 1979) and regional levels (Attaran, 1986) which adopts the entropy measures. These entropy indicators of related and unrelated variety have also been applied by Frenken *et al.* (2007) and by Cainelli *et al.* (2012). Unrelated variety per province is indicated by the entropy of the two-digit distribution; related variety is indicated by the weighted sum of the entropy at the five-digit level within each two-digit class. We compute entropy measures by using employment data, which are available at the five-digit level and at the geographical NUTS-3 level (i.e. at province level), from the Census of Industry and Services conducted by ISTAT (Italian National Institute of Statistics) in 2001. We consider related variety able to generate relatively more Jacobs externalities because it measures the variety within each of two digit classes and hence takes into account the fact that some sectors are more related than others. It is expected that the economies arising from variety are especially strong between subsectors, as knowledge spills over primarily between firms selling related products. By contrast, unrelated variety measures the extent to which a region is diversified in very different types of activity.

In figure A.3 we report six correlograms between the average firm mortality rates by province (on the vertical axis) and each of the different indicators of agglomeration (on the horizontal axis). We observe a quite strong positive correlation of firm mortality at province level in our sample with respect to related variety and to the districtualisation index of the province. We instead observe a negative correlation of firm mortality with unrelated variety. A non monotonic pattern is shown by the indicator of employment density by sector and province (*spec*) which first is negatively related and then, after a certain level, is positively related to firm mortality. The correlation between mortality and the Balassa index of specialization is not clearcut.

Table A.4 in Appendix in addition to providing a detailed description of all the firm, industry and province level variables gives indications on the expected signs.

The following variables at firm level *sales classes*, *productivity*, *labor cost*, *capital intensity*, *pre_tax_profit margin* give rise unambiguously to an expected reduction in the hazard. The expected relationship between the status of domestic and foreign multinationals (*foreign multinational*, *domestic multinationals*) and firm survival is more ambiguous. They are the most productive group of firms (see Wagner 2011 for a detailed survey; Altomonte *et al.*, 2012). However, counter arguments have been investigated for foreign and domestic MNEs which having an international production network, can move production facilities easily between different countries (the “footloose behaviour” hypothesis).

The expected results for all the industry specific determinants are also quite ambiguous. First of all, it is worth considering the ambiguous impact that FDI intensity may have on firm survival. The FDI intensity (*FDI_share_bymarket* and *FDI_share_byregion*) may work through two main opposing effects through which inward FDI can affect a domestic firm’s survival and performance: competition effects and productivity spillover ones. As emphasized by Gorg and Strobl (2003), the increased production of foreign rivals will generally lead to a reduction of the output price which will shrink the price–cost margin and increase the probability of the exit of domestic firms. On the other hand, foreign firms’ activity in the host country may confer positive productivity spillovers on domestic firms, which, *ceteris paribus*, reduce a domestic firm’s average production costs which in turn expands its price–cost margin (Ferragina and Mazzotta, 2013). The degree of openness of a certain sector (*export_ateco07share*) can work in countervailing its internal competitive pressure (Fritsch *et al.*, 2010), but it could also increase its exposition to international demand shocks (Cainelli *et al.*, 2012) *MES* is the minimum efficient scale for each industry. Theoretically, the expectation of the effect of the *MES* on firm survival is quite ambiguous. Industries with a larger

MES are expected to have higher price-cost margins and thus a higher probability of firm survival. However, the MES should exert a positive influence on the hazard rate because the output of new firms is typically less than the MES level (Audretsch, 1991). The Herfindahl–Hirschman index (*herind00*) which measures market concentration is defined as the sum of the squares of the market shares of all firms within a particular industry at the 5-digit NACE level. The expected effect of market concentration is not clear-cut as, on the one hand, the price level is more likely to be elevated above the long-run average cost at the minimum efficient scale (MES) level of output in concentrated industries which may facilitate the survival of suboptimal scale firms which is what typical entrant firms are. On the other hand, firms in highly concentrated markets may be subject to fierce aggressive behaviour by rivals which may reduce their chances of survival. Finally, business survival in science based Pavitt clusters (*pavitt_1*, *pavitt_2*, *pavitt_3*) and in high tech classes (*tech1_2*) (OCSE taxonomy), where there are more R&D-intensive industries, is a priori unclear due to two contradicting effects. A high level of innovative activity in an industry may make entry more risky; consequently, the effect on new firm survival should be negative (Audretsch, 1995). Survival chances may, however, depend on a firm's ability to develop specific capabilities, which can be improved by investing in R&D.

Finally, let's turn to our main variables of interest: the province level variables. In addition to the agglomeration variables described above in detail we have also considered: *death rate* and *start up rate*, expected to be showing opposite signs (positive and negative) on exit risk. *Unemployment rates* is an indicator of local demand and should encourage the survival of new and old businesses hence should play a negative effect on the hazard risk. We also controlled for labour productivity at province level (*prod_man*) and for the size of manufacturing employment (*occ_man*). These two variables are also crucial to detect the resource endowment and the level of income of the province. Value added growth (*growth*) also was regarded as an indicator for the overall economic strength of the province in which a new business is located. However, in the final specification we did not consider the value added growth as it was highly correlated with other variables. We also checked whether survival chances were relatively low in industries which are characterized by high labor unit costs (*llaborcost*). Finally, we took into account that a high level of innovative activity in a region (e.g., measured by the share of patents and trademarks, *patent2*, *patent3*) could be stimulating a higher business survival due to a high level of regional spillovers. Finally, we also added the offshoring of province between 2002-2010 (*offshore_byprov*) which is measured as the ratio between the import of goods and the valued added in manufacturing. This indicator is a proxy for intermediate goods imports on local production. Hence, it is a possible measure of the propensity of each province to international delocalisation (Corò, 2013).

We performed a correlation matrix among all the variables and we carried out the variance inflation factor (VIF) in order to check for multicollinearity. As a rule of thumb, a variable whose VIF value is greater than 10 may deserve further investigation. Tolerance, defined as $1/VIF$, is used to check on the degree of collinearity. A tolerance value lower than 0.1 is comparable to a VIF of 10, which can be used as a cut off value. It means that above that threshold the variable could be considered as a linear combination of other independent variables (see Kutner *et al.*, 2004). This test show for all the variables that all values are lower than the cut off value except for the variable which measures related variety. Hence, except for this variable we may argue that there is absence of multicollinearity among the regressors considered.¹⁹

Table A.5. provides the descriptive statistics for the explanatory variables listed above and included in our estimates. We consider the whole sample and also samples disaggregated according to different types of global engagement (being foreign multinationals, domestic multinationals, non multinational domestic firms) to take into account the superior characteristics of globally engaged firms with respect to domestic non multinational firms. Heterogeneity across firms according to

¹⁹ The correlation table is not included for the sake of shortness but is available upon request.

their ownership status is strongly confirmed. Coherently with Helpman et al. (2004) model, more globalised firms are much larger and productive. Foreign firms outperform domestic firms, in productivity levels and in many other dimensions (higher sales, age, productivity, profit margin, solvency, lower collateral and indebtedness).

5. Estimation results

In table 2 and 3 below we focus only on the agglomeration variables results for the Probit and the Cox models, while in the appendix we also show the industry and the firm level coefficients (Tab. A.6 and A.7).

In table 2 column 2-5 we present the results of our Probit estimates for the whole sample and for three subsamples: domestic non multinationals, foreign multinationals, and domestic multinationals. We see that the role of agglomeration economies is quite different across the three firm categories. In particular, urbanization economies of the provinces, measured by the population density, is detrimental for survival of non multinational firms while they do not play a significant impact on firm mortality of multinational firms. The alternative categorical measure of urbanisation, the presence of urban LLS, shows that only foreign multinational firms tend to live longer if based in these locations. The result for the national firms is unexpected as the denser the province's population, the more the firms should be able to find facilities which help support their activities and resist negative events (i.e. training and education, infrastructures, credit). However, in the literature we also find mixed evidence on the role of urbanisation economies on firm survival: Cainelli *et al.* (2012) find a negative impact on firm death rates at province level while Fritsch *et al.* (2010) a positive one. The population density may capture congestion effects in the cities and might suggest that urban economies are not able to create virtuous effects in Italy. The indicator of economic density, the spatial agglomeration of firms by sector and province (spec), is again not significant for national firms and also foreign multinationals do not get any benefit in these densely agglomerated areas, but domestic multinationals show a reduction in their rate of mortality if located in such contexts.

The results about the variables related to the district areas are also quite different across firms types. Non multinational firms located in the same sectors of specialisation as the local district face a higher firm mortality. Also Italian multinationals located in provinces with a higher presence of employees in the district exhibit a higher risk of exiting. This might depend on higher competition for the ID local resources: the pressure on the local resources play a role in increasing firm mortality for domestic firms which might prevail on the other ID positive features highlighted in the literature. This results on Italian firms higher rate of mortality in the districts seems to confirm the evidence provided in some studies showing that in the last decade belonging to a IDs did not translate into a competitive advantage (Di Giacinto *et al.*, 2012). Cainelli *et al.* (2012) also find that the district degree of a province, taken as alone, does not seem to have any impact on the firm exit of its industries. Their conclusion is that IDs are not safer neither more dangerous.²⁰

However, we find that for foreign multinationals, conversely, the survival chances are higher in highly districtualised provinces.²¹ The opposite happens to domestic multinationals, maybe also due to the strong competition from foreign multinationals.

²⁰ Indeed, the dummy variable for districts gets significant, and with a negative sign, only when an interaction variable of the district with the intra-industry variety is added showing a positive and significant sign, suggesting that IDs may compensate those cases in which there is not a high variety but when variety is high the impact of district is detrimental.

²¹ Albeit, the results are quite ambiguous: foreign investors are less likely to survive if they are located in district provinces, however, they enjoy lower hazard of exit if located in provinces with a high level of districtualisation in terms of employment.

A third important and unexpected insight is given by the coefficients we find on the localisation economies proxied by the normalised Balassa index of specialization. We do not get any impact for multinationals, both domestic and foreign. However, the variable is highly significant for purely domestic firms, confirming the expectation that a higher sector specialization entails Marshallian externalities and productivity effects conducive to a reduction of firms' exit rate. Our results differ from the study of Fritsch *et al.* (2010) for Germany, which conclude that regional specialization in a certain industry has a negative effect on survival chances up to a certain point and are not significant after that, concluding that there is no evidence for localization economies on business survival. Our results are, however, partially in line with the findings for Italy by Cainelli *et al.* (2012) which show a significant U-shape relationship between the firm death rate in the Italian provinces over the retained period and their initial industry specialization. This is attributed to the fact that specializing in a certain sector may expose the firms of a local system to an excessive competitive pressure and to the risk of organizational inertia, and thus may increase their mortality. However, in our case there is no evidence of non linearity of the Balassa specialisation indicator. This suggests that controlling for firm level characteristics allows to clean out spurious relationships between specialisation and survival.

A fourth and important set of finding comes from the results of the variety indicators, i.e. of the Jacobs externalities measured by intra-industry variety, related variety (complementarities between industries at province level), and unrelated variety (diversification across sectors). We observe that for non multinational firms the internal variety of the industrial sectors of one province i.e. the intra-industry variety is able to highly reduce firm mortality. Hence, diversity of the activities within each industry may be considered a source of intra-industry knowledge spillovers which is valuable for firms. A positive impact on firm survival is also played by the unrelated variety of the whole province at the industry level i.e. the variety with respect to the other industries of the same province, which may be considered a force enabling local firms to pursue a portfolio strategy. However, the weighted sum of the two digit entropy (related variety at province level) does play a negative effect on firm survival of non multinationals firms.

The coefficient signs and the relevance of the variety measures for multinationals is suggesting quite different advantages: for foreign multinationals a higher intra-industry variety and related variety both reduce firm mortality, which might suggest the relevance of value chains as a determinant of FDI attraction. The presence of a higher unrelated variety is not significant.

For Italian multinationals a higher variety, both related and unrelated to do not appear significant and intra-industry variety even increases firm mortality.

Tab. 2. Probit and Heckman Probit estimates for all firms, domestic non multinationals, multinationals: focus on the results for the agglomeration variables

| | ALL SAMPLE | Domestic non multinational | Foreign multinationals | Domestic multinational | | Domestic non multinational Heckman's selection | Foreign multinationals Heckman's selection | Domestic multinational Heckman's selection |
|----------------------|----------------------------|----------------------------|------------------------|------------------------|-----------------|--|--|--|
| sll_urb | -0.0290 (0.0437) | -0.0277 (0.0439) | -21.23*** (-7.645) | 0.159 (0.275) | sll_urb | -0.0418 (0.0438) | -38.0186*** (4.637) | 0.5484 (0.4107) |
| pop_dens ity_ | 0.000128*** (0.0000270) | 0.000124*** (0.0000269) | 0.00563 (0.00993) | 0.000442 (0.000283) | pop_density | 0.0001*** (0.000) | -0.0005 (0.0051) | -0.0003 (0.0006) |
| spec | 0.00418 (0.0156) | 0.00663 (0.0152) | -0.0221 (0.0838) | -0.720*** (0.204) | spec | 0.0089 (0.0165) | -0.0972 (0.0795) | -1.6874*** (0.2653) |
| dist_sforzi | 0.0242 (0.0424) | 0.0252 (0.0424) | 12.13*** (-4.504) | -0.187 (0.398) | dist_sforzi | 0.0233 (0.0463) | 18.4952*** (1.936) | -0.7361* (0.4471) |
| dist_sett_s forzi | 0.0839** (0.0338) | 0.0852** (0.0336) | -0.215 (0.662) | 0.0445 (0.198) | dist_sett_sfor | 0.0909** (0.0391) | -0.1342 0.6605 | 0.099 0.1908 |
| ind_dist_s forzi | -0.00516 (0.0663) | -0.000907 (0.0655) | -19.68*** (-6.924) | 0.832*** (0.277) | ind_dist_sforzi | -0.0535 (0.0631) | -26.5231*** (3.512) | 1.2383*** (0.3524) |
| normalbal assa | -0.285*** (0.0668) | -0.283*** (0.0666) | -27.75 (26.90) | 0.125 (0.618) | normalbalassa | -0.2893*** (0.0703) | -40.105 (26.8531) | 1.5844*** (0.4897) |
| normbalas sa2 | -0.0940 (0.175) | -0.101 (0.177) | 57.18 (64.00) | 1.209 (-1.047) | normbalassa2 | -0.0145 (0.1851) | 84.9324 (68.2992) | 3.4266** (1.3483) |
| H | -0.116*** (0.0207) | -0.118*** (0.0215) | -0.333*** (0.123) | 0.158* (0.0908) | H | -0.1137*** (0.0225) | -0.2941 (0.19) | 0.2583** (0.1195) |
| un_var | -0.170** (0.0766) | -0.161** (0.0754) | 2.279 (-2.817) | -0.244 (0.620) | un_var | -0.1502* (0.0848) | 1.6523 (5.2064) | -0.0134 (0.669) |
| rel_var | 0.429*** (0.120) | 0.419*** (0.123) | -33.64*** (10.99) | 1.575 (-1.104) | rel_var | 0.3983*** (0.1235) | -47.8276*** (7.798) | 5.4530*** (1.1076) |
| _cons | -2.738*** | -2.784*** (-0.581) | . | . | _cons | -1.8170** (0.8045) | 15.0415*** (4.1917) | 49.1920*** (12.3999) |
| N | 554,312 | 543,714 | 3,108 | 7,490 | N | 435,270 | 2,679 | 7,017 |
| LI | -9335.3 | -9163.5 | -38.68 | -74.52 | LI | -40401.91 | -12726.57 | -25358.32 |
| | | | | | athrho | 0.4616*** (0.1206) | -0.6876** (0.3426) | -0.14419* (0.0733) |
| | | | | | Rho | 0.4314*** (0.0982) | -0.5964** (0.2207) | -0.1432* 0.0723936 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Huber–White sandwich estimator of variance. Standard errors are robust to heteroskedasticity and adjusted for clusters at firm level and at province level.

In all the regressions there are firm and industry level control variables, additional variables at province level and dummies for time (to capture business cycle), Pavitt sectors, technology dummy (OCSE), five geographical areas (North-East, North-West, Centre, South, Isles). The results for all the variables are in the Appendix table A.6.

Turning to the Cox model estimations, the results for the non multinational group confirm those in the probit model. The results for the foreign multinational group are also consistent with that of the probit model and confirm the non significance of sector specialization for this group, the relevance of within sector variety and of localising in a province with a high district intensity.

Some different findings emerge for the Italian multinationals which show in the Cox estimates a significant reduction of their exit hazard if located in provinces with a high sector specialization (although a too high specialization fail to reduce their exit hazard). Like in the probit estimates, they face an increase in firm mortality rates if located in IDs or in a province with a high related variety. Diversification across sectors instead appear significant for their survival.

TAB. 3. Estimation results of the Cox proportional hazard model for all firms, domestic non multinationals, multinationals: focus on the results for the agglomeration variables

| | All sample | Domestic non multinationals | Foreign multinationals | Domestic multinationals |
|-----------------|----------------------------|-----------------------------|------------------------|-------------------------|
| sll_urb | -0.0611 (0.123) | -0.0598 (0.123) | -3.648 (4.767) | 4.229* (2.333) |
| pop_density | 0.000400*** (0.0000826) | 0.000391*** (0.0000814) | 0.00107* (0.000599) | 0.00366** (0.00151) |
| spec | 0.00511 (0.0279) | 0.0103 (0.0281) | 0.0440 (0.0413) | -8.131*** (2.683) |
| dist_sforzi | 0.0944 (0.135) | 0.108 (0.135) | 8.459 (5.218) | -2.610 (2.039) |
| dist_sett_sfor | 0.235*** (0.0780) | 0.234*** (0.0779) | 0.376 (1.385) | 4.657*** (1.756) |
| ind_dist_sforzi | 0.0272 (0.196) | 0.0347 (0.195) | -1.401** (0.692) | 6.438** (3.205) |
| normalbalassa | -0.748*** (0.193) | -0.746*** (0.194) | -3.680 (5.753) | -6.976* (4.141) |
| normalbalassa2 | -0.326 (0.496) | -0.327 (0.503) | -24.98 (44.41) | -10.51 (7.841) |
| H | -0.280*** (0.0669) | -0.284*** (0.0670) | 0.148 (0.195) | -0.0475 (0.769) |
| un_var | -0.116 (0.204) | -0.0975 (0.204) | 0.905 (3.425) | -11.27*** (3.181) |
| rel_var | 0.688** (0.324) | 0.665** (0.329) | -15.50** (6.067) | 13.00** (5.134) |
| N | 554,312 | 543,714 | 3,108 | 7,490 |
| ll | -1.06E+04 | -1.04E+04 | -15.2843 | -14.1622 |

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are adjusted for clusters at firm level and at province level and adjusted for heteroskedasticity. Huber–White sandwich estimator of variance.

In all the regressions there are firm and industry level control variables, additional variables at province level and dummies for time (to capture business cycle), Pavitt sectors, technology dummy (OCSE), five geographical areas (North-East, North-West, Centre, South, Isles). The results for all the variables are in the Appendix table A.7.

In the appendix, we present the overall results of the Probit and the Cox model including the industry and the firm variables coefficients. We also considered separate estimates for the two different types of variety: unrelated and related variety. Hence, the variables of agglomeration related to variety, have been put in the estimates separately. In this way, we checked whether the high collinearity between these two variables of agglomeration is not going to affect the parameter estimates. We verified that this robustness exercise does not affect our results. Here, we do not present these tables for reasons of shortness.

Looking at the model with all the variables, a strong heterogeneity in firm exit behaviour across firm types also emerges with respect to the industry and firm level variables. For the national firms

the results we obtain for the industry and firm level variables are quite standard. They confirm that the probability of exit is lower for relatively larger businesses (in terms of sales classes), older, but up to a certain point (as we find a non linearity), more productive, with higher capital intensity, and profit margin and for establishments belonging to sector or provinces more export intensive while a higher share of FDI in the region or in the sector does affect negatively firm survival. Economies of scale deter firm survival for non multinationals, while lower competition (hence higher concentration) decrease the exit hazard. Firms in low medium low technology sectors get lower hazard rates than firms in medium and high tech sectors and firms in traditional and scale intensive sectors get lower exit risks with respect to the baseline category (science based sectors), while for firms in specialised suppliers sectors the coefficient is not significant. We also controlled for the start-up in the sector and the province, the manufacturing share of the province, the innovation rate of the province in terms of trademarks and patents registration, the unemployment rate, and get quite expected negative signs (but the variable for innovation measured by registration of patents is not significant), while a positive sign is found on the death rates. The dummy for the crisis years is positive and highly significant. The coefficient on the offshoring variable is negative albeit not significant.

With respect to this patterns of survival the multinational firms show quite interesting differences. Looking first at foreign firms, we observe quite surprisingly that size is not reducing firm exit on the contrary: being smaller, albeit above a certain threshold of sales, translate into higher survival prospects with respect to belonging to the highest sale class. Hence, foreign multinationals, if small, are more able to keep their ownership in Italy when delocalising part of their activity. We also observe that higher wages are a determinant of higher survival, meaning that even controlling for productivity these type of firms if paying higher wages are more likely to survive, maybe because in this way they are able to motivate workers, to reduce sindacalisation and to increase their persistence in the host economy. Three interesting results are that the crisis reduced firm exit for foreign firms, like also higher death rates and higher offshoring at province level. It appears that competition with other foreign investors determine higher exit rates. As for the variables for innovation while the registration of patents is significant that of trademarks is not significant. Besides, belonging to scale intensive sectors translate into lower exit risk than belonging to science based ones, while belonging to traditional and specialized suppliers sectors translate into higher exit risk than belonging to science based ones.

As for the Italian multinational firms, focusing on the most significant and specific results for this firm category, we observe that a higher age and a higher capital intensity increase firm exit like also higher labour cost. It is a peculiar result for domestic multinationals also that a higher presence of scale economies reduce firm exit, and a lower competition in the sector increases it. It is also worth noting that belonging to specialised sectors means higher exit rates with respect to science based ones.

6. Correction for sample selection with Heckman's selection correction of the exit model

We have splitted the sample into foreign multinational, domestic multinationals and domestic firms to take into account the possibility that various factors affect the probability of exiting of these firms categories differently. However, a problem in these estimates is that the sub-samples are non-random samples of all firms. Hence, as a robustness check, we estimated the exit models for each sub-sample correcting for sample selection by using the Heckman's maximum-likelihood probit selection correction model (endogenous switching regime model) (Tab. 2 and Tab. A.6).

In tab. 2 columns 6-8 and in tab. A.6, the results of the ordinary probit estimates on the sub-samples are compared with those controlling for sample selection. For our sub-samples, according to the

Wald's test, the independence of the exit and the selection equation is rejected at 1% risk. The ρ is significant and positive for the domestic non multinationals meaning that the probability of begin domestic firms and of exiting is correlated positively, while it is negative and significant for the foreign and domestic multinationals, which means that the probability of being foreign firms and of exiting are negatively correlated.

For the variables of interest in the paper, the results for the three sub-samples confirm that several factors considered in the model affect the probability of multinational firms exiting differently from the exit of domestic firms. Besides, for foreign multinationals and for domestic non multinationals, the estimation coefficients on the agglomeration variables for the sub-samples, corrected for selection bias (tab. 2), totally support previous estimates without selection correction, with respect to the significance and magnitude of the estimated coefficients. However, we get different results for domestic multinationals, for which the sector specialization of the province and the intra-sectoral variety both produce a significantly higher exit risk.

In addition to this, for the remaining variables in the model, the correction for sample selection give us quite important changes for some results. For the domestic multinationals the coefficient of productivity and capital intensity loose significance. More importantly, the competition effect of FDI on domestic and on foreign firms which increased firm exit disappear in these estimates and the coefficient on these variables become insignificant. Other major changes are found on the variable for innovation measured by patents registration which shows a positive and significant coefficient for the multinationals quite difficult to explain. It is also interesting to observe that now while for foreign multinationals belonging to low and medium low tech sectors increase firm exit it, the same variable has a negative and significant coefficient for the domestic multinationals. Besides, a higher start up rate does not increase survival of domestic multinationals.

The selection equation in the first stage of Heckman's probit selection correction model (not shown for the sake of shortness) indicates that the probability of being a foreign MNEs is inversely related to age, albeit not linearly, while positively to size, wages, presence of high FDI in the region, and high firms death rates in the province, and it is higher in science based sectors and in the North East area. As for the probability of being a domestic multinational, this is positively related to age, capital intensity, profit margin, scale economies, but negatively to productivity. Finally, the probability of being a domestic non multinational is instead positively related to size, productivity, and to belonging to traditional and scale intensity sectors, but negatively related to capital intensity, profit margin, scale economies, export intensity, FDI intensity, death rates in the province, rate of innovation measured by patents.

7. Conclusions

Investigation of local determinants is crucial in the analysis of firm survival. The specificities of the space in which firms are located are strongly interconnected to the sector and firm specific factors and this affect differently the survival rate of the firms in a certain location. Our empirical analysis has the advantage of being applied to a large panel of firms and stratified by firm characteristics, Italian provinces, industrial sectors, and by firm ownership over a long span of time (2002-2010).

The main argument we tested is how agglomeration economies, in addition to industry and firm specific determinants, may provide an explanation for firm mortality and the different impact on multinational and non multinational firms. With respect to these key questions of our analysis, the role of local factors in shaping heterogeneous firm survival, we got results quite consistent with our expectations, based on the theoretical arguments illustrated.

The predictions on the effect of urbanisation economies were quite mixed. We also did not have

clearcut predictions on the role of the clustering of activities in a district on survival. However, we mostly expected a positive impact of both specialisation and variety on firm survival, although with the hypothesis of non linear effects of specialisation due to overspecialisation and a more positive impact of unrelated variety with respect to the effects of related variety. We also expected a different impact of all the local determinants of firm survival for multinational firms with respect to survival non multinational firms.

This latter prediction was strongly confirmed by our results. We did find quite different patterns of exit across firm types with respect to the different sources of external economies and, specifically, we did find quite different results for foreign multinationals. Starting from urbanisation economies, for domestic firms and for Italian multinationals we find no evidence of a lower exit risk in agglomerated urban areas, measured by the density of population. Actually population density affect positively firm exit. Hence, unlike in Dumais *et al.* (2002) who discovered that closure is less likely in those regions that belong to the geographic centres of an industry and this tend to increase geographic concentration, conversely, our results suggest that geographically urban concentrated competition is not conducive to increased firm survival of Italian firms. Hence, in Italian manufacturing industries survival chances are forces that should tend to reduce geographical concentration. However, this result is not common to the foreign multinationals, conversely a lower exit risk is found for foreign firms located in urban local labour system.

We also do not find evidence of a positive district effect on survival of domestic firms both multinational and non. However, in the case of foreign multinationals we find evidence of a reduction in exit due to a higher industrial district degree of the province even controlling for the superior characteristics of these firm, and for other industry and province variables. Hence, this seem to support our hypothesis that foreign firms having a larger global network and being less dependent on credit restrictions, local market for supply and demand, have also the ability to better exploit local external economies in the industrial clusters and this translate into a higher longevity.

Furthermore, our results show that regional industry specialization is still enhancing the survival of firms in a respective industry. Hence, our results confirm the standard relevance of the core specialization of the Italian local systems for Italian firms. However, while specialisation economies are a factor enhancing survival of all Italian firms, they are not significant for foreign multinational firms. This is not surprising if we consider that industry specialisation of Italy does not lie in the sectors of specialisation of multinationals.

Diversification economies at province level significantly increase firm duration for Italian firms if they are across industries and not within industries, i.e. if they involve unrelated variety, while for foreign multinationals there is some evidence of a beneficial effect from intra-industry diversification more than diversification across sectors. We expected that unrelated variety, allowing higher market and product diversification should be more able to enhance firm survival by reducing risk because this allows portfolio strategies of market and production diversification. We did find evidence of this for non multinational firms which especially benefit from intersectoral variety in the province. We also may interpret that for foreign multinationals this diversification is less important for various reasons mentioned above: they sell on different markets with different business cycle condition and this can be a form of risk diversification. Besides, MNEs have access to both internal and international financial markets, which allows them to diversify also their sources of financing and the associated risks. Furthermore, they are also less linked to the host country by means of input sourcing and for their sales. Conversely the significant impact of intra-industry variety may be interpreted as a proof of the relevance of value chains as a determinant of FDI attraction.

Our findings have interesting implications for the assessment of location-based policies. The role played by intra-industry and the extra-industry (i.e. unrelated) variety of the specialization patterns of the Italian provinces call for an important role of industrial policies aiming at extending and

diversifying the economic activities of a local system. Besides, since concentration of activities in urbanized contexts do not impact positively maybe due to congestion and transition costs which offset other benefits, this provides a strong support for extending infrastructural policies beyond urban areas as an important tool for promoting the firms' longevity by reducing the costs of polarisation. A further important result for its policy implications concerns the firm mortality impact of the industrial district degree of the provinces which host them. Due to their negative effect on domestic firms' mortality the question rise about whether IDs have lost the comparative advantage they had in the past and whether this might depend on the fact that their competitive advantage has not evolved towards a model based on innovation and knowledge creation rather than on cost reduction.

Further research should focus on a deeper investigation of the impact of agglomeration economies by firm size, by sub- periods (2002-2007; 2008-2011) and by Pavitt or technology sectors. The application of multilevel models to exploit the potential of the data when variables are related to different dimensions (firm, industry, province) would also further enhance our understanding. These models allow to precisely measure the contribution to the variance the data provide at the different level of aggregation i.e. to better tackle the issue of the hierarchical structure in the data (Snijders and Bosker, 2012).

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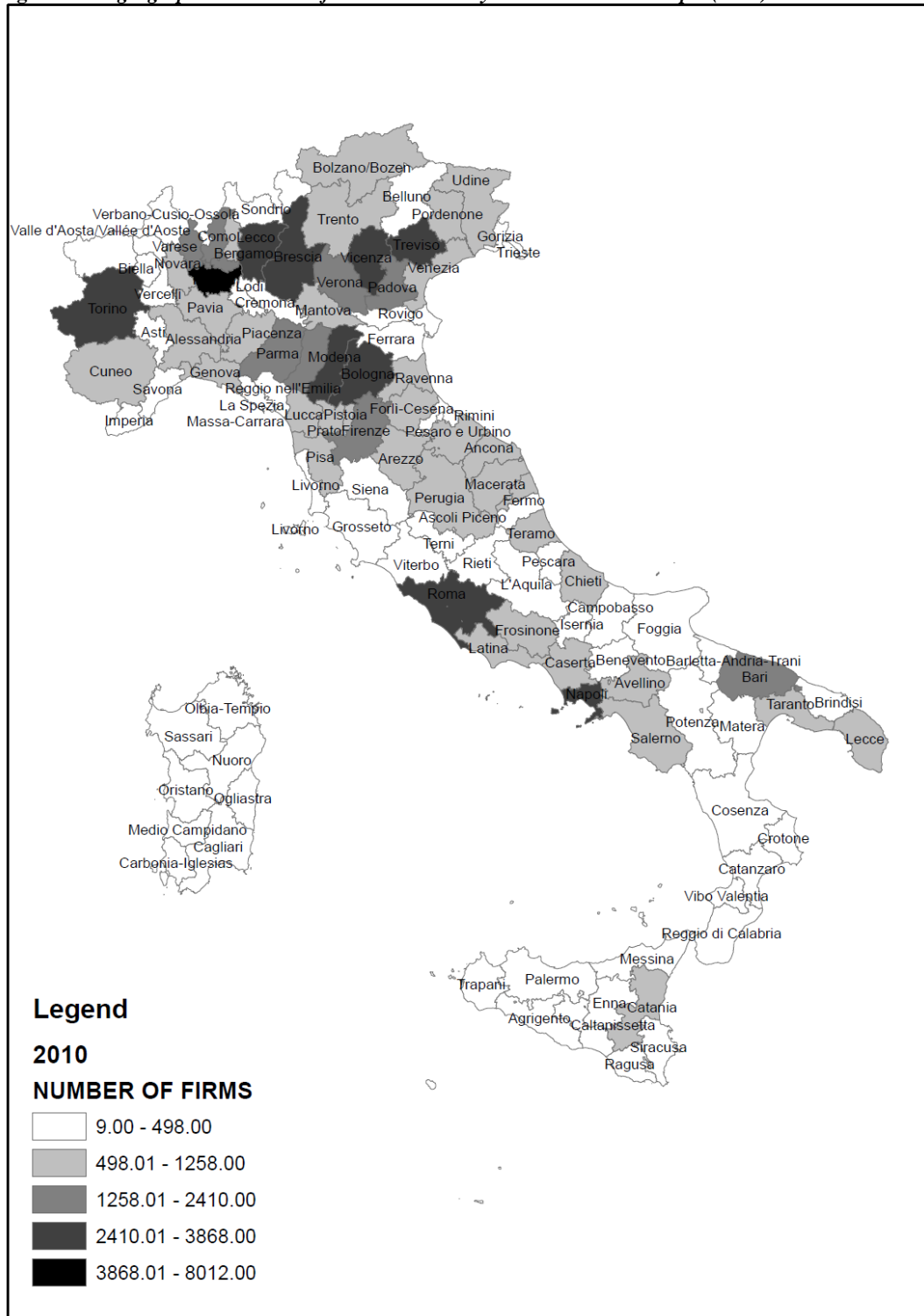
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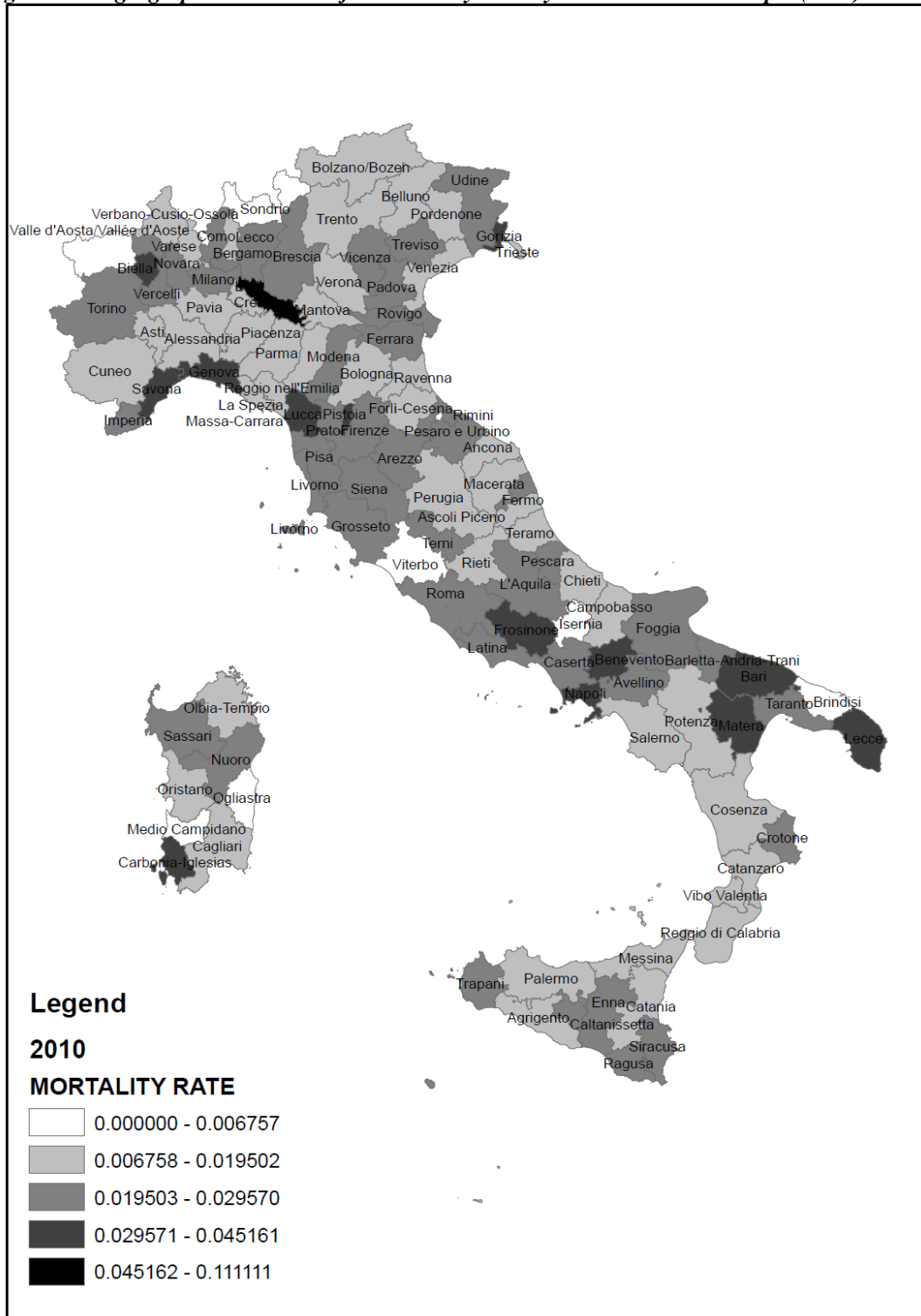
Appendix A.

Fig. A.1. The geographic dimension: firm localisation by Provinces in our sample (2010)



Note: Data have been divided into 5 classes each corresponding to the 20 per cent of the distribution.
Source: Own elaboration on Aida.

Fig. A.2. The geographic dimension: firm mortality rates by Provinces in our sample (2010)



Note: Data have been divided into 5 classes each corresponding to the 20 per cent of the distribution.
Source: Own elaboration on Aida.

Fig. A.3. Correlation between our measures of agglomeration and firm mortality rates by Provinces (2010; mortality rates are expressed in log)

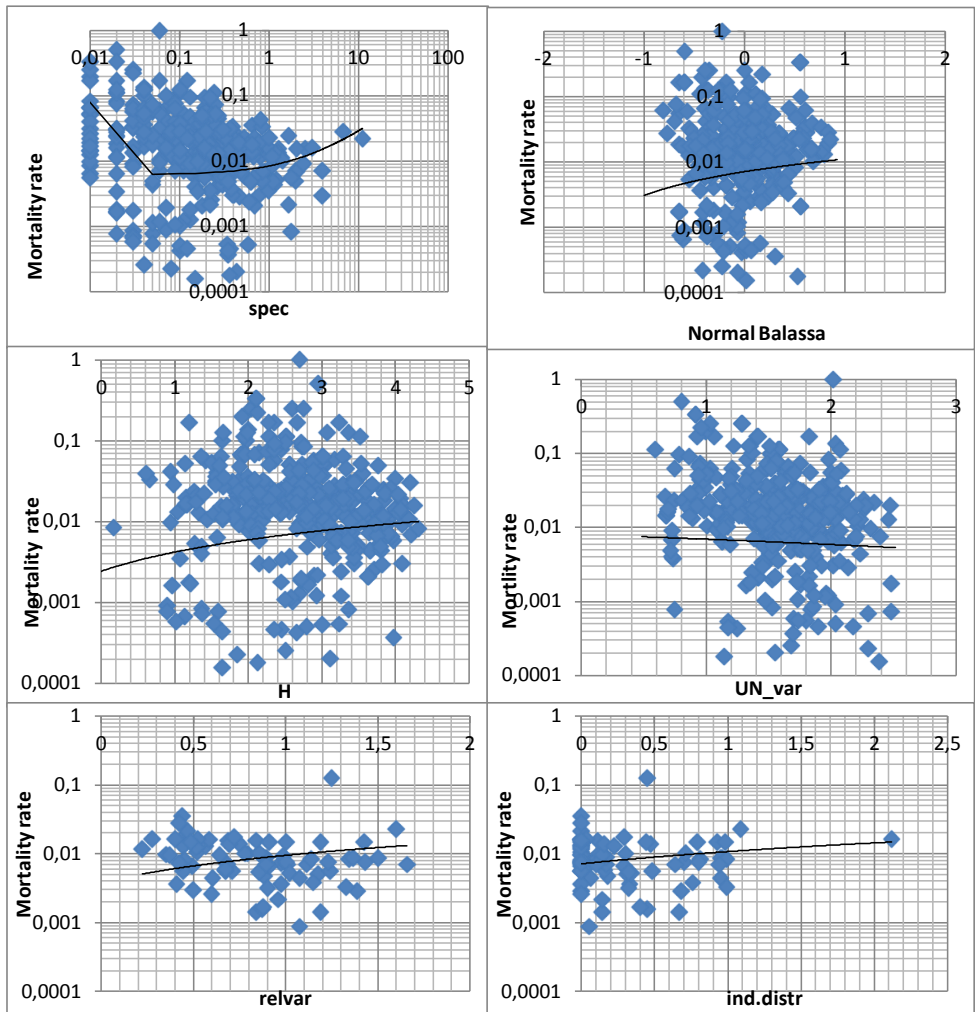


Table A.1. Number of firms in our AIDA sample by year

| <i>Year</i> | <i>a.v.</i> | <i>%</i> |
|-------------|-------------|----------|
| 2002 | 66,808 | 8.99 |
| 2003 | 70,242 | 9.45 |
| 2004 | 74,155 | 9.98 |
| 2005 | 78,392 | 10.55 |
| 2006 | 83,060 | 11.18 |
| 2007 | 87,877 | 11.83 |
| 2008 | 92,053 | 12.39 |
| 2009 | 94,793 | 12.76 |
| 2010 | 95,559 | 12.86 |
| Total | 742,939 | 100 |

Tab. A.2. Description of our sample by region and comparison with Istat data (2010)

| | total AIDA sample firms (1) | % | total ISTAT firms (2) | % | Difference 1-2 | z - statistics | P>z |
|-----------------------|-----------------------------|-------|-----------------------|-------|----------------|----------------|--------|
| Abruzzo | 1,888 | 1.98 | 4,872 | 2.08 | 0.010 | 0.05 | 0.960 |
| Basilicata | 480 | 0.5 | 1,290 | 0.55 | 0.0005 | 0.05 | 0.960 |
| Calabria | 1,037 | 1.09 | 3,421 | 1.46 | 0.0109 | 0.23 | 0.815 |
| Campania | 5,875 | 6.15 | 14,902 | 6.36 | 0.0342 | 0.06 | 0.950 |
| Emilia-Romagna | 10,956 | 11.47 | 24,730 | 10.56 | -0.0091 | -0.21 | 0.837 |
| Friuli-Venezia Giulia | 2,240 | 2.34 | 5,351 | 2.28 | -0.0005 | -0.03 | 0.979 |
| Lazio | 5,545 | 5.8 | 12,011 | 5.13 | -0.0067 | -0.21 | 0.835 |
| Liguria | 1,415 | 1.48 | 4,298 | 1.84 | 0.0035 | 0.20 | 0.844 |
| Lombardia | 24,075 | 25.19 | 54,834 | 23.41 | -0.0177 | -0.29 | 0.770 |
| Marche | 3,791 | 3.97 | 9,823 | 4.19 | 0.0022 | 0.08 | 0.936 |
| Molise | 295 | 0.31 | 821 | 0.35 | 0.0004 | 0.05 | 0.960 |
| Piemonte | 7,137 | 7.47 | 18,347 | 7.83 | 0.0364 | 0.10 | 0.923 |
| Puglia | 3,689 | 3.86 | 9,856 | 4.21 | 0.0034 | 0.13 | 0.900 |
| Sardegna | 1,204 | 1.26 | 3,582 | 1.53 | 0.0027 | 0.16 | 0.871 |
| Sicilia | 2,656 | 2.78 | 8,323 | 3.55 | 0.0077 | 0.31 | 0.755 |
| Toscana | 8,429 | 8.82 | 20,937 | 8.94 | 0.0012 | 0.03 | 0.976 |
| Trentino-Alto Adige | 1,250 | 1.31 | 3,404 | 1.45 | 0.0014 | 0.09 | 0.931 |
| Umbria | 1,287 | 1.35 | 3,930 | 1.68 | 0.0033 | 0.19 | 0.849 |
| Vallée d'Aoste | 118 | 0.12 | 300 | 0.13 | 0.000 | 0.02 | 0.9987 |
| Veneto | 12,192 | 12.76 | 29,156 | 12.45 | -0.0031 | 0.07 | 0.947 |
| Total | 95,559 | 100 | 234,188 | 100 | | | |

Note: We tested by the prtest of the difference in proportions the hypothesis that the two groups are not different in their distribution using $\alpha = .05$. Then we compute the approximate 95% c.i. for the two proportions $p^1 - p^2$. Both the z value and the confidence interval indicated we should not reject the null for all the regions: the two groups do not significantly differ in their distribution.

Tab. A.3. Description of our sample by ATECO 2007 and ownership (2010)

| Ateco 2007 | Domestic non Multinationals | | Foreign Multinationals | | Domestic Multinationals | | Total AIDA | | Foreign Multinational ISTAT | z - statistics | P>z |
|--|-----------------------------|--------|------------------------|--------|-------------------------|--------|------------|---------|-----------------------------|----------------|----------|
| | | | | | | | | | | | |
| 10-11-12: Food, Beverage and Tobacco | 58,017 | 7.90% | 205 | 5.60% | 486 | 5.70% | 51,120 | 7.90% | | | |
| | | 98.82% | | 0.35% | | 0.83% | | 100.00% | 0.30% | 0.06 | 0.95 |
| 13: Textile | 34,745 | 4.80% | 70 | 1.90% | 451 | 5.30% | 35,266 | 4.70% | | | |
| | | 98.52% | | 0.20% | | 1.28% | | 100.00% | 0.40% | -0.26 | 0.796 |
| 14: Clothing, Leather And Fur | 56,281 | 7.70% | 137 | 3.73% | 701 | 8.18% | 26,636 | 7.69% | | | |
| | | 98.53% | | 0.24% | | 1.23% | | 100.00% | 0.30% | -0.08 | 0.935 |
| 16: Wood Products (Excl. Furniture) | 28,936 | 4.00% | 23 | 0.60% | 162 | 1.90% | 29,121 | 3.90% | | | |
| | | 99.36% | | 0.08% | | 0.56% | | 100.00% | 0.10% | -0.05 | 0.962 |
| 17: Paper | 14,200 | 1.90% | 64 | 1.70% | 131 | 1.50% | 14,395 | 1.90% | | | |
| | | 98.65% | | 0.44% | | 0.91% | | 100.00% | 1.40% | -0.71 | 0.477 |
| 18: Printing | 33,002 | 4.50% | 20 | 0.50% | 101 | 1.20% | 33,123 | 4.50% | | | |
| | | 99.63% | | 0.06% | | 0.30% | | 100.00% | 0.30% | -0.4 | 0.689 |
| 19: Coke And Oil Products | 1,835 | 0.30% | 16 | 0.40% | 34 | 0.40% | 1,885 | 0.30% | | | |
| | | 97.35% | | 0.85% | | 1.80% | | 100.00% | 5.50% | -1.88 | 0.061* |
| 20: Chemicals | 20,847 | 2.90% | 403 | 11.00% | 520 | 6.10% | 21,770 | 2.90% | | | |
| | | 95.76% | | 1.85% | | 2.39% | | 100.00% | 5.70% | -1.43 | 0.153 |
| 21: Pharmaceuticals | 3,299 | 0.50% | 203 | 5.50% | 128 | 1.50% | 3,630 | 0.50% | | | |
| | | 90.88% | | 5.59% | | 3.53% | | 100.00% | 23.70% | -3.62 | 0.000*** |
| 22: Rubber And Plastic | 20,586 | 2.80% | 124 | 3.40% | 351 | 4.10% | 21,061 | 2.80% | | | |
| | | 97.74% | | 0.59% | | 1.67% | | 100.00% | 1.70% | -0.74 | 0.461 |
| 23: Non Metallic Minerals Products | 40,069 | 5.50% | 106 | 2.90% | 333 | 3.90% | 40,508 | 5.50% | | | |
| | | 98.92% | | 0.26% | | 0.82% | | 100.00% | 0.50% | -0.28 | 0.783 |
| 24: Metallurgic | 11,005 | 1.50% | 86 | 2.30% | 238 | 2.80% | 11,329 | 1.50% | | | |
| | | 97.14% | | 0.76% | | 2.10% | | 100.00% | 2.10% | -0.8 | 0.425 |
| 25: Metal Products (Excl. Machineries & Tools) | 180,748 | 24.70% | 440 | 12.00% | 1,265 | 14.80% | 182,453 | 24.60% | | | |
| | | 99.07% | | 0.24% | | 0.69% | | 100.00% | 0.40% | -0.2 | 0.841 |
| 26: Computer, Electronics, Optical, Medical, Checking Instr. | 29,740 | 4.10% | 331 | 9.00% | 484 | 5.60% | 30,555 | 4.10% | | | |
| | | 97.33% | | 1.08% | | 1.58% | | 100.00% | 2.50% | -0.76 | 0.449 |
| 27: Electrical and non Electrical Goods | 31,684 | 4.30% | 292 | 7.90% | 642 | 7.50% | 32,618 | 4.40% | | | |
| | | 97.14% | | 0.90% | | 1.97% | | 100.00% | 1.80% | -0.55 | 0.581 |
| 28: Machineries | 78,289 | 10.70% | 686 | 18.70% | 1,608 | 18.80% | 80,583 | 10.80% | | | |
| | | 97.15% | | 0.85% | | 2.00% | | 100.00% | 2.10% | -0.73 | 0.463 |
| 29: Autovehicles | 12,111 | 1.70% | 179 | 4.90% | 243 | 2.80% | 12,533 | 1.70% | | | |

| | | | | | | | | | | | |
|-------------------------------|---------|--------|-------|--------|-------|--------|---------|--------|-------|-------|-------|
| | 96.63% | | 1.43% | | 1.94% | | 100.00% | | 5.20% | -1.49 | 0.136 |
| 30: Other Transport Goods | 11,823 | 1.60% | 75 | 2.00% | 153 | 1.80% | 12,051 | 1.60% | | | |
| | 98.11% | | 0.62% | | 1.27% | | 100.00% | | 2.10% | -0.9 | 0.366 |
| 31: Furniture | 15,616 | 2.10% | 23 | 0.60% | 110 | 1.30% | 15,749 | 2.10% | | | |
| | 99.16% | | 0.15% | | 0.70% | | 100.00% | | 0.30% | -0.22 | 0.823 |
| 32: Other Manufacturing Goods | 24,414 | 3.30% | 76 | 2.10% | 277 | 3.20% | 24,767 | 3.30% | | | |
| | 98.57% | | 0.31% | | 1.12% | | 100.00% | | 0.30% | 0.01 | 0.99 |
| 33: Repairing. Maintenance | 23,448 | 3.20% | 117 | 3.20% | 150 | 1.80% | 23,715 | 3.20% | | | |
| | 98.87% | | 0.49% | | 0.63% | | 100.00% | | 0.40% | 0.1 | 0.924 |
| Total | 730,695 | 100.0% | 3,676 | 100.0% | 8,568 | 100.0% | 742,939 | 100.0% | | | |
| | 98.35% | | 0.49% | | 1.15% | | 100.00% | | 0.70% | -0.19 | 0.847 |

Note: We tested by the ptest of the difference in proportions the hypothesis that the two groups differ in their distribution using $\alpha = .05$. Then we compute the approximate 95% c.i. for the two proportions $p^1 - p^2$. Both the z value and the confidence interval indicate we should not reject the null; the two groups do not significantly differ in their distribution. Only for Coke and Pharmaceuticals we reject the null hypotheses and the difference is significant at 10% and 1% respectively.

Table A.4. Description of our firm, industry and province level variables

| CATEGORY | VARIABLES | DESCRIPTION | SOURCE | Expected Relationship with firm failure risk |
|----------------------------------|------------------|---|--------|--|
| FIRM LEVEL COVARIATES | | | | |
| | SIZE | Firm size measured by sales. | AIDA | - |
| | SIZE CLASSES | Dummy for 4 size classes based on sales: ricavi1=sales below 25th percentile; ricavi2=from 25 to50th percentile; ricavi3=sales from 50 to 75 th percentile; ricavi4=sales more than 75 th percentile. | | |
| | AGE | Firm age measured by the number of years since establishment. | AIDA | - |
| | PRODUCTIVITY | Firm productivity measured by value added per employee. | AIDA | - |
| | WAGE | Ratio between total personnel cost and total employment. | AIDA | - |
| | CAPINTENSITY | Real capital stock on employees. | AIDA | - |
| | PROFIT MARGIN | Pre tax profit margin. Proxy for mark up. | AIDA | - |
| INTERNATIONALISATION VARIABLES | OUTFDI | Domestic multinational ownership dummy that takes on the value 1 if the firm is an Italian owned-MNE. 0 otherwise. | AIDA | +/- |
| | INWFDI | Foreign ownership dummy that takes on the value 1 if the firm is foreign-owned. 0 otherwise. | AIDA | +/- |
| INDUSTRY LEVEL COVARIATES | | | | |
| | EXPSHARE | Ratio of 3 digit Ateco 2007 industry j's total exports over total output in year t. | ISTAT | +/- |
| | FDI SHARE sector | Val_prod_ind_foreign /val_prod_ind_tot | ISTAT | +/- |
| | FDI SHARE region | Val_prod_ind_for/val_prod_ind_totregional | ISTAT | +/- |
| | MES | Minimum efficient scale of the industry measured as the ratio of firms' sales above the average sales for the industry to total industry sales (Comanor and Wilson 1967). | AIDA | +/- |
| | HERF | Herfindahl index of turnover by 2 digit Ateco. a proxy for the level of concentration within the sector built as the sum of the | AIDA | +/- |

| | | | |
|----------------------------------|---|-----------------------------------|-----|
| | squares of the turnover of all firms within a particular industry at the 2-digit Ateco level. | | |
| TECH CLASS | Technology macro sector dummies (TECH CLASS LOW for firms belonging to low and medium-low technology sectors and TECH CLASS HIGH for firms belonging to medium-high and high technology sectors (OECD taxonomy). | OECD | +/- |
| PAVITT CLUSTERS | Dummies for Pavitt clusters: Pavitt 1=Traditional; Pavitt 2=Specialised suppliers; Pavitt 3= Scale based; Pavitt 4= Science based. | | +/- |
| ATECO SECTORS | 2 digit Ateco 1991 and 2 digit Ateco 2007 classification dummies.. | ISTAT | |
| PROVINCE LEVEL COVARIATES | | | |
| Death rate | Firms exited on total active firms (2002-2010; Province, ISTAT ateco91 2 digit) | | + |
| Startup rate | Firms registered on total active firms (2002-2010; Province, ISTAT ateco91 2 digit) | | - |
| Occ Man_Share | ULA_MAN/ULA | ISTAT | - |
| Unemployment rate | Ratio of people searching for a job on labour force (in %) 2002-2010 | ISTAT | - |
| Offshore_byprov | Offshoring measured as the ratio between the import of goods and the valued added in manufacturing | ISTAT | +/- |
| Growth | Manufacturing value added (VA-MAN) growth =(VA_MAN-VA_MAN(-1))/VA_MAN(-1) (2002-2010) | ISTAT | - |
| Prod_Man | Value added per employee (000 euros current prices) 2002-2010 | ISTAT | - |
| Patent2 | Registered trademarks net of renewed ones per active firm (MARCHI_TOT-MARCHI_RIN)*1000/ATTTOT (2011) | Ufficio Italiano Brevetti (2011) | +/- |
| Patent3 | Patents per active firm (BREV_EPO*1000/ATTTOT) (2002-2009) | Patent Italian Office (2011) | +/- |
| SII_urb | Dummy for provinces with at least a Urban Local Labour System (2002-2010) according to ISTAT definition of urban labour system: a local labour system with a density of economic activities (employees per square km) above the national median. | ISTAT | |
| Population density | Number of inhabitants per squared kms (province. 2002-2009) | ISTAT | +/- |
| Spec | Total active firms/province area in squared km (Province, ateco91 2 digit, 2002-2010) | ISTAT | +/- |
| Normal_Balassa | industry specialization (Balassa index of sector i ateco91 2 digit and province s) is calculated as follows: $IS_{jk} = \frac{\left(\frac{L_{j,k}}{\sum_k L_{j,k}} - 2001 \right)}{\left(\frac{\sum_j L_{j,k}}{\sum_{j,k} L_{j,k}} - 2001 \right)}$ | ISTAT | +/- |
| | where $L_{j,k}$ represents employment in industry j in province k, $\sum_k L_{j,k}$ represents total employment in industry j in Italy, $\sum_j L_{j,k}$ represents total employment in in k province and $\sum_{j,k} L_{j,k}$ represents total employment in Italy. The standardised IS is used in the regressions and is constrained within the interval (-1,+1) by taking $(IS_{j,k} - 1)/(IS_{j,k} + 1)$. (Paci and Usai, 2000; Bronzini, 2007). | | |
| Ind_dist_Sforzi | Employment share in industrial districts in 2001 where employees in the districts are the employees in the sectors of specialisation j of each Local Labour System belonging to province k qualified as district in the Sforzi-Istat algorithm | ISTAT | +/- |
| Dist_Sforzi | Dummy for firms belonging to Sforzi Industrial district. | ISTAT | +/- |
| Dist_sett_Sforzi | Dummy for firms belonging to the main sector of specialisation of the district. | ISTAT | +/- |

| | | | |
|---------|--|-------|---|
| H | $-\sum_{g \in K_j} \frac{p_{g,k,2001}}{P_{j,k,2001}} \log_2 \left(\frac{p_{g,k,2001}}{P_{j,k,2001}} \right)$ | ISTAT | - |
| | Index of intra industry variety (Ateco91 2 digit e 5 digit) see Cainelli et al.. 2012 (Entropy of the two-digit sector j in province k in 2001 ($H_{j,k,2001}$), where $p_{g,k,2001}$ is the share of workers employed in the five-digit sector g in province k on the total number of workers in province k and $P_{j,k,2001}(=\sum_{g \in K_j} p_{g,k,2001})$ is the same fraction computed with respect to the two-digit sector j, which the sub-sector g belongs to. | | |
| un_var | Entropy index of unrelated variety (ateco91 2 digit) following Cainelli <i>et al.</i> . 2012 Entropy computed at the two digit level in province k for sectors μ different from j in 2001 | ISTAT | - |
| | $-\sum_{\mu \neq j} P_{\mu,k,2001} \log_2 P_{\mu,k,2001}$ | | |
| rel_var | Entropy index of related variety (Ateco91 2 digit e 5 digit) see Cainelli <i>et al.</i> . 2012 Weighted sum of the entropy computed for each two-digit sector in province k during 2001. | ISTAT | - |
| | $-\sum_j P_{j,k,2001} H_{j,k,2001}$ | | |

Tab. A.5. Descriptive statistics

| Variable | Domestic non Multinationals | | | Domestic Multinationals | | | Foreign Multinationals | | |
|-----------------------|-----------------------------|----------|-----------|-------------------------|----------|-----------|------------------------|----------|-----------|
| | Obs | Mean | Std. Dev. | Obs | Mean | Std. Dev. | Obs | Mean | Std. Dev. |
| exitpro2 | 543,714 | 0 | 0.05 | 7,490 | 0 | 0.05 | 3,108 | 0 | 0.06 |
| age | 543,714 | 22.86 | 19.19 | 7,490 | 16.14 | 13.59 | 3,108 | 26,99 | 17.45 |
| ricavi | 543,714 | 6,08E+06 | 3,22E+07 | 7,490 | 6,42E+07 | 1,40E+08 | 3,108 | 7,64E+07 | 1,95E+08 |
| ricavi4_1 | 543,714 | 0.24 | 0.43 | 7,490 | 0.01 | 0.11 | 3,108 | 0.02 | 0.15 |
| ricavi4_2 | 543,714 | 0.26 | 0.44 | 7,490 | 0.02 | 0.15 | 3,108 | 0.04 | 0.2 |
| ricavi4_3 | 543,714 | 0.26 | 0.44 | 7,490 | 0.07 | 0.25 | 3,108 | 0.09 | 0.29 |
| ricavi4_4 | 543,714 | 0.25 | 0.43 | 7,490 | 0.9 | 0.3 | 3,108 | 0.85 | 0.36 |
| area5_1 | 543,714 | 0.36 | 0.48 | 7,490 | 0.44 | 0.5 | 3,108 | 0.56 | 0.5 |
| area5_2 | 543,714 | 0.29 | 0.45 | 7,490 | 0.4 | 0.49 | 3,108 | 0.28 | 0.45 |
| area5_3 | 543,714 | 0.2 | 0.4 | 7,490 | 0.12 | 0.32 | 3,108 | 0.12 | 0.33 |
| area5_4 | 543,714 | 0.12 | 0.32 | 7,490 | 0.03 | 0.18 | 3,108 | 0.04 | 0.19 |
| area5_5 | 543,714 | 4.00E-02 | 0.19 | 7,490 | 0.01 | 9.00E-02 | 3,108 | 0.00E+00 | 6.00E-02 |
| val_prod | 543,714 | 6.27E+06 | 3.32E+07 | 7,490 | 6.64E+07 | 1.46E+08 | 3,108 | 7.98E+07 | 2.03E+08 |
| val_agg_reale | 543,714 | 14.552 | 77.296 | 7,490 | 1.60E+05 | 3.73E+05 | 3,108 | 1.82E+05 | 4.75E+05 |
| dipendenti | 543,714 | 3,017 | 214 | 7,490 | 293.14 | 1008 | 3,108 | 256 | 722 |
| productivity | 543,714 | 638 | 2,007 | 7,490 | 798.86 | 2467 | 3,108 | 1072 | 5499 |
| costi_pers_real | 543,714 | 8,128 | 42,077 | 7,490 | 77,432 | 1.77E+05 | 3,108 | 9.00E+04 | 2.38E+05 |
| imm_mat_real | 543,714 | 13,686 | 78,770 | 7,490 | 1.41E+05 | 3.25E+05 | 3,108 | 1.17E+05 | 3.08E+05 |
| capintensity | 543,714 | 720 | 4,300 | 7,490 | 878 | 3,967 | 3,108 | 2,407 | 33,722 |
| multinaz | 543,714 | 0 | 0 | 7,490 | 1 | 0 | 3,108 | 0 | 0 |
| foreign | 543,714 | 0 | 0 | 7,490 | 0 | 0 | 3,108 | 1 | 0 |
| pre_tax_profit_margin | 543,714 | 3.22 | 16.26 | 7,490 | 2.97 | 28.65 | 3,108 | 3.84 | 44.19 |
| mes | 543,714 | 0.79 | 0.03 | 7,490 | 0.8 | 0.03 | 3,108 | 0.8 | 0.03 |
| herind00 | 543,714 | 0.68 | 0.86 | 7,490 | 0.67 | 0.79 | 3,108 | 0.91 | 1.06 |
| exp_ateco07share | 543,714 | 1.03 | 0.83 | 7,490 | 1.13 | 0.74 | 3,108 | 1.17 | 0.85 |

| | | | | | | | | | |
|--------------------|---------|--------|---------|-------|--------|--------|-------|--------|--------|
| FDI_share_bymarket | 543,714 | 0.04 | 0.04 | 7,490 | 0.06 | 0.06 | 3,108 | 0.08 | 0.07 |
| FDI_share_byregion | 543,714 | 0.06 | 0.05 | 7,490 | 0.07 | 0.06 | 3,108 | 0.08 | 0.06 |
| tech1_1 | 543,714 | 0.7 | 0.46 | 7,490 | 0.53 | 0.5 | 3,108 | 0.36 | 0.48 |
| tech1_2 | 543,714 | 0.3 | 0.46 | 7,490 | 0.47 | 0.5 | 3,108 | 0.64 | 0.48 |
| pavitt_1 | 543,714 | 0.44 | 0.5 | 7,490 | 0.36 | 0.48 | 3,108 | 0.22 | 0.41 |
| pavitt_2 | 543,714 | 0.18 | 0.38 | 7,490 | 0.27 | 0.44 | 3,108 | 0.29 | 0.45 |
| pavitt_3 | 543,714 | 0.32 | 0.47 | 7,490 | 0.28 | 0.45 | 3,108 | 0.33 | 0.47 |
| pavitt_4 | 543,714 | 0.06 | 0.23 | 7,490 | 0.08 | 0.28 | 3,108 | 0.16 | 0.37 |
| death_rate | 543,714 | 0.07 | 0.03 | 7,490 | 0.07 | 0.03 | 3,108 | 0.07 | 0.03 |
| startup | 543,714 | 0.04 | 0.02 | 7,490 | 0.04 | 0.02 | 3,108 | 0.03 | 0.02 |
| occ_man_share | 543,714 | 0.25 | 0.09 | 7,490 | 0.27 | 0.07 | 3,108 | 0.25 | 0.07 |
| growth | 543,714 | 0 | 0.07 | 7,490 | -0.04 | 0.07 | 3,108 | -0.02 | 0.06 |
| patent1 | 543,714 | 23.89 | 26.26 | 7,490 | 29.32 | 27.76 | 3,108 | 38.75 | 31.83 |
| patent2 | 543,714 | 80.7 | 61.96 | 7,490 | 84.38 | 61.31 | 3,108 | 115.54 | 76.28 |
| patent3 | 543,714 | 7.63 | 5.32 | 7,490 | 7.76 | 4.89 | 3,108 | 8.86 | 4.88 |
| sll_urb | 543,714 | 0.63 | 0.48 | 7,490 | 0.61 | 0.49 | 3,108 | 0.77 | 0.42 |
| densita_pop | 543,714 | 533.4 | 648.22 | 7,490 | 543.92 | 618.93 | 3,108 | 828.55 | 788.7 |
| unemployrate | 543,714 | 5.87 | 3.51 | 7,490 | 5.05 | 1.98 | 3,108 | 5.08 | 2.02 |
| dist_sforzi | 543,714 | 0.8 | 0.4 | 7,490 | 0.87 | 0.34 | 3,108 | 0.86 | 0.35 |
| dist_sett_sfor | 543,714 | 0.36 | 0.48 | 7,490 | 0.42 | 0.49 | 3,108 | 0.23 | 0.42 |
| ind_dist_sforzi | 543,714 | 0.36 | 0.37 | 7,490 | 0.4 | 0.37 | 3,108 | 0.28 | 0.31 |
| H | 543,714 | 2.85 | 0.91 | 7,490 | 2.88 | 0.94 | 3,108 | 2.88 | 1.02 |
| un_var | 543,714 | 1.59 | 0.4 | 7,490 | 1.7 | 0.36 | 3,108 | 1.6 | 0.34 |
| rel_var | 543,714 | 0.95 | 0.34 | 7,490 | 1.05 | 0.3 | 3,108 | 0.94 | 0.29 |
| normalbalassa | 543,714 | -0.08 | 0.29 | 7,490 | -0.15 | 0.27 | 3,108 | -0.11 | 0.24 |
| prodman | 543,714 | 348.43 | 1303.37 | 7,490 | 181.24 | 875.54 | 3,108 | 202.19 | 876.49 |
| crisi | 543,714 | 0.38 | 0.49 | 7,490 | 0.74 | 0.44 | 3,108 | 0.51 | 0.5 |
| offshore_byprov | 543,714 | 47.23 | 139.31 | 7,490 | 30.21 | 111.3 | 3,108 | 25.19 | 100.52 |

Tab. A.6. Probit and Heckman probit exit models estimates for domestic non multinationals, foreign and Italian multinationals

| | Domestic non multinationals (without selection) | Multinationals Foreign (without selection) | Domestic Multinationals (without selection) | Domestic non multinationals Heckman's selection | Multinationals Foreign Heckman's selection | Domestic Multinationals Heckman's selection |
|-----------------------|---|--|---|---|--|---|
| age2 | -0.00366** (-0.00178) | 0.0144 (-0.0235) | 0.0481* (-0.0268) | -0.0085*** (0.0018) | 0.003 (0.0144) | 0.0520* (0.0271) |
| agesq | 3.94E-05 (-3.5E-05) | -8.4E-05 (-0.00023) | -0.00083 (-0.00059) | 0.0001*** (0.0000) | 0.000 (0.0001) | -0.0008* (0.0005) |
| ricavi4_1 | 0.389*** (-0.0477) | -0.0264 (-0.414) | 0.406 (-1.295) | 0.3904*** (0.0535) | -0.016 (0.3179) | 1.0284 (1.1526) |
| ricavi4_2 | 0.200*** (-0.0357) | -0.658*** (-0.25) | 0.985** (-0.502) | 0.1937*** (0.0393) | -0.6720*** (0.2402) | 1.4463** (0.6173) |
| ricavi4_3 | 0.112*** (-0.0363) | -0.969* (-0.51) | 0.875*** (-0.265) | 0.0996** (0.0406) | -2.1949*** (0.5347) | 0.9805** (0.4195) |
| area5_1 | -0.177* (-0.0989) | 16.81 (-10.59) | 0.187 (-0.265) | -0.1506 (0.11) | 50.4709*** (5.0334) | 0.34 (0.4597) |
| area5_2 | -0.121 (-0.0963) | 24.70** (-11.41) | 0.286 (-0.281) | -0.1301 (0.1071) | 63.1901*** (5.6923) | -0.1797 (0.5684) |
| area5_3 | -0.144 (-0.0889) | | | -0.133 (0.0989) | | |
| area5_4 | -0.0565 (-0.0652) | | | -0.0486 (0.0746) | | |
| lproductivity | -0.0591*** (-0.0122) | -0.261** (-0.114) | -0.245*** (-0.0819) | -0.0891*** (0.0146) | -0.1641 (0.14) | -0.1723 (0.1078) |
| llaborcost | -0.00398 (-0.00439) | -0.164*** (-0.0457) | 0.154*** (-0.0496) | 0.0005 (0.0054) | -0.1660** (0.0736) | 0.1296** (0.0585) |
| lcapintensity | -0.118* (-0.0604) | -1.951** (-0.804) | 0.342* (-0.178) | -0.1565* (0.0806) | -6.6045*** (1.0684) | -0.4808 (0.358) |
| pre_tax_profit_margin | -0.00315*** (-0.00028) | -0.0133*** (-0.00365) | -0.00639*** (-0.00175) | -0.0040*** (0.0004) | -0.0419*** (0.0054) | -0.0126*** (0.0032) |
| mes | 2.651*** (-0.54) | 11.39 (-7.862) | -17.91*** (-4.954) | 2.0050*** (0.5954) | 11.1265*** (3.6963) | -22.0577*** (5.2525) |
| herind00 | -0.124*** (-0.0297) | 0.0823 (-0.159) | 0.201** (-0.0877) | -0.1066*** (0.0353) | 0.1176 (0.081) | 0.1663* (0.0858) |
| exp_ateco07share | -0.0330** (-0.0145) | -0.0228 (-0.198) | 0.0124 (-0.0932) | -0.0337** (0.0164) | -0.0017 (0.1021) | 0.1573* (0.0935) |
| FDI_share_bymarket | 0.481* (-0.278) | 1.812 (-2.188) | 2.2 (-2.038) | 0.4282 (0.2947) | 0.0274 (1.5677) | 1.7315 (2.472) |
| FDI_share_byregion | 0.964*** (-0.237) | 11.63** (-4.773) | -1.016 (-1.703) | 0.8838*** (0.2281) | 0.6869 (3.5698) | -0.6735 (3.1248) |
| tech1_2 | -0.291*** (-0.0575) | 1.741 (-1.3) | -4.225 (-3.799) | -0.2728*** (0.0603) | 3.8230* (2.1003) | -4.7600* (2.4733) |
| pavitt_1 | -0.285*** (-0.0675) | 3.269** (-1.295) | -4.229 (-3.696) | -0.2357*** (0.0829) | 6.3226*** (1.8902) | -5.2070** (2.4752) |
| pavitt_2 | 0.0209 (-0.0549) | 0.722* (-0.374) | 0.444* (-0.236) | 0.0443 (0.061) | 1.3376*** (0.2796) | 0.0332 (0.1977) |
| pavitt_3 | -0.279*** (-0.0588) | -0.446*** (-0.141) | -4.359 (-3.851) | -0.2336*** (0.07) | -0.3835** (0.1947) | -4.8278* (2.5906) |
| death_rate | 1.012*** (-0.309) | -27.74*** (-4.303) | 1.723 (-2.224) | 0.8514*** (0.2896) | -23.9846*** (4.5933) | 0.274 (4.0166) |
| startup | -1.268** (-0.514) | -13.45*** (-4.828) | -8.005** (-3.223) | -1.1818** (0.5597) | -24.4661*** (8.7529) | -4.9156 (4.2097) |
| occ_man_share | -1.830*** (-0.517) | -16.47 (-19.62) | -3.428 (-3.309) | -1.7024*** (0.5277) | -55.1861** (23.6552) | -3.8326 (5.1088) |
| patent2 | -0.000711* (-0.00037) | 0.0311 (-0.11) | 0.00499 (-0.00454) | -0.0006 (0.0004) | 0.1750*** (0.0394) | 0.0220*** (0.0082) |
| patent3 | -0.0036 (-0.00577) | -0.323* (-0.18) | -0.0395 (-0.0263) | -0.0041 (0.0065) | -0.6175*** (0.1478) | -0.0532 (0.0458) |
| sll_urb | -0.0277 (-0.0439) | -21.23*** (-7.645) | 0.159 (-0.275) | -0.0418 (0.0438) | -38.0186*** (4.637) | 0.5484 (0.4107) |
| densita_pop | 0.000124*** (-2.7E-05) | 0.00563 (-0.00993) | 0.000442 (-0.00028) | 0.0001*** (0.000) | -0.0005 (0.0051) | -0.0003 (0.0006) |
| spec | 0.00663 | -0.0221 | -0.720*** | 0.0089 | -0.0972 | -1.6874*** |

| | | | | | | |
|-----------------|----------------------------------|-----------------------------------|-----------------------------------|---------------------------------|------------------------------------|-----------------------------------|
| unemployrate | (-0.0152) -0.0111 (-0.009) | (-0.0838) -0.803** (-0.317) | (-0.204) -0.207** (-0.0807) | (0.0165) -0.0096 (0.0095) | (0.0795) -1.3378*** (0.2096) | (0.2653) -0.2567** (0.1079) |
| dist_sforzi | 0.0252 (-0.0424) | 12.13*** (-4.504) | -0.187 (-0.398) | 0.0233 (0.0463) | 18.4952*** (1.936) | -0.7361* (0.4471) |
| dist_sett_sfor | 0.0852** (-0.0336) | -0.215 (-0.662) | 0.0445 (-0.198) | 0.0909** (0.0391) | -0.1342 (0.6605) | 0.099 (0.1908) |
| ind_dist_sforzi | -0.00091 (-0.0655) | -19.68*** (-6.924) | 0.832*** (-0.277) | -0.0535 (0.0631) | -26.5231*** (3.512) | 1.2383*** (0.3524) |
| H | -0.118*** (-0.0215) | -0.333*** (-0.123) | 0.158* (-0.0908) | -0.1137*** (0.0225) | -0.2941 (0.19) | 0.2583** (0.1195) |
| un_var | -0.161** (-0.0754) | 2.279 (-2.817) | -0.244 (-0.62) | -0.1502* (0.0848) | 1.6523 (5.2064) | -0.0134 (0.669) |
| rel_var | 0.419*** (-0.123) | -33.64*** (-10.99) | 1.575 (-1.104) | 0.3983*** (0.1235) | -47.8276*** (7.798) | 5.4530*** (1.1076) |
| normalbalassa | -0.283*** (-0.0666) | -27.75 (-26.9) | 0.125 (-0.618) | -0.2893*** (0.0703) | -40.105 (26.8531) | 1.5844*** (0.4897) |
| normalbalassa2 | -0.101 (-0.177) | 57.18 (-64) | 1.209 (-1.047) | -0.0145 (0.1851) | 84.9324 (68.2992) | 3.4266** (1.3483) |
| lprodman | -0.00982 (-0.01) | -0.864 (-0.993) | 0.175* (-0.091) | -0.0114 (0.0108) | -2.2303 (1.475) | 0.4772*** (0.078) |
| Crisi | 0.343*** (-0.0265) | -1.632** (-0.812) | -0.282 (-0.253) | 0.3005*** (0.0302) | -2.2828*** (0.7755) | -0.4671 (0.3984) |
| offshore_byprov | -7.9E-05 (-9.8E-05) | -0.119*** (-0.0394) | 0.00101 (-0.00079) | -0.0001 (0.0001) | -0.1751*** (0.0179) | 0.0023*** (0.0008) |
| _cons | -2.784*** (-0.581) | | | -1.8170** (0.8045) | 49.1920*** (12.3999) | 15.0415*** (4.1917) |
| N | 543,714 | 3,108 | 7,490 | 435,270 | 2,679 | 7,017 |
| LL | -9163.5 | -38.68 | -74.52 | -40401.91 | -12726.57 | -25358.32 |
| Athrho | | | | 0.4616572*** | -0.6876714** | -0.14419* |
| | | | | 0.120672 | 0.342694 | 0.0733216 |
| Rho | | | | 0.4314339*** | -0.596484** | -0.1432* |
| | | | | 0.098211 | 0.220766 | 0.0723936 |

Standard errors in parentheses

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$ t-statistics are in parentheses. Std. Err. are adjusted for firm and province clusters. Huber–White sandwich estimator of variance.

TAB. A.7. Estimation results: Cox proportional hazard model estimates for exit of all firms, non multinationals, foreign multinationals, domestic multinationals

| | (1) | (2) | (3) | (4) |
|-----------------------|----------------------------|-----------------------------|------------------------|-------------------------|
| | All firms | Domestic non multinationals | Foreign multinationals | Domestic multinationals |
| ricavi4_1 | 0.992*** (0.143) | 0.964*** (0.148) | 0.138 (0.738) | 9.311*** (3.579) |
| ricavi4_2 | 0.563*** (0.105) | 0.534*** (0.108) | 1.103 (0.966) | 16.51*** (5.496) |
| ricavi4_3 | 0.337*** (0.112) | 0.297** (0.117) | | 4.266*** (1.433) |
| area5_1 | -0.772** (0.309) | -0.775** (0.312) | 2.090 (1.475) | 7.979*** (2.126) |
| area5_2 | -0.503* (0.291) | -0.497* (0.294) | | 10.16*** (2.976) |
| area5_3 | -0.665** (0.272) | -0.660** (0.276) | | |
| area5_4 | -0.361* (0.211) | -0.364* (0.213) | | |
| lproductivity | -0.168*** (0.0332) | -0.156*** (0.0330) | -0.835*** (0.239) | -2.369*** (0.562) |
| llaborcost | 0.0410** (0.0163) | 0.0409** (0.0179) | -0.0546 (0.331) | -0.0969 (0.514) |
| lcapintensity | -0.623*** (0.177) | -0.666*** (0.179) | -0.725 (1.681) | 2.111 (3.361) |
| multinaz | 0.133 (0.218) | | | |
| foreign | 0.636 (0.430) | | | |
| pre_tax_profit_margin | -0.00435*** (0.000660) | -0.00433*** (0.000683) | -0.00306 (0.00376) | |
| mes | 56.63*** (3.698) | 57.72*** (3.905) | 110.7*** (32.92) | -144.2*** (41.44) |
| herind00 | -0.915*** (0.120) | -0.937*** (0.129) | -1.589*** (0.356) | -4.311*** (1.660) |
| exp_ateco07share | 0.0622 (0.0516) | 0.0516 (0.0533) | 0.864*** (0.207) | 2.355*** (0.528) |
| FDI_share_bymarket | 3.701*** (0.584) | 3.599*** (0.627) | 2.138 (4.152) | -1.894 (24.19) |
| FDI_share_byregion | 3.422*** (0.665) | 3.502*** (0.685) | 0.0115 (9.985) | 18.10** (8.304) |
| tech1_2 | -4.264*** (0.326) | -4.225*** (0.319) | | |
| pavitt_1 | -1.755*** (0.230) | -1.820*** (0.247) | 1.729 (3.667) | |
| pavitt_2 | -0.822*** (0.213) | -0.845*** (0.219) | -1.836* (0.964) | |
| pavitt_3 | -1.788*** (0.201) | -1.834*** (0.214) | -1.999 (3.157) | |
| death_rate | 1.594 (1.018) | 1.557 (1.012) | | -43.40 (32.54) |
| startup | -1.755 (1.246) | -1.539 (1.278) | -77.39* (45.02) | 16.07 (50.37) |
| occ_man_share | -4.736*** (1.589) | -4.774*** (1.593) | 70.11** (33.36) | |
| patent2 | -0.00144 (0.00101) | -0.00144 (0.000997) | | 0.0279* (0.0165) |
| patent3 | -0.0169 (0.0162) | -0.0164 (0.0163) | | -0.0274 (0.394) |
| sll_urb | -0.0611 (0.123) | -0.0598 (0.123) | -3.648 (4.767) | 4.229* (2.333) |
| pop_density | 0.000400*** (0.0000826) | 0.000391*** (0.0000814) | 0.00107* (0.000599) | 0.00366** (0.00151) |
| spec | 0.00511 (0.0279) | 0.0103 (0.0281) | 0.0440 (0.0413) | -8.131*** (2.683) |

| | | | | |
|-----------------|---------------------------|---------------------------|----------------------|----------------------|
| dist_sforzi | 0.0944 (0.135) | 0.108 (0.135) | 8.459 (5.218) | -2.610 (2.039) |
| dist_sett_sfor | 0.235*** (0.0780) | 0.234*** (0.0779) | 0.376 (1.385) | 4.657*** (1.756) |
| ind_dist_sforzi | 0.0272 (0.196) | 0.0347 (0.195) | -1.401** (0.692) | 6.438** (3.205) |
| H | -0.280*** (0.0669) | -0.284*** (0.0670) | 0.148 (0.195) | -0.0475 (0.769) |
| un_var | -0.116 (0.204) | -0.0975 (0.204) | 0.905 (3.425) | -11.27*** (3.181) |
| rel_var | 0.688** (0.324) | 0.665** (0.329) | -15.50** (6.067) | 13.00** (5.134) |
| normalbalassa | -0.748*** (0.193) | -0.746*** (0.194) | -3.680 (5.753) | -6.976* (4.141) |
| normalbalassa2 | -0.326 (0.496) | -0.327 (0.503) | -24.98 (44.41) | -10.51 (7.841) |
| unemployrate | -0.0244 (0.0250) | -0.0213 (0.0254) | | -1.549*** (0.343) |
| Lprodman | -0.0322 (0.0281) | -0.0332 (0.0282) | 1.676 (1.338) | 2.057*** (0.528) |
| Crisis | 1.091*** (0.0942) | 1.102*** (0.0953) | | |
| offshore_byprov | -0.000379 (0.000285) | -0.000363 (0.000287) | -0.00422 (0.0178) | |
| <hr/> | | | | |
| T | | | | |
| Llaborcost | -0.00204*** (0.000744) | -0.00241*** (0.000849) | -0.0324 (0.0262) | 0.0122 (0.0321) |
| <hr/> | | | | |
| N | 554,312 | 543,714 | 3,108 | 7,490 |
| Ll | -10550.2 | -10351.9 | -15.28 | -14.16 |

Standard errors in parentheses

* $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$ t-statistics are in parentheses. Std. Err. are adjusted for firm and province clusters. Huber–White sandwich estimator of variance