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The Impact of Clusters on Firm Performance in the Growth and Sustainment Stages of the Cluster Lifecycle

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Abstract

This paper examines the mechanisms driving firm performance throughout a cluster?s lifecycle, focusing on later stages of that cycle (growth and sustainment). We look at two alternative mechanisms driving firm performance at these later stages, once agglomeration has been established: agglomeration economies and organizational heritage. The setting for this research is a vertically disintegrated industry composed of networked small firms where scale economies are not prevalent and tacit knowledge is important. Results show that both mechanisms have significant effects on performance. However, effects associated with heritage through spinoffs seem to have a stronger impact, supporting a stronger durability of heritage effects in the growth and sustainment stages of the cluster lifecycle. Results also point to the importance of spinoffs from related industries (in the same value chain).

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ABSTRACT

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Keywords: Clusters; Spinoffs; Cluster Lifecycle; Agglomeration Economies; Organizational Heritage.

I. INTRODUCTION

Successful industry clusters are rare (Ellison and Glaeser 1997). Examples like Silicon Valley motivate interest in clusters as models of successful economic development (Leslie and Kargon 1996; Chatterji, Glaeser, and Kerr 2013), potentially replicable elsewhere. Studies of highly concentrated industry clusters (Saxenian 1994; Lécuyer 2006) offer arguments stating that firms accrue benefits from agglomeration. Once firms in an industry begin to congregate in a specific region, such advantages will attract more companies into the region. The evidence compiled about clusters is broadly consistent with the existence of benefits from agglomeration associated with firm growth (Rosenthal and Strange 2004) and innovation (Baptista and Swann 1998).

A more recent line of work focuses on the role played by spinoffs and, more broadly, the transmission of capabilities from parent firms to independent startups. The definition of 'spinoffs' used here is the one adopted by Garvin (1983) and Klepper (2002), i.e. de novo firms with one or more founders who were working in the same industry prior to startup. This is equivalent to the definition of 'spinouts' adopted in more recent research, which follows Agarwal et al. (2004).

Klepper (2008), and Buenstorf and Klepper (2009) propose that the offspring of the better firms inherit more capabilities and, therefore, become superior performers. Since new entrepreneurs tend not to venture far from their geographic origins, the best spinoffs locate near the best parents, leading to a build-up of superior firms in a region. Such a process does not strictly require the existence of any advantages associated with agglomeration.

While these approaches are not mutually exclusive, they do generate different predictions with regard to cluster impact on firm performance. While agglomeration economies suggest that firms located in a cluster will perform better regardless of their heritage (i.e. the organizational ancestry of their founders), heritage theory suggests that spinoffs will perform better regardless of their location. This paper aims to contribute to this discussion by extending the analysis of cluster impact on firm performance beyond the emergence stage. The aim of the paper is to test whether agglomeration or heritage drive firm performance beyond the emergence stage. Arguably, more important than enquiring about what motivates the creation of a cluster by itself, it is to understand the mechanisms behind the superior performance of the firms inside the cluster.

This paper examines the case of the Portuguese industry of plastic injection molding. This industry agglomerates in two small regions in Portugal (Marinha and Oliveira). The Portuguese plastic injection molding industry is recognized by the U.S. International Trade Commission as 'one of the world's principal producers of precision molds for the plastics industry.' (Fravel *et al.* 2002). Agglomeration occurred historically since the first few firms in the molds industry chose to locate in the same region, in a process similar to that experienced by the US automotive industry in Detroit and the semiconductor industry in Silicon Valley (Klepper 2010; Kowalski 2012).

The paper uses the main predictions of the two theoretical accounts of agglomeration, and tests the predictions of the theories over the later stages of cluster's lifecycle, looking to discern whether the observations are in line with the evolution of the molds industry. Detailed data matching firms, founders, and geographical regions (at the *concelho* or county level) available for the period 1986-2009 is used to examine the origin of founders, firms' locations decisions, and performance. The analysis employs a longitudinal dataset to examine the founders' paths before they create molds companies.

This paper contributes to the literature on the geographical agglomeration phenomenon in a number of ways. First, we expand the cluster analysis beyond the emergence period by looking at firm performance drivers in the later stages of the cluster's lifecycle. Second, our empirical study focuses precisely on an industry that, in the way proposed by the organizational reproduction account, was born out of firms in precursor industries and exhibits a strong share of spinoffs, but (unlike automobiles or tires), shows virtually no signs of scale or vertical integration economies. Instead, the industry is based on a network of small, interdependent suppliers that share specific knowledge and competences, in a way comparable to some agglomeration economies accounts. Lastly, we are able to take into account heritage effects that go beyond same industry spinoffs, by including data on related industries (value chain and skill-related).

The paper is organized as follows. The next section outlines the theoretical discussion. The third section describes the data and methodology used in the study. The forth section presents and discusses the empirical results and the finally we offer concluding remarks.

II. THEORETICAL ASPECTS

We concentrate on two theories providing explanations for the existence of clusters, though there are alternative and complementary viewpoints that warrant discussion – see, for example, Martin and Sunley (2006); and Frenken *et al.* (2013). Organizational heritage and agglomeration economies are competing but not mutually exclusive theories of cluster development.

Agglomeration Economies Theory

Three fundamental factors are commonly invoked to explain clustering due to agglomeration economies, or externalities. First, some regions may have natural advantages for firms in particular industries, causing entrants to cluster there. Second, pecuniary economies related to transportation costs and scale effects, as featured in new economic geography models (Krugman 1991a; Krugman and Venables 1995), may cause entrants to cluster near consumers and suppliers to their industry. Thirdly, and crucially, production, or supply-side externalities, may induce entrants to cluster (Marshall 1890; Porter 1990; Krugman 1991b). Supply-related factors drive companies to locate near their competitors, related industries, and suppliers: pooling of the labor market, supply of specialized inputs, and technological spillovers facilitate access to specialized workers, key inputs, and knowledge relevant for production, organization, and marketing.

There is a long tradition in regional and urban economics of modeling industry agglomerations as the result of Marshallian externalities. The micro-foundations of these externalities are reviewed in Duranton and Puga (2004) and empirically tested by Henderson (2003) and LaFountain (2005). More recently, urban economists have focused on the role played by entrepreneurship in the industry agglomeration process. The motivation for this research is that regional performance in terms of employment growth has been consistently found to be highly correlated with the presence of a multitude of small firms, and therefore with entrepreneurship (see for example Acs and Armington 2006; Glaeser, Kerr, and Ponzetto 2010; Glaeser, Kerr, and Kerr 2012; Rosenthal and Strange 2010). Glaeser, Kerr, and Ponzetto (2010) find empirical support for Chinitz's (1961) claim that the supply of entrepreneurs differs across space. Glaeser, Rosenthal, and Strange (2010) suggest that agglomeration economies may be driving the entrepreneurship leading to clustering. In regions with a higher supply of entrepreneurs, more founders might be generated by agglomerative spillovers such as input sharing, labor pooling, and the opportunity to learn from their neighbors.

Heritage Theory

Heritage theory postulates that clustering is caused by the combination of entrants tending to locate close to their geographic roots with an uneven regional distribution of potential entrants (Buenstorf and Klepper 2009; 2010). New entrants need pre-entry organizational knowledge to compete (Phillips 2002; Helfat and Lieberman 2002; Helfat and Peteraf 2003). An important source of such capabilities is experience acquired by employees who later decide to leave and create independent spinoffs in the same or a related industry.

The routines and experience of a successful organization may be transferred to a new startup firm if the founder(s) used to work for the parent firm (Phillips 2002). Klepper (2001; 2002) finds that an important source of firm capabilities is industry experience acquired by spinoff founders. Agarwal *et al.* (2004) and Klepper (2008) argue that the success of new organizations is fundamentally shaped by knowledge inherited from industry incumbents that was accumulated by their founders throughout their careers. Often the founding team shares the same work experience (Agarwal *et al.* 2013).

Several studies have shown that entrants commonly locate close to where their founders previously worked and/or were born. Such studies arise from urban economics (Figueiredo, Guimarães, and Woodward 2002); economics of entrepreneurship (Michelacci and Silva 2007), as well as sociology and management (Dahl and Sorenson 2009; 2012) and propose explanations associated with better access to skilled labor (Delgado, Porter, and Stern 2010), local network ties (Beckman 2006), and sources of financing (Stuart and Sorenson 2003).

Buenstorf and Klepper (2009) propose that clustering of an industry in a region begins with one firm (for instance, Oldsmobile in the case of the automotive industry in Detroit, or Goodrich in the case of the tire industry in Akron) and its initial influence spreading to other regional producers, similar to the conventional agglomeration economics account. The subsequent growth of the regional cluster, however, is attributed to an endogenous process in which incumbent firms involuntarily spawn independent spinoffs. As they try to enhance their own performance through technological innovation and improved organizational processes, successful industry incumbents inadvertently function as training grounds for their employees, allowing them to acquire the skills needed to start ventures of their own. Employees acquire more useful knowledge as prospective spinoff founders by working in superior incumbent firms, so spinoffs from the better performing incumbents should also perform better than other startups. Since new firms mostly locate close to their founders' origins, spinoff dynamics should reinforce the existing geographical differences in firms performance as better spinoffs locate near better incumbents.

Evidence from the regions of Detroit, Akron, and Silicon Valley suggest that organizational heritage was the main force underlying the clustering of the automotive, tire, and semiconductor industries in those regions (Klepper 2007; 2010; Buenstorf and Klepper 2009; 2010; Kowalski 2012). Further evidence from the Dutch book publishing cluster (Heebels and Boschma 2011) and the British automotive industry (Boschma and Wenting 2007) also support this view.

While agglomeration-based cluster research also pursues approaches associated with the changing industrial structure of regions (Martin and Sunley 2006; Menzel and Fornahl 2009; Buenstorf and Geissler 2008) the spinoff process is not necessarily perceived as the main driver of cluster emergence and superior performance. Agglomeration economies and heritage theory propose distinctive predictions regarding the motivations for agglomeration and the drivers of firm performance that can be used to assess their relative importance in driving cluster success. Following Buenstorf and Klepper (2009; 2010), Heebels and Boschma (2011), and Kowalski (2012) find that the spinoff process was key to clustering in several industries while agglomeration economies and proximity to markets played a minor role. However, agglomeration economies supporters claim that although the role of spinoffs should not be neglected, the motivations for their location choice are linked to agglomeration economies (Glaeser, Rosenthal, and Strange 2010).

The Cluster Lifecycle

Different agglomeration mechanisms may play different roles at different stages of the cluster's development, as the industry's structure evolves. According to Menzel and Fornahl (2009), the cluster lifecycle includes the following stages: emergence; growth; sustainment; and decline. While the role of entrepreneurship is often acknowledged in the emergence stage (Feldman, Francis, and Bercovitz 2005; Porter 2000), other mechanisms (notably agglomeration economies) are subject of examination in the literature as driving cluster growth and sustainment (LaFountain 2005).

Some analyses of clusters suggest, however, that entrepreneurship remains a key determinant of cluster development long after emergence. Sorenson and Audia (2000) propose that the main driver of cluster persistence over time, in particular for those clusters composed mainly of small firms, is the heterogeneity in entrepreneurial opportunities. Regions with dense concentrations of firms in the same industry would increase the local pool of potential entrepreneurs, therefore increasing entry inside the cluster and thus maintaining the agglomeration. Golman and Klepper (2013) associate entrepreneurship in clusters by with market opportunities generated by innovation led by incumbents. These authors model cluster growth by spinoff formation associated with the discovery of new submarkets through innovation, showing that cluster persistence over time may result exclusively from the self-reinforcing dynamic generated by innovation leading to spinoffs, possibly complemented by non-Marshallian positive externalities associated with entrepreneurship (like the demonstration effect and the availability of venture capital). This process would not require the presence of agglomeration economies.

We propose that the first stages of an agglomerated industry's evolution are dominated by the transmission of technological and organizational capabilities through startups originating in the same or related industries and, in particular, sequences of spinoffs originating in the earlier, better companies in the industry that locate near their parent companies. However, as the cluster evolves towards sustainment, having attained a certain size, or critical mass, while reproduction through spinoffs should remain important, agglomeration of companies with similar and/or complementary objectives and capabilities might generate a region-specific dynamic network shaped by the connections between closely located small firms. Interactions between firms may be associated with conventional agglomeration economies arguments.

The setting for our argument is based on the observation of clusters of small and micro firms that establish local networks of producers specializing in different stages of the production process, or in different product designs, in industries where product development and customization are far more important than scale economies. Influenced by Marshall's (1890) observation that a larger volume of industry output within a region leads to specialization, there is an extensive literature on industrial districts dating to the 1980s and 1990s, primarily based on case studies illustrating the presence of specialized suppliers and firm vertical disintegration in particular industries (see, for instance, Piore and Sabel 1984; Markusen 1996). More systematic studies conducted by Holmes (1999), Li and Lu (2009), and Figueiredo, Guimarães and Woodward (2010), find a positive correlation between geographical concentration of an industry and firm vertical disintegration.

In industrial districts such as the ones described by Brusco (1982), and Piore and Sabel (1984), small vertically disintegrated companies depend on each other to fulfill orders of complete, final products. The narrower a firm's boundaries, the more likely that it may have easy access to resources, competences, and capabilities residing in other firms (Langlois and Robertson 1995). The entrepreneur chooses to narrow the boundaries by specializing in a part of the production process where he has a comparative advantage, and locates near firms that can contribute to other parts of the production process. A close, well-coordinated network of neighboring firms with complementary capabilities would be able to respond to a variety of customer orders of final products by pooling together their resources through sub-contracting and outsourcing (Grandori and Soda 1995). Such transactions would be made easier by the trust built through geographical proximity and by a mutual knowledge of each other's capabilities and specialties inside the network. Lorenzoni and Lipparini (1999) argue that the capability to interact with other companies accelerates a firm's knowledge access and transfer. Mature clusters of small, integrated firms that simultaneously compete and cooperate would display the type of agglomeration economies implied by Porter (1990) and Scott (1988), concerning flexible production agglomerations.

Maskell (2001) points out that firms in clusters can learn, and thus create knowledge, by observing their competitors (horizontal dimension), but most of all by interacting with suppliers and subcontractors specializing in parts of the production process that possess complementary capabilities (vertical dimension). Such deepening of specialization allowed by physical proximity inside the cluster would account for high performance of clusters in terms of productivity and innovation, and arguably is more likely to be important when a cluster has achieved a strong critical mass.

This kind of cluster dynamics are considerably less likely to occur in clusters dominated by large and very large firms, such as the automobile, tire and semiconductor industries, studied by Buenstorf and Klepper (2009); and Klepper (2007; 2010). Under such circumstances, connections between firms might not be formed so easily; any networks of firms would be more formal and agglomeration economies arising from access to external capabilities would be fewer, thus explaining the observations made by these authors with regard to the lack of impact of agglomeration economies firm performance. Inversely, work by de Vaan *et al.* (2012) for the video game industry finds that effects of clustering on firm survival become positive once a cluster exceeds a critical size.

What happens when clusters decline? Cluster extinction is generally attributed to congestion costs that offset agglomeration economies, meaning that any effects of agglomeration on firm performance should be negative. Heritage effects, however, are not necessarily withered by congestion, making it more likely for spinoffs to better withstand cluster decline and survive longer in an environment where exit rates are greater than entry rates.

III. DATA AND METHODOLOGY

The methodological approach used in the present paper is an econometric analysis of detailed data on firms, founders, and workers in the Portuguese molds industry, covering the period 1986-2009. In this section we describe the data and methods we use to examine the predictions associated with the theories being analyzed.

Our study uses a dataset extracted from the "Quadros de Pessoal" (QP) micro-data, a Portuguese longitudinal matched employer-employee database including information on the mobility of firms, workers and business owners from 1987 to 2009. QP data are collected every year by the Portuguese Ministry of Social Security[1] and covers all firms (and establishments) with at least one wage-earner in Portugal. QP data has been used and described at length in a variety of studies including for instance: Geroski et al. (2010); and Baptista et al. (2012).

We use longitudinal data to look at agglomeration and firm performance in clusters over later stages of the cluster's lifecycle. Therefore our level of analysis is not the cluster per se, but firms inside the cluster and the mechanisms affecting their location choice and performance. The study examines the founders' paths before they create molds companies, in particular looking at the industry where they had previous working experience and the region where they came from.

Before we proceed further, it should be pointed out that, during the time span of our data, there seems to be no convincing evidence of significant decline and/or congestion costs in the Portuguese molds cluster, meaning that our analysis is limited to evidence regarding the sustainment stage.

The Portuguese plastic injection molds industry is one of the world's principal producers of precision molds for plastics. Each mold is a new, unique project, or rather a unique combination of standard components (for instance, heating and cooling systems, and injectors) and non-standard components (for instance, specific molding surfaces). This degree of customization and specialization limits scale

[1] Submission by firms is mandatory.

economies[2] and emphasizes worker's skills and experience (Beira et al., 2004), Henriques, 2008). Fulfilling orders typically involves a multiplicity of firms and outsourcing is commonly used in key parts of the production process such as designing, machining, and thermal treatments. Very few Portuguese molds companies have chosen to extend their boundaries. Some of the more successful marketing or engineering firms may keep connections with as much as 70 molds producers and 10 designers simultaneously (Mota and Castro, 2004).

An historical account of the first decades of the industry (see Costa and Baptista, 2015) shows that its initial location in Marinha Grande was dictated by the presence of precursor industries, glass and glass molds, in a process of industrial heritage similar to what occurred, in the case of the automobile industry in Detroit (Klepper 2001; 2007) and the tire industry in Akron (Buenstorf and Klepper 2009). Like Oldsmobile and Goodrich in those industries, the pioneer firm (A.H.A.) played a major role in the future evolution of the industry. A.H.A. and its immediate followers decisively influenced both the future location of the industry – by spawning a series of successful spinoffs located around them – and the future organization of the industry by implementing division of labor and specialization of workers. Workers that learned their specialization in early incumbents would then found independent spinoffs whose boundaries were conditioned by their own narrow specialty, which could be refined into a high quality, price-competitive component of the final mold product.

[2] In the last two and a half decades investments in physical capital required for entry have increased significantly, but are still relatively low when compared with other manufacturing industries.

The empirical specifications aim to evaluate the main mechanisms of agglomeration that increase the success of firms, using cross-section data. In order to test the predictions derived from both the agglomeration theory and the organizational heritage theory, two main types of models are estimated regarding:

I. the probability of survival of a new molds entrant, given its industry of origin (molds, value chain, skill related, or other) and the location of the founder (inside or outside the cluster), while controlling for firm quality (with proxies by firm size)[3], location in the same county as the parent company (home), and accounting for firm heterogeneity;

II. the probability a new entrant will become a top one-third seller in its third year in the market, given its industry of origin and the location of the founder, while controlling for firm quality (with proxies by firm size), location in the same county as the parent company (home), and economic cycles;

Model I estimates the probability of survival using mixture hazard (frailty) models (considering that size is unlikely to capture firm heterogeneity influencing performance). Parametric specifications of survival/failure models can only go so far in explaining the variability in observed time to failure. A frailty model attempts to measure this overdispersion by modeling it as resulting from a latent multiplicative effect on the hazard function (Gutierrez 2002).[4]

[3] It should be acknowledged that, in an industry like molds, with mostly very small companies, firm size is unlikely to represent a good measure for firm quality. However, there are no valid alternatives in the dataset to account for sources of firm heterogeneity other than regional and industrial origin. Klepper (2007) uses firm longevity as a measure of quality. However, this choice involves significant endogeneity.

[4] Goodness-of-fit tests performed on the data confirm the existence of overdispersion in firm heterogeneity.

Model II examines the likelihood an entrant will become a top one-third seller in its third year of activity. This model provides an additional assessment of the entrants' performance. The model uses Logit estimation of the likelihood to rank in the top one-third molds sellers among entrants by the time the company reaches its third year in the market. Both performance assessment models (survival and sales ranking) use cross-section data. For the hazard models the sample included one observation for each entrant for which there was information on background (again, 611 molds companies).

In order to enrich the analysis of industrial heritage and the effects of pre-entry knowledge in the success of startups, we extend our definition of spinoffs to include not only firms started by founders who were previously employed in the same industry, but also by those who were previously employed in related industries. Specific knowledge regarding technology, marketing, customers and suppliers in related industries should also have an impact on startup performance. We capture industry relatedness in two ways. First, we identify industries belonging to the value chain of the molds industry (that is, industries that use significant inputs from the molds industry or sell significant outputs to the molds industry), based on data from Beira et al. (2004), Henriques (2008), and Mota and Castro (2004). Second, we also capture relatedness associated with skills by estimating an adaptation of the index of skill relatedness developed by Neffke and Henning (2009). Skill-related industries were identified using an adaptation of the skill-relatedness index proposed by Neffke and Henning (2013), based on cross-industry labor flows. The relatedness index was computed for the molds industry from 1995 to 2002 (using a 5-digit CAE level). Contrary to Neffke and Henning (2013), our index does not exclude managers. The reason for this was that, on average, these are medium and small companies where most managers are performing industry-specific tasks and have a high proportion of industry-specific knowledge and skills (Henriques 2008). The estimated index of skill-relatedness compares the actual flow of workers between each pair of industries and regions with the estimated flow expected to occur given the characteristics of the industry in each region. Industries found to be strongly related to molds include: general mechanical engineering; engineering activities and related technical consultancy, and manufacture of general purpose machinery.

IV. RESULTS

The estimations of all the Logit models present the marginal effects of the explanatory variables. For a discrete explanatory variable, the marginal effect is the change in the dependent variable when the explanatory variable is incremented by one unit. Estimations for the survival analysis present hazard ratios (Table 1). A hazard ratio above one means that the variable has a negative impact on firm survival, while a hazard ratio below one indicates a variable that has a positive impact on survival.

If spinoffs or firms originating in related industries are more likely to survive and have higher sales, then the prediction of the heritage theory is supported. If molds companies located in the cluster are more likely to survive and sell more, regardless of their industry of origin, then the prediction of the agglomeration economies account is supported.

Table 1 presents the results for the frailty survival models. However, estimations using Cox Proportional Hazards models lead to similar results. Table 1 presents the hazard ratios for exit corresponding to each explanatory variable for models mixing the Weibull distribution hazard function with Gamma and Inverse Gaussian heterogeneity distributions. The mixed/frailty model specification that fits the data better is the one using the Weibull distribution to account for multiplicative unobserved heterogeneity.

TABLE 1

Across all models the results for the larger sample (including entrants with unknown background but known entry location and entry size) naturally tend to erode the impact and significance of the background variables in favor of the location variable. This is expected, considering that the additional observations only add information about location. Additionally, companies with unknown background seem to perform worse than companies whose background can be traced in the data. This may imply that QP data are biased to include more information on better firms, which are more likely to report to the authorities accurately and consistently. If this proposition is true, the sample with firms of unknown background may balance that but it may also add more noise by lowering the quality of the data. Therefore results should be assessed with caution.

Evidence from Model I is positive for both theories. Spinoffs and startups originating from the molds value chain industries have significantly greater chances of survival. This result supports the heritage account argument that spinoffs benefit from more pre-entry knowledge and therefore are more likely to survive.[5] However, molds firms located in the cluster also have a greater probability of survival,

[5] Again, the effects experienced by spinoffs and startups coming from value chain industry firms are not confirmed for startups founded by individuals who worked in industries/regions that are skill-related to molds. This suggests that the concept may not apply with regard to the accumulation of pre-entry knowledge and capabilities relevant to the startup.

regardless of their industry of origin, thus confirming the prediction of the agglomeration economies account (possibly resulting from reduction of transportation costs from suppliers and to customers, scale economies, labor pooling, access to supply of specialized goods, technological spillovers, or a combination of these effects). Nevertheless, the magnitude of the effects on firm survival is strongest for companies originating from the value chain or molds industries.

This is reinforced by the fact that the hazard ratio for firms that locate in the home region of the entrepreneur is greater than one, meaning that locating in the home region when such region is not agglomerated actually has a negative impact on survival (however, this ratio is not significant in the Cox proportional hazards model).

In addition to firm survival we also consider other performance measures for molds entrants. To evaluate the performance of the entrants in the molds industry we look at the factors associated with the level of sales in the entrant's third year of activity. This analysis has a selection bias, considering that we only observe the companies that survived in the market for at least three years. However, the sample of firms with sales in their third year is large (losing only 11 firms out of 611 entrants with identified backgrounds and 27 for the full sample of entrants). Therefore, we believe these estimates are not severely biased and can provide information on the characteristics of high performing companies in the molds industry. It should also be acknowledged that sales are a measure of output that give no account of the input used to generate it; thus they are a poor measure of efficiency. However, the aim is to identify the companies with larger market shares, which could be considered top players in the industry.

Model II uses Logit estimation. The dependent variable for the Logit model is ranking in the top one-third companies in sales value in the same year. Columns 1 and 2 in Table 2 show the marginal effects for the sample without firms of unknown background, while columns 3 and 4 refer to the sample that includes those entrants.

TABLE 2

Results from the Logit model in Table 2 show that entrants with a background in the molds and value chain industries are significantly more likely to become top sellers across all models. Initial size, however, seems to be the strongest predictor of sales performance. Entrants locating in the molds agglomeration region only seem to be significantly more likely to perform better if we include the firms with unknown background, but even then, the coefficients are much lower than the ones associated with firm initial size or industry background. If we exclude the entrants with unknown background, entrants locating in the home region also tend to perform better. However, when we add entrants with unknown backgrounds the significance disappears. For both samples, the interaction variables are not significant, suggesting that firms with experienced background are not significantly more likely to perform better if they are located in the cluster. Also, entrants that locate in the cluster are not more likely to perform better for having a background in molds or the value-chain industries.

In summary, results suggest that there are agglomeration benefits accrued by firms that locate in the cluster making them more likely to survive, regardless of their origin. However, for entrants with known background, the entrepreneur's industry experience (in the value chain or molds industries) has a stronger positive impact in firm survival. Moreover, prior experience in the molds industry seems to be the strongest predictor of the sales ranking in the third year of activity. The effect of locating in the molds cluster is much smaller and only significant in the models with firms with unknown background.

While it is complex to determine causality for these performance results, there is no evidence that effects ascribable to sources other than agglomeration economies and organizational heritage are at play. However, the location effects could also be consistent with a self-reinforcing process occurring in the cluster, which may not draw from Marshallian externalities, as argued by Golman and Klepper (2013). These could be due to many factors such as better access to international markets (foreign buyers are more likely to visit the cluster), better access to financing, the entrepreneur demonstration effect, or higher flexibility due to the close relationships to subcontractors, etc.

Lifecycle stages

Considering that results suggest that different mechanisms play important roles at different stages of the cluster's lifecycle, this section aims to take a more detailed look at what is happening in the cluster in different time periods. The molds cluster emerged in the 1950s and is believed to have grown substantially in the first three decades of its existence. However, we will again confine our analysis in the period of 1986 to 2009, due to the unavailability of earlier data. Figure 1 shows the evolution of the number of workers in the cluster, compared to the total for the country. The cluster continues to grow until 2005, when exports start slowing down. At this point production continues to increase, but it's mainly driven by a surge in internal demand.

Compares growth rates inside and outside the cluster we see that until 1996 the cluster maintains a superior growth rate, and after that the difference is attenuated and on occasions surpassed by the rest of the country. Looking more closely at the growth of the regions of Marinha and Oliveira, we see that in Marinha this superior performance is extended up until 1997 and that after 1997, the growth rate is mainly slower than for the total country. Oliveira shows a sharp decrease in 1997, balanced by an even larger growth in the following year. The increase in 1998 largely compensates the decrease in the prior year; therefore, this may have been a circumstantial spike in the data.

Considering these data, the transition between the growth stage and the sustainment stage of the cluster may be situated between 1997 and 1998. Therefore, data can be separated into two different samples to test if it is possible to identify different agglomeration mechanisms at play in different stages of the lifecycle. For the first part of the analysis the cluster's growth stage will be attributed to the period of 1986-1997 (Stage 1), while the sustainment stage will comprise the period of 1998-2009 (Stage 2).

Firm survival seems to suffer substantially different influences in the growth and the sustainment stages, if we consider the estimates from mixed frailty models presented in Table 3. The effects of industry background from value-chain industries appear to play the most important role in improving survival in both periods. Conversely, the background in the molds industry seems to have a strong impact in the growth stage but not in the sustainment stage. The same applies to locating in the cluster.

TABLE 3

Results in Table 4 show the marginal effects for the likelihood to become a top one-third seller, in the third year of activity. During the growth stage (Stage 1) we find significant effects for the region; however, the marginal effect is not large (0.06 in the sample without entrants with unknown background and 0.08 when we include them). Nonetheless, during the sustainment stage (Stage 2) there is a significant effect for a background in the molds industry, even when considering the entrants with unknown background.

TABLE 4

In addition to the separation between the growth and sustainment stages of the lifecycle, it could also be argued that we could separate the steeper growth stage that may still cover the first years of our data. Following this rationale, the following analysis separates the first three years of the data (1986 to 1989), when growth in the cluster is higher, considering that they could be included in a growth stage with steeper rates (Growth I). The second growth period (1990 to 1997) has substantial growth but not as steep (Growth II).

Results from the frailty survival models in Table 5 also point to stronger and more significant impacts of industry of origin (and location for the sample with unknown background) in the early growth stage. In the late growth stage we also find a significant and positive effect for experience in the molds industry. Again, location in the cluster is significant for the extended sample with firms of unknown background.

TABLE 5

Table 6 shows the results about sales performance in the Growth I and II stages. During Growth I we find significant and strong effects for a background in the value-chain. In the second growth stage there is a significant effect for location, but only in the sample including entrants with unknown background. At this stage there are no significant effects associated with background.

TABLE 6

Finally, the sustainment stage can also be divided into two periods, before and after the decline in the number of workers in the cluster. As mentioned before, in 2005 the molds exports started to decrease, and this trend was intensified for the remaining years of data. This pattern is consistent with the sustainment stage, considering that the decline in the number of workers is not very strong. However, it could also be the beginning of the decline stage. It seems to be too soon to tell with the existing data, but we can analyze if the results for the sustainment stage remain unchanged if one removes the later years. Therefore, the ensuing analysis separates the first period of sustainment, from 1998 to 2004, and the second period, which could potentially be considered part of the decline stage of the cluster's lifecycle.

Results in Table 7 share the above mentioned caveats. Significant effects persist in the sustainment stage for the industry background in value chain industries. Furthermore, in the sustainment stage there is a negative effect on survival to firms locating in their home region. During the decline stage no significant effects on survival persist.

TABLE 7

Table 8 presents the results for the sales Logit model in the sustainment and decline stages (Stage 2). In both stages there is a significant and growing effect of the background in the molds industry. Therefore, even excluding the final years of the data (of possible decline stage) the effects of the molds background persists in this later stage.

TABLE 8

In summary, the results from the examination of separate stages of the molds cluster's lifecycle, albeit facing data limitations, are consistent with different effects and magnitudes affecting entry, location, and firm survival. However, results do not show a clear separation in time for the effects associated with heritage and the effects associated with agglomeration economies. Nevertheless, there remain weak effects of background persisting in the sustainment stage, while location effects do not.

Results on the survival of the entrants suggest that the effects of background are stronger and more persistent, even in the sustainment stage (for value chain). Overall, having a related industry background (molds and value chain) has a stronger positive impact on survival than locating in the molds region. Location effects only seem to be advantageous in the growth stage, but when we separate it into two stages (Growth I and Growth II) we find that, for Growth I stage, locating in the cluster only has an effect if we include firms with unknown backgrounds. For firms whose backgrounds we could trace, locating in the cluster proves to increase survival only in Growth II stage, and only in the mixed frailty model. Our findings seem to be consistent with the view that heritage effects have a stronger and more persistent impact on performance.

V. CONCLUDING REMARKS

This research aims to contribute to the understanding of the mechanisms driving the performance of industries clustering in specific regions. The case of the molds industry in Portugal is an example of a successful cluster that emerged in the 1950s and is still prevalent today.

The history of the emergence of the molds cluster resonates with heritage theory accounts of spinoffs emerging out of an innovative incumbent (A.H.A.), in successive waves of employees who become entrepreneurs. This pattern is similar what was identified in the semiconductor, tire, and automotive industries in the US (Klepper 2007; 2010; Buenstorf and Klepper 2009; 2010). This would suggest that molds spinoffs inherited knowledge from their high quality parents and located in the same region as their parents. However, this does not exclude the possibility that the clustering process of these spinoffs was not motivated by their intention to benefit from agglomeration economies in the region. Therefore, although spinoffs and the entrepreneurship environment they generated played a very important role in the emergence of the Portuguese molds cluster, it is less clear to discern the motivations that led to their location choice, resulting in the accumulation of spinoffs in Marinha and Oliveira regions.

Heritage theory proposes that entrants in general tend to locate home and therefore, spinoffs would naturally locate in the same region as their parents (Buenstorf and Klepper 2009; Buenstorf and Klepper 2010). Golman and Klepper (Golman and Klepper 2013) model spinoff-driven cluster growth and development, based on perceived new opportunities detection associated with innovation, occurring in the absence of agglomeration economies. Spinoff motivations for home preference could range from the possibility to hire ex-coworkers from the parent firm (Carias and Klepper 2010), the opportunity to exploit their local social capital (Dahl and Sorenson 2012), the non-Marshallian externalities associated with the entrepreneurship demonstration effect (Nanda and Sörensen 2010), to even the simple desire to locate close to family and friends (Dahl and Sorenson 2010), among others not part of or inherent in traditional agglomeration economies.

Nevertheless, researchers arguing in favor of agglomeration economies recognize that entrepreneurship plays a significant role in the emergence of a cluster's development (Glaeser and Kerr 2009; Feldman, Francis, and Bercovitz 2005; Rosenthal and Strange 2010). Glaeser *et al.* (2010) point out that traditional agglomeration spillovers could also influence entrepreneurship and spinoffs' decision to locate in proximity to their parents. In that case, location choice would be influenced by the possibility to benefit from input sharing and labor pooling and the opportunity to learn from their neighbors.

We focused on the later stages of the cluster's lifecycle to analyze the persistence of heritage or agglomeration economies effects that would affect the performance of the entrants. When focusing on the molds cluster's late growth and sustainment stages results point to the persistence of heritage effects even in the later stages. However, agglomeration economies effects also seem to play a role in the late growth and sustainment stages of the cluster's lifecycle, likely because this is a cluster where scale economies are not prevalent, tacit knowledge is important, and networks of vertical disintegrated companies interact. Nevertheless, the factor with most impact on firm survival, even in the growth and development stages of the molds cluster, seems to be the origin of the entrepreneur. Such findings suggest that agglomeration economies effects, although significant, are not the main drivers of firm performance in the cluster, in the growth or sustainment stages of the cluster's development. Moreover, agglomeration economies seem to complement the effect of heritage in the late growth and sustainment stages of the cluster's lifecycle, but there is no evidence that those effects would be able to cause agglomeration on their own. However, results point to significant effects attributed to agglomeration economies, which cannot be ignored.

Our results are concordant with the work by Boschma and Wenting (2007) who studied the automotive industry in Britain and concluded that there are complementarities between agglomeration economies and spinoff linkages driving the industry's agglomeration. . As research on geographical agglomeration pursues approaches focusing on the changing industrial structure of regions (such as in Menzel and Fornahl, 2009; and Buenstorf and Fornahl, 2009), individual cluster accounts are likely to provide more clarifying evidence.

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Table 1 – Model I: Estimates of the frailty models for entrant survival†

	Weibull distribution with GAMMA heterogeneity (1)	*Weibull distribution with INVERSE GAUSSIAN heterogeneity* (2)	*Weibull distribution with GAMMA heterogeneity* (3)	*Weibull distribution with INVERSE GAUSSIAN heterogeneity* (4)
VARIABLES	Hazard Ratio			
Entrant's initial size	1.0555	0.9636	0.9647	0.9264
(log(*pemp_f*))	(0.1155)	(0.1274)	(0.0771)	(0.0754)
Founder from molds	0.4597***	0.4620***	0.5174***	0.5602***
(*molds*)	(0.1041)	(0.1124)	(0.1157)	(0.1220)
Founder from value chain	0.3266***	0.2944***	0.3094***	0.3128***
(*vc*)	(0.0845)	(0.0843)	(0.0814)	(0.0814)
Founder from skill-related	1.9891**	2.4942**	2.4768***	2.8878***
(*rel*)	(0.6250)	(0.8922)	(0.8119)	(0.9516)
Locating in the agglom. region	0.6041**	0.5819**	0.3415***	0.3753***
(*agg*)	(0.1351)	(0.1444)	(0.0617)	(0.0594)
Locating in the home region	1.6087**	1.5159*	1.7894**	1.5550*
(*home*)	(0.3583)	(0.3735)	(0.4151)	(0.3561)
Entrant w/unknown background	-	-	2.4793***	2.2751***
(*ub*)			(0.6465)	(0.5593)
Constant	0.0405***	0.0589***	0.0471***	0.0647***
	(0.0127)	(0.0233)	(0.0129)	(0.0180)
Observations	611	611	1,066	1,066
Log-likelihood	-654.89	-653.13	-1,249.51	-1,249.09
Likelihood-ratio test of θ = 0	0.000	0.000	0.000	0.000

[†] *significant at the 0.10 level; ** significant at the 0.05 level; ***significant at the 0.01 level (standard errors in parentheses)

Table 2 – Model II: Estimates of the Logit models for top sales in the third year – marginal effects†

VARIABLES	(1)	(2)	(3)	(4)
Entrant's initial size (log(*pemp_f*))	0.1936*** (0.0226)	0.1949*** (0.0225)	0.1737*** (0.0146)	0.1739*** (0.0145)
Founder from molds (*molds*)	0.1146*** (0.0431)	0.1442** (0.0621)	0.0928** (0.0382)	0.1278** (0.0517)
Founder from value chain (*vc*)	0.0967** (0.0477)	0.1488** (0.0640)	0.0846* (0.0432)	0.1317* (0.0529)
Founder from skill-related (*rel*)	-0.0461 (0.0683)	-0.0335 (0.0794)	-0.0362 (0.0602)	-0.0141 (0.0620)
Locating in the agglom. region (*agg*)	0.0304 (0.0434)	0.0920 (0.0794)	0.0489* (0.0292)	0.0838* (0.0381)
Locating in the home region (*home*)	0.0694* (0.0408)	0.0708* (0.0414)	0.0549 (0.0364)	0.0603 (0.0463)
Entrant w/unknown background (*ub*)	-	-	0.0153 (0.0463)	0.0204 (0.0463)
Molds industry and molds region (*molds*agg*)		-0.0580 (0.0893)		-0.0541 (0.0596)
Value-chain and molds region (*vc*agg*)		-0.1122 (0.0989)		-0.1070 (0.0771)
Observations	600	600	1,039	1,039
Log-pseudo likelihood	-336.15	-335.42	-525.14	-523.81
Pseudo R^2	0.1789	0.1807	0.2129	0.2149
Wald test	0.0000	0.0000	0.0000	0.0000

† *significant at the 0.10 level; ** significant at the 0.05 level; ***significant at the 0.01 level (robust standard errors in parentheses)

Table 3 – Model I: Estimates of the frailty models for entrant survival (Stages 1 and 2) – hazard ratio†

VARIABLES	*Gompertz distribution with INVERSE GAUSSIAN heterogeneity*			
	Growth Stage		Sustainment Stage	
	(1)	(2)	(3)	(4)
Entrant's initial size (log(*pemp_f*))	1.0458 (0.1192)	0.9368 (0.0632)	0.8152 (0.1199)	0.8829 (0.0950)
Founder from molds (*molds*)	0.4872*** (0.1150)	0.6172** (0.1224)	0.8886 (0.2300)	0.8618 (0.2208)
Founder from value chain (*vc*)	0.3950*** (0.1009)	0.4316*** (0.0968)	0.5240* (0.1752)	0.5365* (0.1775)
Founder from skill-related (*rel*)	2.2296** (0.7604)	2.4830*** (0.7270)	1.7291 (0.5925)	1.6071 (0.5381)
Locating in the agglom. region (*agg*)	0.5841** (0.1412)	0.4069*** (0.0611)	0.8620 (0.2196)	1.0216 (0.1926)
Locating in the home region (*home*)	1.2182 (0.2635)	1.1930 (0.2337)	1.5518 (0.4257)	1.4587 (0.3948)
Entrant w/unknown background (*ub*)	-	1.7959*** (0.3573)	-	1.3510 (0.4424)
Constant	0.0896*** (0.0268)	0.1124*** (0.0241)	0.0385*** (0.0144)	0.0415*** (0.0142)
Observations	317	590	294	476
Log-likelihood	-412.62	-829.33	-243.50	-419.60
Likelihood-ratio test of θ = 0	0.019	0.004	1.000	1.000

† *significant at the 0.10 level; ** significant at the 0.05 level; ***significant at the 0.01 level
(standard errors in parentheses)

Table 4 - Model II: Estimates of the Logit models for top sales in the third year (Stages 1 and 2) – marginal effects†

VARIABLES	Growth Stage		Sustainment Stage	
	(1)	(2)	(3)	(4)
Entrant's initial size (log(*pemp_f*))	0.1386*** (0.0302)	0.1235*** (0.0185)	0.2686 *** (0.0297)	0.2559*** (0.0206)
Founder from molds (*molds*)	0.0192 (0.0606)	0.0385 (0.0482)	0.1614** (0.0641)	0.1513** (0.0620)
Founder from value chain (*vc*)	0.0261 (0.0640)	0.0167 (0.0529)	0.1164 (0.0727)	0.1074 (0.0681)
Founder from skill-related (*rel*)	-0.0742 (0.0931)	-0.0425 (0.0754)	0.0178 (0.1077)	0.0252 (0.1004)
Locating in the agglom. region (*agg*)	0.0602** (0.0434)	0.0794** (0.0382)	0.0310 (0.0637)	0.0334 (0.0455)
Locating in the home region (*home*)	0.0627 (0.0564)	0.0457 (0.0468)	-0.0166 (0.0613)	-0.0233 (0.0556)
Entrant w/unknown background (*ub*)	-	-0.1329** (0.0542)	-	0.0914 (0.0759)
Observations	317	590	283	449
Log-pseudo likelihood	-187.95	-303.31	-147.25	-223.42
Pseudo R^2	0.1414	0.1913	0.2231	0.2328
Wald test	0.0000	0.0000	0.0000	0.0000

† *significant at the 0.10 level; ** significant at the 0.05 level; ***significant at the 0.01 level (robust standard errors in parentheses)

Table 5 – Model I: Estimates of the frailty models for entrant survival (Stage 1) – hazard ratio†

	Gompertz distribution with INVERSE GAUSSIAN heterogeneity			
	Growth I Stage		Growth II Stage	
VARIABLES	(1)	(2)	(3)	(4)
Entrant's initial size (log(*pemp_f*))	0.8453 (0.1575)	0.8241** (0.0800)	1.1237 (0.1618)	1.0376 (0.1006)
Founder from molds (*molds*)	0.3417** (0.1479)	0.4849** (0.1723)	0.5628* (0.1680)	0.6627 (0.1707)
Founder from value chain (*vc*)	0.1624*** (0.0775)	0.1927*** (0.0766)	0.6235 (0.1977)	0.6490 (0.1837)
Founder from skill-related (*rel*)	2.0946 (1.2084)	3.2501** (1.7204)	2.8087** (1.2228)	2.7819*** (1.0468)
Locating in the agglom. region (*agg*)	0.5990 (0.2249)	0.3068*** (0.0764)	0.5577* (0.1721)	0.4432*** (0.0862)
Locating in the home region (*home*)	1.0080 (0.3617)	0.8802 (0.2871)	1.4446 (0.4101)	1.4002 (0.3588)
Entrant w/unknown background (*ub*)	-	0.9664 (0.2920)	-	2.6886*** (0.7469)
Constant	0.1452*** (0.0665)	0.2139***) (0.0713	0.0702*** (0.0268)	0.0776*** (0.0227)
Observations	95	216	222	374
Log-likelihood	-119.31	-300.57	-284.41	-518.84
Likelihood-ratio test of θ = 0	0.114[6]	0.057	0.020	0.006

† *significant at the 0.10 level; ** significant at the 0.05 level; ***significant at the 0.01 level (standard errors in parentheses)

[6] Models with Weibull distribution with Gamma heterogeneity, Weibull distribution with Inverse Gaussian heterogeneity, and Gompertz distribution with Gamma heterogeneity have results with the same significance and order of impacts (with significant values for the Likelihood-ratio test of θ = 0: 0.006, 0.027, and 0.025, respectively).

Table 6 – Model II: Estimates of the Logit models for top sales in the third year (Stage 1) – marginal effects†

VARIABLES	Growth I Stage		Growth II Stage	
	(1)	(2)	(3)	(4)
Entrant's initial size (log(*pemp_f*))	0.2310*** (0.0448)	0.1766*** (0.0283)	0.1211*** (0.0337)	0.0954*** (0.0236)
Founder from molds (*molds*)	0.0866 (0.1018)	0.0548 (0.0806)	0.0136 (0.0723)	0.0293 (0.0587)
Founder from value chain (*vc*)	0.2208** (0.0931)	0.1845** (0.0784)	0.0200 (0.0795)	0.0117 (0.0665)
Founder from skill-related (*rel*)	0.0752 (0.1351)	0.0370 (0.1139)	-0.1943 (0.1199)	-0.1470 (0.0991)
Locating in the agglom. region (*agg*)	-0.0951 (0.1133)	-0.0451 (0.0634)	0.1144 (0.0726)	0.0920* (0.0495)
Locating in the home region (*home*)	0.2965*** (0.1137)	0.2252*** (0.0844)	0.0084 (0.0662)	0.0024 (0.0558)
Entrant w/unknown background (*ub*)	-	0.0224 (0.1021)	-	-0.1775*** (0.0664)
Observations	95	216	283	374
Log-pseudo likelihood	-46.55	-95.25	-147.25	-195.10
Pseudo R^2	0.2926	0.3072	0.2231	0.1789
Wald test	0.0007	0.0000	0.0000	0.0000

† *significant at the 0.10 level; ** significant at the 0.05 level; ***significant at the 0.01 level (robust standard errors in parentheses)

Table 7 – Model I: Estimates of the frailty models for entrant survival (Stage 2) – hazard ratio†

	Gompertz distribution with INVERSE GAUSSIAN heterogeneity			
	Sustainment Stage		Decline Stage	
VARIABLES	(1)	(2)	(3)	(4)
Entrant's initial size (log(*pemp_f*))	0.7981 (0.1249)	0.8815 (0.1035)	0.9927 (0.4444)	0.9370 (0.3182)
Founder from molds (*molds*)	0.9614 (0.2697)	0.9228 (0.2561)	0.4357 (0.3085)	0.4071 (0.3297)
Founder from value chain (*vc*)	0.4969* (0.1803)	0.5028* (0.1812)	0.8529 (0.7431)	0.9443 (0.8865)
Founder from skill-related (*rel*)	1.7888 (0.6460)	1.6522 (0.5841)	1.9990 (2.3504)	1.9542 (2.5345)
Locating in the agglom. region (*agg*)	0.8361 (0.2288)	1.0059 (0.2102)	1.3610 (1.1493)	1.9703 (1.1811)
Locating in the home region (*home*)	1.7732* (0.5273)	1.6678* (0.4901)	0.4609 (0.4076)	0.3528 (0.3351)
Entrant w/unknown background (*ub*)	-	1.4116 (0.5111)	-	0.5972 (0.5539)
Constant	0.0314*** (0.0127)	0.0330*** (0.0124)	0.0905** (0.0973)	0.0645*** (0.0635)
Observations	239	374	55	102
Log-likelihood	-209.70	-350.57	-30.63	-60.59
Likelihood-ratio test of θ = 0	1.000	1.000	1.000	0.355

† *significant at the 0.10 level; ** significant at the 0.05 level; ***significant at the 0.01 level (standard errors in parentheses)

Table 8 – Model II: Estimates of the Logit models for top sales in the third year (Stage 2) – marginal effects†

VARIABLES	Sustainment Stage		Decline Stage	
	(1)	(2)	(3)	(4)
Entrant's initial size	0.2686***	0.2370***	0.2627***	0.2922***
(log(*pemp_f*))	(0.0324)	(0.0232)	(0.0916)	(0.0440)
Founder from molds	0.1151*	0.1111*	0.4751**	0.4611**
(*molds*)	(0.0696)	(0.0637)	(0.1852)	(0.1966)
Founder from value chain	0.1128	0.1026	0.2179	0.2111
(*vc*)	(0.0802)	(0.0729)	(0.1828)	(0.1947)
Founder from skill-related	-0.0109	0.0038	0.1520	0.0768
(*rel*)	(0.1108)	(0.0987)	(0.2731)	(0.2784)
Locating in the agglom. region	0.0529	0.0412	-0.0294	0.0651
(*agg*)	(0.0683)	(0.0499)	(0.1705)	(0.1045)
Locating in the home region	-0.0277	-0.0269	0.2395	0.1794
(*home*)	(0.0658)	(0.0588)	(0.1688)	(0.1398)
Entrant w/unknown background	-	0.0136	-	0.5504***
(*ub*)		(0.0807)		(0.1979)
Observations	239	374	44	75
Log-pseudo likelihood	-123.24	-183.93	-21.87	-37.08
Pseudo R^2	0.2262	0.2259	0.2828	0.2823
Wald test	0.0000	0.0000	0.1525	0.0021

† *significant at the 0.10 level; ** significant at the 0.05 level; ***significant at the 0.01 level (robust standard errors in parentheses)

Figure 1 - Molds Industry and Cluster: 1989-2009