Papers in Evolutionary Economic Geography

12.21

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CLUSTERING AND FIRM PERFORMANCE IN PROJECT-BASED INDUSTRIES:

THE CASE OF THE GLOBAL VIDEO GAME INDUSTRY, 1972 - 2007

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ABSTRACT

Explanations of spatial clustering based on localization externalities are being questioned by recent empirical evidence showing that firms in clusters do not outperform firms outside clusters. We propose that these findings may be driven by the particularities of the industrial settings chosen in these studies. We argue that in project-based industries, negative localization externalities associated with competition grow proportionally with cluster size, while positive localization externalities increase more than proportionally related to cluster size. By studying the survival patterns of 4,607 firms and 1,229 subsidiaries in the global video game industry, we find that the net effect of clustering becomes positive after a cluster reaches a critical size. We further unravel the subtleties of the video game industry by differentiating between exits by failure and exit by acquisition, and conclude that being acquired is best considered as a sign of success rather than as a business failure.

KEYWORDS

localization externalities, survival analysis, acquisition, spinoff, cluster, video game industry

JEL-CODES

L25 – R11 – R12

1. INTRODUCTION

Economic geographers traditionally explain the spatial clustering of firms as a result of localization externalities that stem from the co-location of firms within the same or related industries. Co-located firms have been argued to be able to establish a local pool of skilled labor, reduce the costs of interfirm transactions, and generate knowledge spillovers (Marshall, 1920). Dense interdependencies between co-located firms are argued to provide these firms with the opportunity to learn from new insights, to respond to changes in the environment, and to generate novel products as a result of exposure to diverse practices (Porter, 1990; Malmberg et al, 1996; Maskell et al, 1998; Malmberg and Maskell, 2002). What follows from this line of thought is that co-located firms are expected to perform better and survive longer than firms that are located outside clusters. Even if scholars disagree about the exact definition and boundaries of a cluster (Martin and Sunley, 2003), explanations of clusters based on localization externalities remain rather dominant[1].

An emerging literature[2] building on longitudinal micro-data tends to question the importance of localization externalities. A prime example of this line of thought is a study on the evolution of the U.S. automobile industry and its geographic concentration in Detroit (Klepper, 2007). The study found that the higher survival probability of firms in the Detroit cluster could be attributed to the pre-entry experience of the founders of firms in the cluster. The genealogy of successful Detroit firms could be traced back to a few successful parent firms that passed on their capabilities to subsequent generations of spinoff firms. Importantly, co-location in Detroit area did not affect survival, indicating that localization externalities were absent – a result that was also found in six follow-up studies on other industries.[3] This conclusion that co-location per se does not benefit firms also resonates earlier findings on negative localization externalities in metal-working (Appold, 1995), footwear (Sorenson and Audia, 2000), knitwear (Staber, 2001) and biotechnology (Stuart and Sorenson, 2003).

Given the evidence across different industries, one would be tempted to conclude that localization externalities play no role in the evolution of clusters. However, the evidence for such a thesis is largely based on findings from manufacturing industries, leaving project-based industries relatively unexplored. Various scholars have stressed the fact that project-based industries heavily rely on localized networks of a broad range of actors involved in these industries (Bielby and Bielby, 1999; Caves, 2000; Scott, 2000; Grabher, 2002; Sydow and Staber, 2002; Ibert, 2004; Perretti and Negro, 2007) and this characteristic is likely to set apart the spatial organization of these industries from the spatial organization of manufacturing industries. We build on this research and expect the size of localized networks to be related to the likelihood that

[1] Other alternative accounts of cluster emergence have been proposed, including the regional innovation system approach (Cooke et al., 1997; Asheim and Gertler, 2005), theories about herding behavior in location decisions (Appold, 2005; Suire and Vicente, 2009), and the anchor tenant thesis (Agrawal and Cockburn, 2003; Niosi and Zhegu, 2010).

[2] This literature is mostly contributed to by scholars from fields other than Economic Geography. The vast majority of publications come from scholars in the fields of population ecology and organization studies.

[3] These studies concern, among others, the British car industry (Boschma and Wenting, 2007), the global fashion design industry (Wenting, 2008), the U.S. tire industry (Buenstorf and Klepper, 2009), the German machine tool industry (Buenstorf and Guenther 2011), the U.S. semiconductor industry (Klepper, 2010) and the Dutch book publishing industry (Heebels and Boschma, 2011).

firms survive. Although we do not explicitly observe the networks present in the video game industry, we argue that by observing time series of cluster sizes and its relation to firm survival we provide empirical nuance on the association between the opportunities provided by networks and the spatial concentration of economic activity. In particular, we expect that negative externalities increase proportionally with cluster size due to increased competition, while positive externalities stemming from the increased opportunity to get access to financial resources and recombine human resources increase more than proportionally with cluster size. We test our hypothesis by using data on 4,607 video game firms worldwide and find evidence that co-location positively affect firm survival only when a cluster exceeds a critical size.

In our analysis of firm survival, we differentiate between exits by failure and exit by acquisition, since the latter is likely to be a sign of success rather than of failure (Cefis and Marsili 2007). Our findings show that most variables explaining firm survival also explain firm acquisition, indicating that acquisition is indeed best considered as a sign of business success rather than as business failure in the context of the video game industry. In sum, our study sheds new light on how the organizational details of specific industries should be taken into account when studying localization externalities and we theorize about the micro processes that may underlie this delicate relation. Moreover, we suggest that evolutionary approaches to clustering should be more sensitive to industry specificities that are reflected not only in the nature of localization externalities but also in the different modes of performance.

The paper is organised as follows. The next section develops the main hypothesis against the background of the recent literature in evolutionary economic geography. We specifically pay attention to the subtleties of project-based industries. Section 3 discusses the operationalization of clustering and success by critically examining the various measurements of agglomeration externalities and business performance indicators. Section 4 introduces the method and data and section 5 presents the results. We end with some concluding remarks.

2. SPATIAL CLUSTERING IN PROJECT-BASED INDUSTRIES

Since the end of the nineteenth century, the spatial concentration of industries has attracted attention from economic geographers. The cause of geographical concentration of industries is sought in agglomeration externalities that arise from the co-location of firms within similar or related industries, better known as localization externalities.[4] Most influential has been the account of Marshall (1920) who referred to benefits that co-locating firms from the same industry may exploit as a result of local access to specialized suppliers and buyers, a large and specialized labour pool, and local knowledge spillovers. Storper (1995) referred to another component of agglomeration externalities by introducing the idea of untraded interdependencies as crucial economic underpinnings of clusters. These untraded interdependencies, such as conventions, rules, norms and practices are place-specific and could form an asset to local firms.

[4] Agglomeration externalities specific to firms operating in the same or similar industries has become known under the label of localization externalities as to distinguish this type of agglomeration externalities from urbanisation externalities stemming from co-location between any firm in a city or region (Appold 1995). For a recent review on empirical evidence on localization externalities, see Wennberg and Lindqvist (2010).

A more recent line of research argues that spinoff dynamics rather than localization externalities are responsible for cluster formation. Klepper (2002, 2007, 2010) proposes that new industries emerge from related industries when entrepreneurs exploit the relevant capabilities from related industries in the context of a new industry. With the subsequent growth of an industry, the share of spinoffs increases at the expense of other types of entrants, where spinoffs refer to firms founded by entrepreneurs who previously worked for an incumbent firm as an employee within the same industry. The dynamics of spatial clustering can then be understood as an evolutionary process. Firms are assumed to be heterogeneous in their capabilities, partly because of different pre-entry experience and partly because of idiosyncratic factors. Firms with capabilities that show the best fit with market demand and technological supply will grow fastest and produce most spinoff firms. Initially such firms are diversifiers from other industries that can leverage their capabilities from their core industry to the new industry. Then, following a Darwinian logic (Boschma and Frenken, 2003; Boschma and Frenken, 2011), these successful diversifiers produce more - and more successful - spinoffs. These spinoffs inherit a large part of the capabilities of their parent and they tend to locate in the same region as the parent firm, which causes a cluster to emerge as a result of a few successful firms starting to create many successful spinoffs which, in turn, create successful spinoffs themselves.

The implication for our understanding of geographical clustering holds that clusters are expected to emerge even in the absence of localization externalities. This has been confirmed by studies on the U.K. car industry (Boschma and Wenting, 2007), the U.S. car industry (Klepper, 2007), the global fashion industry (Wenting, 2008), the U.S. tire industry (Buenstorf and Klepper, 2009), the U.S. semiconductor industry (Klepper 2010), the German machine tool industry (Buenstorf and Guenther, 2011) and the Dutch publishing industry (Heebels and Boschma, 2011), which showed that being located in a cluster did *not* increase the survival probability of firms.

Klepper (2007) empirically addressed the emergence of a cluster by interacting the spinoff and the Detroit variables, showing that the increased likelihood to survive in the Detroit cluster was confined to spinoffs rather than to firms without pre-entry experience. The emergence of the Detroit cluster, then, can be attributed to the exceptional capabilities of Detroit spinoffs which were inherited from selected parents in Detroit. This methodology was also followed in the studies on U.S. tire firms clustering in Akron, Ohio (Buenstorf and Klepper, 2009) and Dutch publishing firms clustering in Amsterdam (Heebels and Boschma, 2011). In both cases, it was also found that spinoffs within the cluster outperformed spinoffs outside the cluster, suggesting that clusters emerged through the transmission of exceptionally fit capabilities from selected parent firms within the cluster.

The results on the absence of positive localization externalities resonate earlier findings that questioned the alleged benefits that firms accrue from co-location. For example, Appold (1995) found that localization externalities were negatively affecting the performance of U.S. metalworking firms. Similarly, Sorenson and Audia (2000) found that firms in clusters in the U.S. footwear industry were characterized by higher failure rates, because of stronger competitive pressures. This made them to conclude that geographical clustering of an industry is the result of higher founding rates, rather than lower failure rates. Staber (2001) found that failure rates of firms increase with the number of firms active in the same industry at a particular location, while failure rates decrease with the number of firms operating in complementary industries at a location. Also, Stuart and Sorenson (2003) found that U.S. biotechnology firms performed worse

when co-located with other biotech firms in clusters. In all cases, the lines of reasoning attributed the absence of positive localization externalities to the disadvantages of clustering related to upward pressures on wages and prices stemming from increased competition for resources.

Despite the cumulative evidence in recent years suggesting that positive localization externalities played no role in the clustering of manufacturing industries, it would be premature to conclude that co-location provides no net benefits to firms in any context. Project-based industries such as the video game industry rely on very different resources than manufacturing industries. We believe that the co-evolution of resources and the size and composition of a cluster follows a different pattern in project-based industries. Our argument holds that *negative externalities stemming from co-location increase roughly linearly with the number of fellow competitors as suggested in the aforementioned studies, but that positive localization externalities increases more than proportionally with the number of co-located firms in the case of project-based industries*. We further develop this line of thought within the context of the global video game industry.

Video game development is organized in temporary project teams in which artistic expertise, commercial expertise and financial expertise capital are being recombined (Johns, 2005; Tschang, 2007). At the start of the industry in the 1970s, project teams consisted of only a few individuals, but this number rapidly increased reflecting the rising technological complexity of modern video game production. At present, many games involve about 100 people who are involved during the process of conception, creation, marketing and distribution of a video game. A development firm brings in the artistic expertise by providing professionals with different artistic roles ranging from game play writers, programmers, sound engineers, and graphic artists. The publishing firm provides upfront capital and as well as testers, distributors, marketers, financial managers and project managers. While in some cases, the development and publishing of a game takes place within a single firm, more often a game results from formal collaboration between a developer and a publisher (Balland et al., forthcoming). Although the industry is organized in temporal projects, each project is clearly a collaborative effort between firms rather than a spontaneous gathering of freelancers.

In order to answer the questions of whether localization externalities arise in the video game industry and whether they persist over time, we highlight the main resources upon which firms in the video game industry draw: human capital and financial capital. Human capital has been mentioned as a valuable resource across a wide range of project-based industries and has been described in detail in case studies on various industries including advertising (Grabher, 2002), architecture (Kloosterman, 2010), film (Scott, 2000), new media (Girard and Stark, 2002) and software (Ibert, 2004). Financial capital is not always identified as an important resource drawn upon by firms in project based industries; however, the strong dependence on technology and the sheer size of projects in the video game industry makes financial capital a salient part of the ecology of game production.

The challenge for firms is to raise funding for their increasingly large and complex projects. On average the costs of producing a video game have increased rapidly and some video game projects now have a reported cost exceeding $25 million (New York Times, 2009). In order acquire funding for these costly projects a local infrastructure needs to be built that facilitates firm's access to these resources. While firms in manufacturing industries also require funding, the

project-based nature of the video game industry poses some difficulties. One-off projects in an industry that is characterized by a skewed distribution of rents are associated with high levels of risk. A few hits receive the majority of all rents, while many non-hits and flops will most likely have a difficult time to earn back their initial investments. Therefore, successful investment relies on investors who are highly knowledgeable about the technological specificities of the industry and the state of the market (Hellmann, 2000; Kenney and Florida, 2000; Whitley, 2006) which is likely to disqualify banks and other traditional financial intermediaries. In order to attract investors who are knowledgeable about the technological specificities of the industry and the state of the market, the industry needs to generate visible milestones that outside investors can identify as markers of significance in terms of the progress being made (Tylecote and Conesa, 1999; Whitley, 2006).

Human capital is another undeniable source of production for project-based industries. The dependence on human capital differs largely from manufacturing industries that laid the foundation for evolutionary economics and its core concepts of routines as the main repository of knowledge (Nelson and Winter, 1982). Routines underlie a firm's capabilities, and with the transmission of routines from parent to spinoff, capabilities are inherited from the parent by the spinoff (Klepper, 2002). In project-based firms, organizational routines inherited by the founder will indeed be important, particularly the project-management routines that apply across projects. However, the impact of routines on firm performance is expected to be less apparent than in manufacturing because projects are one-off events and novelty is often more valuable than efficiency. Therefore, lessons drawn from one project do not necessarily carry over to the next project (Gann and Salter, 2000). As a result, firms are highly dependent on access to collaborative partners, the inflow of new employees, and the collaborative histories of the firm and its employees (Engwall, 2003). That is, the networks between firms, their employees and other stakeholders in the industry are a second "repository of knowledge" alongside the organizational routines of firms (Grabher, 2004).

Negative versus positive localization externalities in project-based industries

Traditional negative localization externalities such as increasing congestion and high real estate prices are expected to play a minor role in project-based industries, because the main resources used in its production system are financial capital and labour rather than bulky tangible inputs or land. However, competition between firms based on the demand for financial investment or creative individuals with specialized skills is likely to be highly localised. Both labour and funding tend to be rather immobile in space (Gordon and Molho, 1995; Breschi and Lissoni, 2009; Eriksson, 2011), which implies that firms compete for these two resources with other co-located firms. As a result, each additional firm within a spatial domain forces all co-located firms to compete with one additional firm, leading to a proportional increase in competition. Following previous studies (Sorenson and Stuart, 2000; Staber, 2001; Sorenson and Audia, 2003), we expect that due to the increase of competition, the probability of survival will decrease linearly with the number of firms in a cluster.

While negative localization externalities are likely to be roughly proportional to cluster size, one may expect that in project-based industries the positive localization externalities increase more than proportionally with cluster size. The main reason of why the addition of firms to a region may have a non-proportional effect on how firms in a region perform can be found in the literature on network externalities (Katz and Shapiro, 1985; Grabher, 2002; Cattani et al., 2011).

The potential to recombine diverse sets of expertise held by different employees rises with the size of a cluster (cf. Weitzman, 1998). Grabher (2002, p. 255) stated that "*(t)he practice of project-based collaboration (...) maximizes recombinatory options between a diverse range of skill sets, biographical backgrounds and cultural orientations*". That is, for each new video game to be developed, the challenge is to assemble a new team that combines complementary skills and ideas as to be successful. Since team members are often sourced locally, a large cluster has the advantage of providing many more possible combinations of team members than small clusters. Since the possible configurations of individuals in teams rises more than linearly with the number of individuals, benefits from clustering are expected to rise more than proportional with cluster size.

In a similar vein, within the context of the Hollywood feature film industry, Perretti and Negro (2007, pp. 567 – 568) find that "*teams with higher incidence of newcomers show a positive relationship with innovation*" and that "*teams with higher incidence of new combinations, both from old-timers and from newcomers, show a positive relationship with innovation*". That is, for firms to successfully innovate, flexibility in team memberships is necessary to remain creative and up to date. Thus, for firms operating in large clusters it will be better able to find suitable replacements compared to firms operating in smaller clusters, both during the lifetime of a single project and across subsequent projects.

With the recombinatory potential of project teams rising non-linearly with cluster size, the social networks across firm boundaries will also be more developed in larger clusters compared to smaller clusters. One of the main mechanisms through which social ties are created among employees is through joint participation in project teams. Past team members tend to remain in touch after the project for the purpose of informal knowledge sharing even when employed at different firms (Breschi and Lissoni, 2009). Given the larger number of firms and the higher rate of labour mobility between firms in clusters (Eriksson, 2011), the social networks stemming from job-hopping will be much more extensive and much less redundant in larger clusters compared to smaller clusters.

More generally, the concepts of "community learning" (Brown and Duguid, 1991) and "knowledge community" (Henry and Pinch 2000) apply well to the video game industry. These notions refer to the importance of employees' interaction in professional networks. Participation in such networks keeps a firm's employees up-to-date with the latest market trends and technological development. In order to become and remain member of a community, firms, employees and other actors need to be engaged in a continuous process of judging, being judged and sharing judgments. In this context, Storper and Venables (2004, p. 356) argue that "*(i)n such fields as fashion, public relations, and many of the arts (including cinema, television, and radio) there are international networks 'at the top', but in the middle of these professions networks are highly localized, change rapidly, and information used by members to stay in the loop is highly context-dependent"*. Staying in the loop is a complex process because it requires tacit knowledge that can only be absorbed by face-to-face interaction. Hence, firms in larger clusters will have much more employees profiting from the information percolating in such informal professional networks (Grabher, 2004).

With positive localization externalities increasing more than proportionally with cluster size and negative localization externalities increasing proportionally with cluster size, the joint effect on

firm performance can be depicted as in Figure 1. The figure shows that once cluster size exceeds a critical threshold, co-location starts to enhance firm survival because the net effect of co-location becomes positive. It is this hypothesis that we will test below for all firms in the global video game industry.

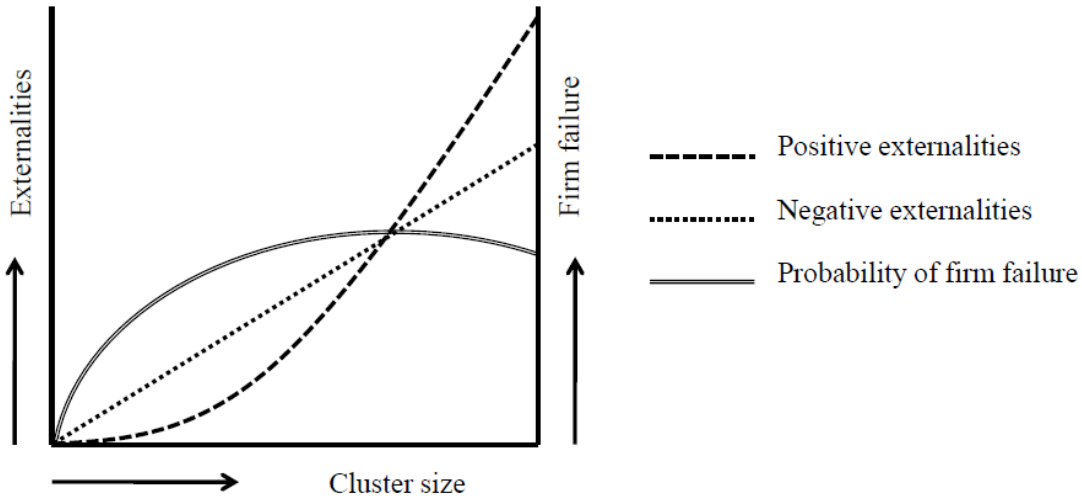

Figure 1. Expected relation between cluster size, externalities and firm failure

One may object to this hypothesis that if co-location in larger clusters brings more than proportional more benefits than in smaller clusters, firms will re-locate from smaller to larger clusters leading to one single super-cluster. There are two opposing forces that render the emergence of a single cluster unlikely. First, as explained, the production process of a video game is characterized by the coalescence of art, technology and commerce. To the extent that art work is an expression of cultural values, norms and traditions, cultural-geographical boundaries play an important role in the industry. Indeed, many have stressed the increasing importance of space and place in creative industries based on symbolic knowledge, because of the symbiotic relationship between place, culture and the economy (Pratt, 1997; Scott, 1997; Asheim and Gertler, 2005; Johns, 2006; Asheim et al., 2007; Currid and Williams, 2009). Johns (2006, p. 173) argues that "cultural differences remain important considerations for publishers and developers. Despite relatively close cultural proximity, even some UK- and USA-produced games require localization – that is, adaptation in the gameplay, character design and other final product characteristics to better suit the specific demands of culturally different game consumers – before they are suitable for consumers". The consumer's taste in terms of art and cultural expression not only becomes known to publishers and developers through statistics about sales levels; more importantly, employees of both publishers and developers are often avid gamers, strongly embedded in local communities of other avid gamers, which provide them with information about the wants and needs of potential customers (Saltzman, 2004). Second, as for any other industry, most entrepreneurs start their company in their home region or home country given their local knowledge and networks (Figueiredo et al., 2002; Stam, 2007). Over time, firms

and their employees will become part of the local community as well as develop strong ties with key clients, often local (Grabher, 2002). Re-location will render it more costly to maintain these relationships in a meaningful way. At the same time, after entering a new cluster it will take time and effort to become part of the local community and to get linked to key local players, both employees and clients. These forms of local embeddedness render the probability of re-location unlikely despite the possible benefits that larger cluster may bring to a firm.

3. MEASURING LOCALIZATION EXTERNALITIES AND FIRM PERFORMANCE

As we will address the effect of localization externalities on firm performance, the manner in which we define and measure localization externalities and firm performance deserve special attention. Starting with localization externalities, previous studies on localization externalities in the evolutionary tradition have applied different indicators. Klepper (2007, 2010) and Wenting (2008) simply used dummies for cities in which clusters emerged over time, which obviously does not directly measure the effect of co-location. Rather, it defines clusters with the benefit of hindsight, by first observing in the data in which locations the industry eventually concentrated, and then entering these locations as dummies in the analysis. Boschma and Wenting (2007) and Heebels and Boschma (2011) measured localization externalities more directly in terms of the number of co-located firms in the same industry, but they measure this effect only at the time of entry. Even if one can argue that the benefits of co-location are especially important for small and young firms that have to rely more on cluster advantages to overcome the 'liability of newness' (Stinchcombe, 1965) compared to larger and more established firms, in a survival analysis one ideally measures the effect of co-location at each moment in time. Following this reasoning, Buenstorf and Klepper (2009) and Buenstorf and Guenther (2011) measure localization externalities on a yearly basis, yet they use regional shares of firms rather than the absolute count of firms.

We measure localization externalities by counting the number of firms present in each year and in each region. Since the firms in our dataset are located across the globe, the regionalization of the data requires a uniform regional classification. The Organization for Economic Co-operation and Development (OECD) offers such a uniform regionalization. '*Regions in OECD Member Countries have been classified according to two territorial levels (TL), to facilitate international comparability. The higher level (Territorial level 2) consists of macro-regions, while the lower level (Territorial level 3) is composed of micro-regions in the 30 OECD member countries. These levels are officially established, relatively stable and are used in most countries as a framework for implementing regional policies*' (OECD, 2010, p.3). The regional variables employed in this paper are all measured at the TL3 level, because this level represents labor market areas. In the US, TL3 regions represent economic areas as defined by the Bureau of Economic Analysis (BEA), while in Europe, TL3 regions are largely equal to the NUTS3 level.[5] By following this measurement strategy, we excluded 311 firm founding events from the analysis. These firms are located in regions outside the OECD regionalization.[6] Our final model includes a total number of 379 TL3 regions.

[5] More info on the regionalization can be found at http://www.oecd.org/dataoecd/32/4/42027551.pdf

[6] In order to test whether the omission of these 311 firm founding events affected our outcomes, we also estimated a model in which we created artificial regions based on distances between firms for all 311 firms. Firms within a 150

In order to exploit the fact that we cover the video game industry globally, we will assess not only the effect of agglomeration at the regional level, but also on higher scales of spatial aggregation.[7] Even if one would expect that external costs and benefits of co-location at the regional level are most important on theoretical grounds, co-location at higher levels of spatial aggregation may also be a source of externalities. In particular, as discussed above, national boundaries may play a role. Video games are cultural products and their meaning and success is mostly bounded by national markets. Indeed, the vast majority of all video games are initially only released in the country in which the game was produced. The more successful games are then released in multiple countries (Kent 2001).

Turning to performance, we follow most industry studies that measure performance as survival. Even if this measure has the advantage of being clearly defined by a (legal) event that is easily traceable in the past, there is increasing awareness that exit may not always indicate failure. In particular, in case of exit by acquisition, this may be actually a sign of success rather than failure (Cefis and Marsili, 2007). Entrepreneurs often found firms with the specific objective of selling the firms at a later stage to larger incumbent firms who want to obtain capabilities that they find too expensive to develop in-house (Ranft and Lord, 2002). In this way, incumbents can remain competitive in a rapidly changing technological environment despite their inability to push the technological frontier by themselves. For the seller, especially when this concerns a young entrepreneurial firm, an acquisition can represent a successful strategy to harvest economic returns and liquidate assets. This is especially the case for innovative firms that are backed up by venture capital, or for firms that aim to grow rapidly in the presence of managerial and financial constraints.

Indeed, the video game industry is characterised by high rates of acquisition. Especially during the last decade, many founders set up a company with the purpose of selling their successful business to other firms in the industry (Rogers, 2004). The financial compensation and the decreasing pressure are important motives for selling a successful business. From our data (further explained below), we observe that 355 firms and 179 subsidiaries in the video game industry were acquired in the 1972-2008 time frame, out of 4,607 firms and 1,229 subsidiaries ever started. In many cases these firms were young, well performing firms that either developed a 'hit' video game or created a valuable proprietary technology. Indeed, our data show that young – as expressed through age – and well performing – as expressed through their pre-entry experience and quality of products – firms are more likely to be acquired than firms lacking these characteristics.

We will therefore conduct two separate survival analyses. First, we will estimate a *failure model* in which both firms that are alive at the end of the observed time period and acquired firms are treated as right censored observations (Klepper, 2002, 2007). Second, we will estimate an *acquisition model*, where firms that were alive at the end of the observed time period and firms that had gone bankrupt are treated as right censored exits. Thus, in the first case the hazard refers

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kilometer radius were placed in the same region. Since the vast majority of the 311 firms were Russian firms, we had no problem with 'overlapping regions' (firms that could be put in 2 or more regions). Including the artificial regions did neither alter the direction nor the significance of any of the explanatory variables in our models.

[7] In organizational ecology, density effects at both regional, national and global levels are taken into account (e.g., Hannan et al. 1995; Bigelow et al. 1997). Note, however, that such studies explain entry rates rather than survival.

to firms going bankrupt, while in the second case, the hazard refers to the likelihood of being acquired by another firm.

4. METHODS AND MATERIALS

The analyses in this paper are based on a unique, newly constructed database that contains information on firms that developed or published one or more computer games from the inception of the industry in 1972 to the end of our dataset in 2007. The database includes 91 platforms on which these computer games can be played. These 91 platforms[8] can be categorized into three types: game consoles, personal computers (PCs) and handhelds. Game consoles are computers specifically designed to play video games, PCs are computers that have multiple applications (which include gaming), and handhelds are small, mobile game consoles specifically designed for playing games.

We collected firm level data such as years of production, location and pre-entry experience of video game developers and publishers[9] from the inception of the industry in 1972 until the end of 2007. The aggregation of some of the firm level data resulted in industry level data, such as regional, national and global firm population levels. The data is a compilation of various data sources. The starting point was the Game Documentation and Review Project Mobygames.[10] The Mobygames website is a comprehensive database of software titles and covers the date and country of release of each title, the platform on which the game can be played, and the name of the publisher and developer of the game. Additionally, for 55% of all firms the Mobygames database provides a firm bio. In many of these bio's information of the location of the firm and the background of the entrepreneur is included. The database goes back until the inception of the industry in 1972, and the project aims to include all games that have ever been developed and published in the video game industry. To obtain data on entry, exit, location at the municipality level and pre-entry experience of all firms, and to control and monitor the quality of the Mobygames data, we also consulted the German Online Games Datenbank.[11] This online database is complementary to the Mobygames database in that it provides more detailed information on the location of companies and backgrounds of entrepreneurs. In the rare case that neither of the two databases provided this information or in the rare case that the information in the two databases was contradicting, other online or hardcopy resources were consulted. By combining the Game Documentation and Review Project Mobygames and the Online Games Datenbank, we were able to cover[12] 4,607 firms and 1,229 subsidiaries.[13]

[8] A list of platforms and characteristics of the platforms is available and can be sent by the authors upon request.

[9] In the figures and the analyses in this paper publishers and developers are grouped together. One third of all firms only develops games, one third only publishes and one third does both. We also estimated three models that included each group separately, and the results remained statistically similar.

[10] The Game Documentation and Review Project Mobygames can freely be consulted at http://www.mobygames.com. The Mobygames database is a catalog of 'all relevant information about electronic games (computer, console, and arcade) on a game-by-game basis' (http://www.mobygames.com/info/faq1#a). The information contained in MobyGames database is the result of contribution by the website's creators as well as voluntarily contribution by Mobygames community members. All information submitted to MobyGames is checked by the website's creators and errors can be corrected by visitors of the website.

[11] The Online Games Datenbank can freely be consulted at http://www.ogdb.de.

[12] Both the Mobygames and the OGDB are crowd sourced databases. All entries to the databases are checked for accuracy by moderators of the websites and by its users. We argue that by combining both sources we constructed a

Figure 2 shows the entry, exit and the global population levels for video game firms throughout the history of the industry. The figure clearly shows that the video game industry has been growing for many years, with 1983 and 2005 as years of a slight slowdown. Although entry of firms exceeds exit of firms in the majority of the time span, there is a clear connection between entry and exit of firms. Entry of firms seems to precede the exit of firms, which may be indicative for the competitive effect of an increase in population on exit.

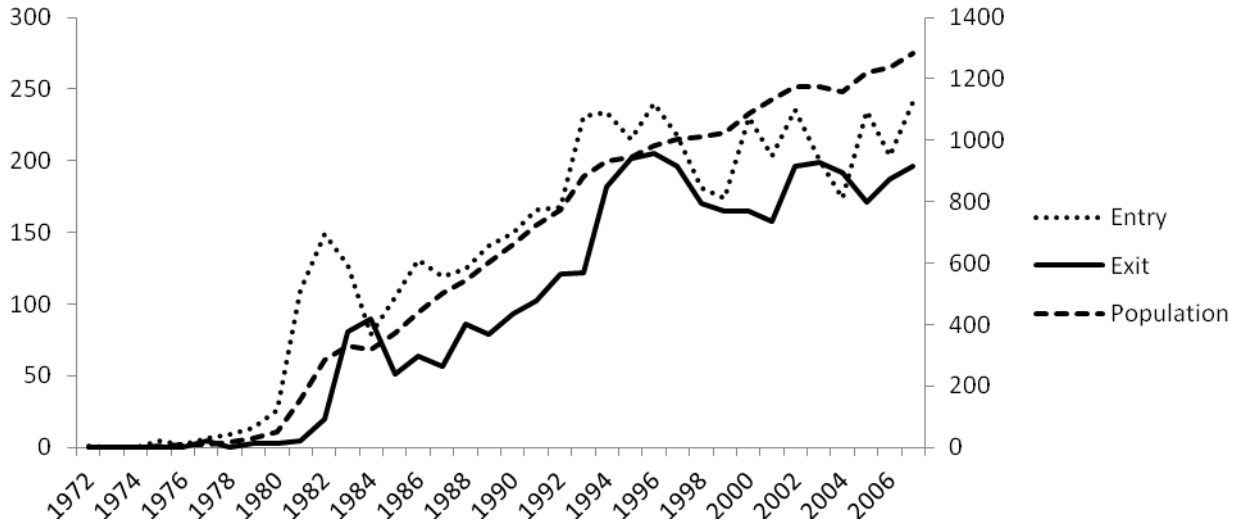

Figure 2. Entry and exit of publishers and developers in the video game industry

In Figure 3 we plotted the number of firms going bankrupt and the number of firms being acquired. The number of firms being acquired is steadily growing after the mid 1990s. In 2005, a total of 34 firms were acquired in the industry. Approximately 56% of all M&A activity took place within countries. The USA was most active both in terms of acquiring firms and of firms being acquired. Firms in the Los Angeles region were the most active acquirers, while firms in the San Francisco area were most likely to be acquired.

highly accurate database, free from large errors and omissions. We also compared the coverage of firms in our dataset with the coverage provided by other proprietary datasets such as gamespot.com and allgames.com and found a much higher accuracy in our dataset.

[13] The data on subsidiaries is solely used to construct the firm population statistics and are neither included as cases in our analyses, nor as cases in our figures.

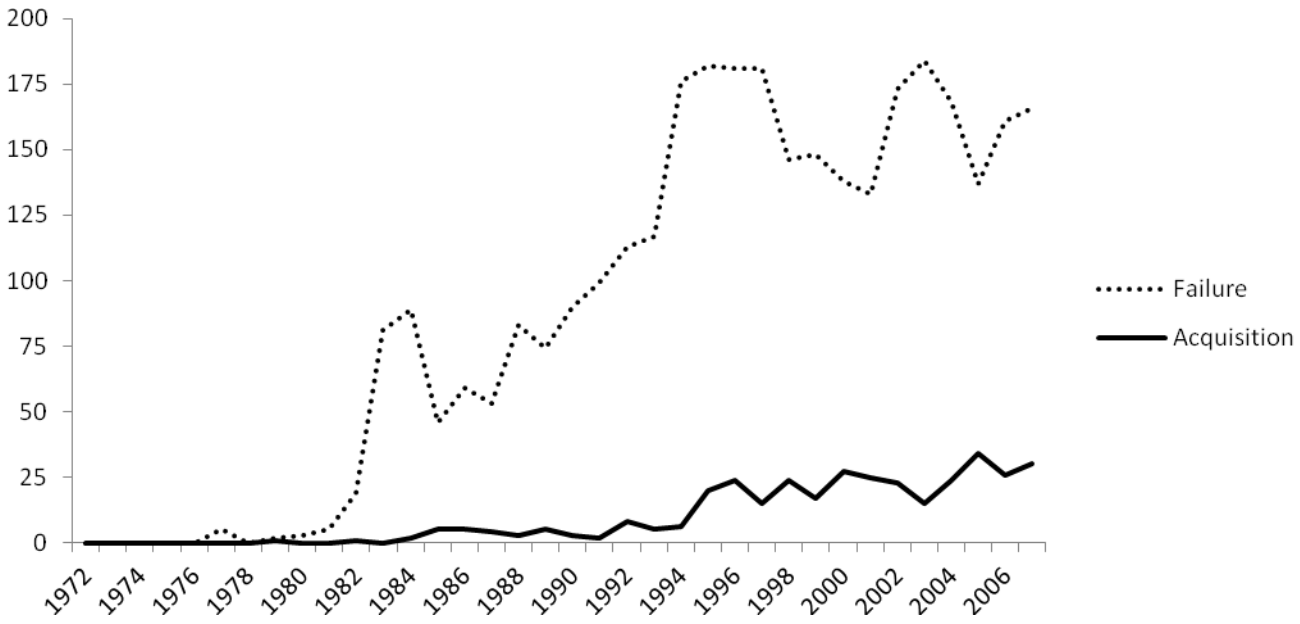

Figure 3. Publisher and developer exits from the video game industry by type of exit

In Figure 4, we plotted the annual number of entrants in the industry specified according to their pre-entry background. Experienced firms are firms that diversified from industries other than the video game industry and firms that were founded by entrepreneurs that previously headed or owned a firm in another industry. Spinoffs are firms founded by individuals previously employed by an incumbent firm in the video game industry. Startups are constituted by all other firms.[14] Initially, entrants in the industry were mainly startups and experienced firms, while since the mid 1990s the share of spinoffs among the total number of entrants is increasing. This finding is in line with other findings reflecting that especially spinoffs, with their pre-entry experience, can overcome entry barriers that rise over time (Klepper, 1996).

[14] This data was collected through the Mobygames database and the OGDB. By using these data sources, 69 % off all firms could be classified in one of the three categories. For the remaining 31 % we used other sources such as books, websites (Linkedin) and games magazines. This search increased coverage to 98%. The final 2% was covered by sending e-mails and making phone calls to entrepreneurs, local authorities and industry insiders.

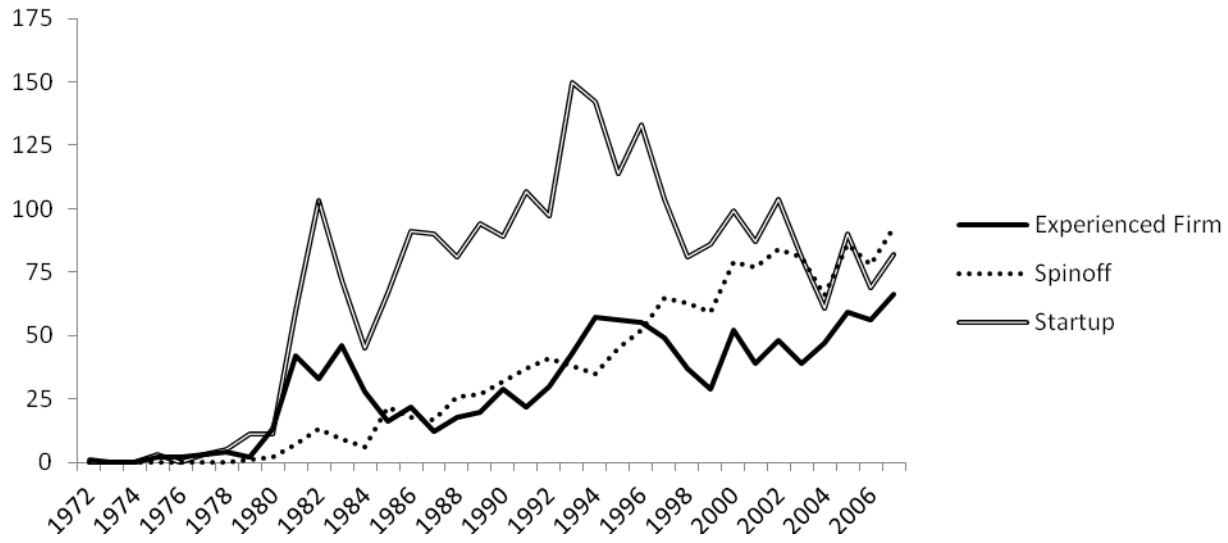

Figure 4. Entry of experienced firms, spinoffs and startups

Following previous studies (Boschma and Wenting, 2007; Klepper, 2007), one expects most spinoffs to locate close to their parent company, thus contributing to a clustering process. Calculating distances based on a straight line between two locations ("as the crow flies"), we find that the mean distance between the spinoff and the parent firm is quite large: 799 kilometers. However, the distribution of distances is highly skewed. No less than 71 percent of all spinoffs located within a radius of 150 kilometers from the parent firm and 90 percent of all spinoffs were located in the same country as the parent. The most common movement of spinoffs that relocated to another country were movements between the US, the UK and Australia, which obviously increase the mean distance between the parent firm and the spinoff substantially.

In Figure 5 we plotted the annual population of video game producers in the 10 largest regions in 2007. Tokyo is by far the largest with a peak of 219 establishments in 1998. The second largest region in Japan is Osaka with a peak of 29 firms in 1998. The United States is very well represented in the population graph. San Francisco and Los Angeles rank second and third, with a maximum of 117 establishments in the Los Angeles region and a maximum of 101 establishments in the San Francisco region. Other US regions that appear in the top 10 of regions are New York, Seattle and Dallas. In addition, the Vancouver region in Canada ranks number 9 in 2007. So there seems to be not just a strong presence of US firms, but also a clear pattern of concentration along the North American west coast.

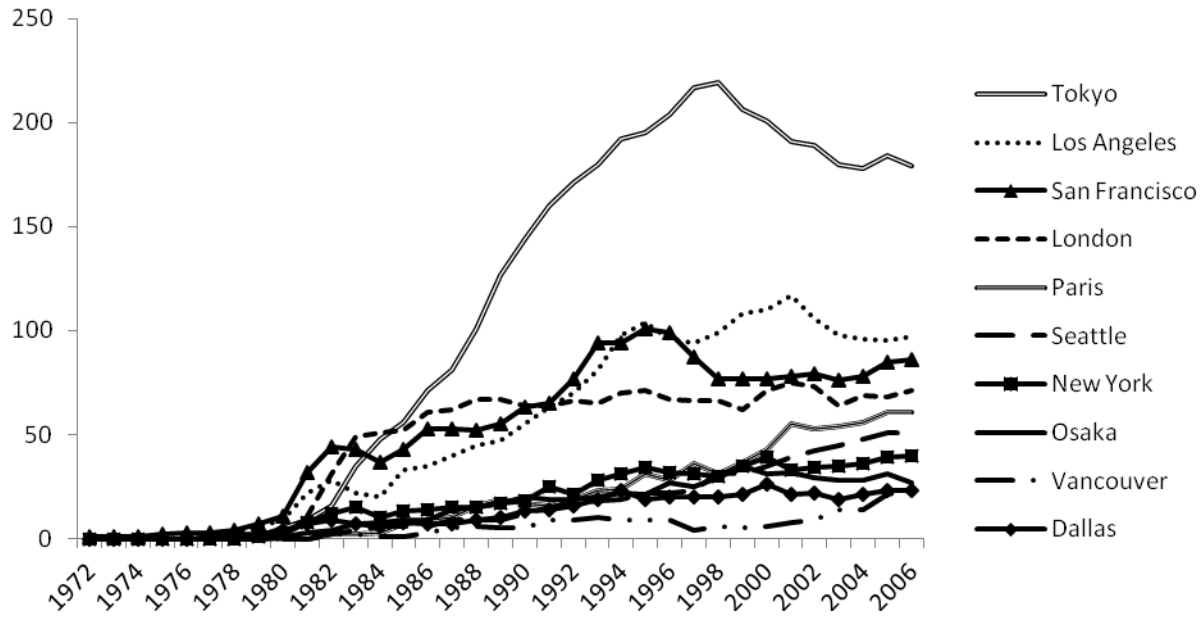

Figure 5. Annual number of firms in the top 10 regions worldwide

5. ESTIMATION

To test our hypotheses concerning failure and acquisition, we use two similarly specified hazard models.[15] Hazard models are used to model time-to-event data. In the field of industrial dynamics and organizational ecology, hazard models are widely used to test the determinants of firm failure (Agarwal and Gort, 1996; Klepper, 2002, 2007, 2010; Disney et al., 2003; Thompson, 2005; Buenstorf and Klepper, 2009). Hazard models take into account both the probability of occurrence of an event and the time-duration until the occurrence of an event. Hazard analysis also allows for the incorporation of cases that have artificially imposed ends of duration. Such an analysis is appropriate for our two models in which we are interested in the time to failure and the time to acquisition. As explained in section 3, while failure of a firm is a negative event, an acquisition event is considered here a positive event. Thus, the signs of the covariates are to be interpreted accordingly.

Previous research (Klepper, 2002, Buenstorf and Klepper, 2009) and descriptive statistics from our dataset indicates that the hazard rate decreases monotonically with duration. Therefore, using a Gompertz specification to model our time-to-event data provides a good fit (Blossfeld et al., 2007). The Gompertz specification provides two parameters to include variables. One parameter allows the explanatory variables to affect the hazard rate proportionally at all ages, while the

[15] We also estimated a competing risk model taking into account the competing risks of failure and M&A. Such a model has the advantage of not treating either failure or M&A as a right-censored observation, but it cannot take into account a specific distribution of the baseline hazard rate. Also, one can argue that in our case failure and M&A are not truly competing risks. In any case, the outcomes of the competing risk model were similar to the outcomes from the two separate specifications.

other parameter allows the explanatory variables to condition the effect of duration on the hazard rate. In our models, duration equals firm age. So, we specify both our failure model and our acquisition model accordingly:

$$h(\tau) = \exp(\beta_0 + \beta' c)\exp[(\gamma_0 + \gamma' x)\tau],$$

where $h(\tau)$ is the hazard of either failure or acquisition of the firm at age τ . That is, we estimate the probability that an event – going bankrupt or being acquired – occurs conditional on the fact that it did not occur in the prior time frame. In the failure model, both firms that are alive at the end of the observed time period and acquired firms were treated as right-censored observations. In the acquisition model, firms that were alive at the end of the observed time period and firms that had gone bankrupt are treated as right-censored exits. In our specification, *c* is the vector of covariates that affect the hazard proportionally at all values of duration, *x* is the vector of covariates that condition how age affects the hazard, β_0 and γ_0 are scalar coefficients, and β' and γ' are vectors of coefficients. Also, all explanatory variables that change over time are lagged by one year.

Dependent variable

The dependent variable in the hazard and the acquisition model is the hazard of exit or acquisition at age τ – $h(\tau)$ – which is a proxy for firm performance. Since we collected data on the entry and exit years of each video game firm from the inception of the industry in 1972 until December 31, 2007, we can determine firm age by counting the number of years between the first and last years of commercial production.

Independent variables

The variable *Spinoff* includes firms that were founded by former employees of other firms within the video game industry. The variable *Experienced Firm* includes all firms that diversified from industries other than the video game industry and firms that were founded by entrepreneurs that previously headed or owned a firm in another industry. These entrepreneurs were typically former CEOs, CFOs or other types of leading managers. The reference group here comprises all other startups. This group of firms includes recently graduated entrepreneurs that had no former affiliation and lower level employees of firms outside the industry, who decided to start a venture in the video game industry. As discussed in section 2, the main argument in establishing these categories is the fact that firms differ in their prior exposure to relevant organizational routines and their ability to reuse them in a new setting. While spinoffs and experienced firms are able to build upon routines exposed to prior to founding, other startups do not have this advantage. To further probe the hypothesis on the performance of spinoff companies, we also included the variable *Years Parent Produced,* which quantifies the age of the parent firm at the time that the spinoff company is created. Following Klepper (2007), we use this variable as a measure of the parent firm's quality.

We included three types of location-specific variables that might affect the hazard of failure and acquisition. First, the variable *Top 4 Regions* is a 1-0 dummy variable, with *Top 4 Regions* equal to 1 for the four regions with the largest number of video game producers in 2007: Tokyo, San Francisco, Los Angeles and London (as shown by Figure 4). We construct this dummy following the use of the Detroit dummy in Klepper's (2007) study on the U.S. automobile industry. Second,

we constructed several population variables where a firm enters the population at the year of entry and exits the population at the year of exit. The variable *Regional Firm Population* measures the yearly number of video game firms located in a firm's region excluding the firm itself. This is our localization externalities variable. The variable *National Firm Population* measures the number of video game firms located in the same country as the focal firm minus *Regional Firm Population*. *Global Firm Population* measures the number of video game firms in the previous year minus *National Firm Population.* Third, we used data on the number of inhabitants at the regional and national scale to control for potential consumer base. The variable *Regional Population* counts the absolute number of inhabitants in a firm's TL3 region in the previous year, while *National Population* counts the absolute number of inhabitants in country in the previous year minus the *Regional Population* of the region where a firm is located. These data are obtained from the OECD statistics center, which can be found at http://stats.oecd.org.[16]

Finally, we included a number of firm level control variables. First, we created 3 dummy variables based on the time of entry of each firm. All firms are categorized into three cohorts – *Cohort 1*, *Cohort 2*, and *Cohort 3* – with the first cohort spanning 1972-1990, the second cohort spanning 1991-1998, and the third cohort spanning the period 1999-2007. The division is based on the introduction of new generations of consoles, in which we combine generation 1 and 2, generation 3 and 4, and generation 5 and 6 respectively (De Vaan, 2010; Forster 2005). Cohort 3 is the omitted reference category. Second, the variable *Multi-activity* is a dummy variable equal to 1 if a firm was active in both publishing and developing of video games. Such firms are able to master two disciplines and they are able to spread risks. Third, the variable *Multi-Product* is a dummy variable that measures whether a firm is active in both the production of console games and the production of PC games, the two largest submarkets in the video game industry. Fourth, the variable *# Games* counts the yearly number of games produced by a firm. And fifth, we constructed the variable *Review Scores*, which measures the mean score received from game critics on the games produced by a firm in a particular year. A review source – either online or in print – is included in the measure if it has issued at least a hundred reviews, and if it reviews multiple platforms. Hence, the variable *Review Scores* is used as a proxy for the artistic success of video games and is expected to be a main determinant of firm success as well, as artistic success often, though not automatically, translates into commercial success. In the acquisition model, we also included two country dummies for *Japan* and *USA*. We included these two variables to account for country-specific institutions that affect acquisition rates, as Japanese firms are characterized primarily by attitudes of internal growth, while US firms accomplish growth more often through external acquisitions (Odagiri and Hase, 1989).

[16] National population statistics are available for all years of our observations. Population statistics for some regions are difficult to obtain for the 1970s and the 1980s. We therefore used growth of the national population and the distribution of the regional population in the first five years of complete information to compute the regional population in the years in which data was missing. To check the robustness of our findings we used similar procedures for regions on which data was complete and compared them to the computed data. Outcomes indicate no significant statistical difference between the means of the computed populations and the means of the observed populations.

6. FINDINGS

In the Appendix, we present the descriptive statistics, while Table 1 and Table 2 present the estimation results of the failure model and acquisition model, respectively.

Failure model

Starting with the failure model, we learn that spinoffs and experienced firms outperform other firms. We also observe that the years of production of the parents of spinoffs lower the hazard of failure. All this clearly indicates that, in line with previous findings, pre-entry experience matters for firm survival. Furthermore, the effects of *Experienced Firm* and *Spinoff* in the *x* vector are positive and significant. This implies that the initial advantage of experienced firms and spinoffs over other types of startups declines with firm age. In other words, pre-entry experience is especially important to overcome early-stage difficulties, known as liability of newness (Stinchcombe, 1965). At later stages, the effect of pre-entry experience fades away, reflecting the fact that relying on the heritage of the parent firm's routines does not benefit these firms at older ages.

The second main finding holds that, contrary to all previous evolutionary studies, we find evidence for positive localization externalities. In model 2, we first tested for such externalities by using a dummy for the four main clusters, which exactly replicates the research design of Klepper (2007). The positive and significant coefficient indicates that firms benefited from locating in one of the main clusters. Furthermore, these benefits are not confined to spinoffs in these clusters as shown by the non-significant coefficient of the interaction term. That is, in addition to spinoffs other firms in the cluster were also able to benefit from being co-located. The emergence of the four clusters can then not be explained by a localized process of capability transmission from outstanding parents to newly established firm in the cluster, but rather as a product of pervasive localization externalities benefiting spinoffs and other firms alike. Note, however, that the advantage of cluster location is about eight times smaller[17] than the advantage of being a spinoff. Thus, even though we find evidence for a positive cluster effect on firm survival, our study still supports the argument that pre-entry experience as such remains the main driver of firm success.

[17] Standardized coefficients show a similar ratio.

*Table 1. Failure Model; ** ≤ 0.01, * ≤ 0.05*

Variable	1		2		3		4		5	
Top 4 Regions	-0.101	**	-0.118	**	-0.095	*	-0.160	*	-0.010	
	0.039		0.043		0.039		0.068		0.074	
Top 4 Regions * Spinoff			0.094							
			0.100							
Regional Firm Population²/100									-0.001	**
									0.000	
Ln(Regional Firm Population)							0.044	*	0.084	**
							0.021		0.023	
Ln(National Firm Population)							0.051	*	0.029	
							0.026		0.026	
Ln(Global Firm Population)							-0.156	**	-0.135	**
							0.038		0.039	
Ln(Regional Population)							-0.031		-0.048	
							0.026		0.026	
Ln(National Population)							0.009		0.029	
							0.044		0.044	
Experienced Firm	-0.706	**	-0.706	**	-0.708	**	-0.717	**	-0.732	**
	0.064		0.064		0.064		0.066		0.066	
Spinoff	-0.847	**	-0.872	**	-0.660	**	-0.666	**	-0.683	**
	0.068		0.073		0.094		0.096		0.096	
Years Parents Produced					-0.022	**	-0.026	**	-0.026	**
					0.008		0.008		0.008	
Cohort 1	0.073		0.072		0.060		-0.156		-0.175	*
	0.065		0.065		0.065		0.087		0.088	
Cohort 2	0.309	**	0.308	**	0.301	**	0.222	**	0.228	**
	0.064		0.064		0.064		0.068		0.068	
Multi-Activity	-0.261	**	-0.261	**	-0.263	**	-0.290	**	-0.277	**
	0.068		0.068		0.068		0.071		0.071	
Multi-Product	-0.302	**	-0.301	**	-0.299	**	-0.325	**	-0.346	**
	0.104		0.104		0.104		0.106		0.106	
# Games	-0.058	**	-0.058	**	-0.058	**	-0.057	**	-0.058	**
	0.007		0.007		0.007		0.007		0.007	
Review Scores	-0.188	**	-0.188	**	-0.187	**	-0.187	**	-0.190	**
	0.014		0.014		0.014		0.014		0.014	
Constant	-0.945	**	-0.940	**	-0.942	**	0.140	**	-0.086	**
	0.057		0.057		0.056		0.724		0.724	
Experienced Firm * τ	0.060	**	0.060	**	0.061	**	0.060	**	0.061	**
	0.011		0.011		0.011		0.011		0.011	
Spinoff * τ	0.066	**	0.065	**	0.063	**	0.062	**	0.062	**
	0.013		0.013		0.013		0.013		0.013	
Cohort 1 * τ	-0.062	**	-0.062	**	-0.064	**	-0.058	**	-0.052	**
	0.016		0.016		0.016		0.017		0.017	
Cohort 2 * τ	-0.069	**	-0.070	**	-0.069	**	-0.063	**	-0.059	**
	0.017		0.017		0.017		0.018		0.018	
τ (Firm Age)	0.013		0.013		0.014		0.020		0.019	
	0.015		0.015		0.015		0.016		0.016	
Number of Observations	20,794		20,794		20,794		19,698		19,698	
Log-Likelihood	-5878.674		-5878.833		-5874.711		-5487.556		-5476.877	

In model 4 we include the effect of *Regional Firm Population*, as our preferred measure of localization externalities, and in model 5 we add the quadratic term of this variable to test for the hypothesized non-linearities. The linear term increases the probability of failure while the quadratic term decreases the probability of firm failure. These results are consistent with our expectation that negative localization externalities increase linearly with the number of firms in a cluster, while the positive localization externalities increase non-linearly with the number of firms in a cluster. In particular, initially the negative effects of an increase in number of co-locating firms outweigh the positive effects. Then, after a threshold of 55 firms, the positive effects of an increase in the number of co-locating firms start to outweigh the negative effects. Interestingly, this threshold is almost similar to the threshold found by Folta et al. (2006) who studied the effect of clustering on firm failure in the biotech industry and found that firms started to benefit from co-locating after a threshold of 53 firms. We plotted the relation between cluster size and hazard rate in Figure 6 and the graph shows a clear bell-shaped curve. Also note that the effect of *Top 4 Regions* is not significant anymore, reflecting that our preferred measure of localization externalities best captures the effects of clustering on performance.[18]

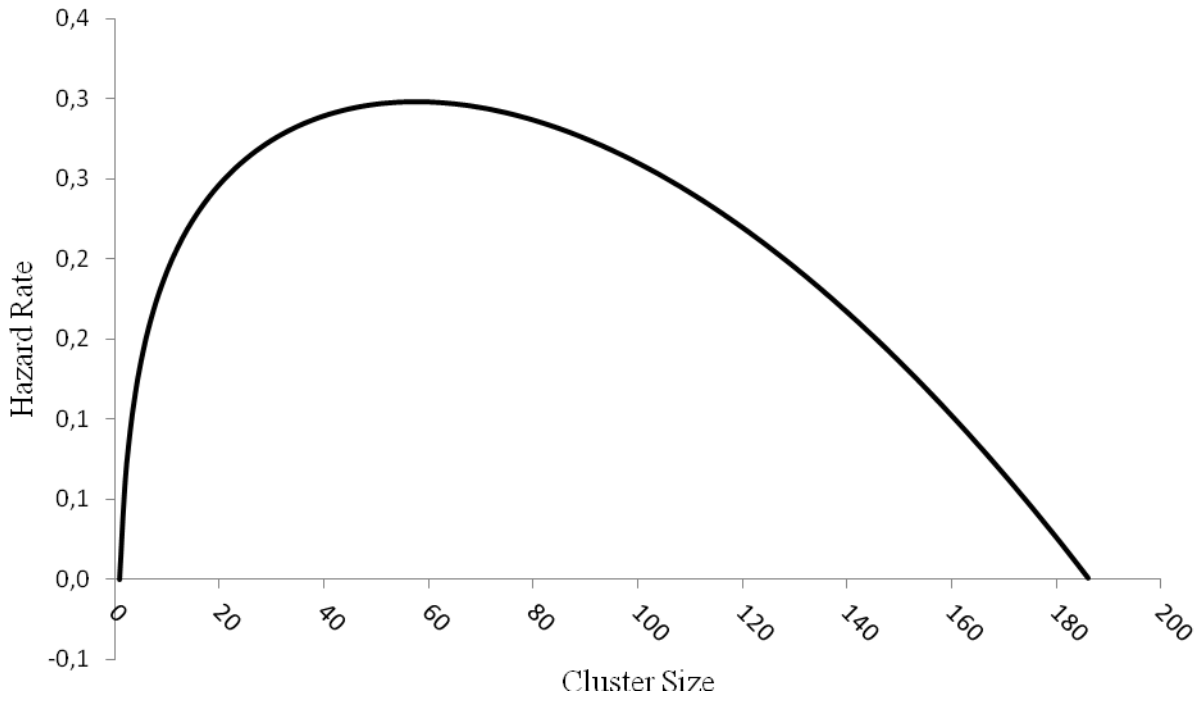

Figure 6. Relation between hazard rate and cluster size

[18] The variables Top4 Regions, ln(Regional Firm Population) and Regional Firm Population²/100 show high levels of correlation. To test the robustness of our findings we both calculated the variance inflation factors – which indicated that our results are not biased – and we estimated our models by removing Top4 regions from the specification. The results were statistically and interpretively similar to the findings presented in this paper.

Further controls include *National Firm Population*, which has no effect on hazard rates, while *Global Firm Population*, surprisingly, lowers the hazard to exit where one would expect a negative effect resulting from an increase in competition. The firm-level control variables are all affecting firm survival in the expected direction. *Multi-activity* (being active in both publishing and development), *Multi-Product* (being active both in console and PC games) and *# Games* (yearly number of games) lower the failure hazard. These variables indicate a spread of risks by being active in two markets, in two sub-markets, or in the production of multiple games. Firms that produced artistically successful games (*Review Scores*) are also less likely to fail.

Acquisition model

In Table 2, we present the findings of the acquisition model. Since one of the objectives is to compare these findings with the ones obtained in the failure model, we have included the same variables as in Table 1. We expect that the covariates that explain survival (a negative, significant coefficient in Table 1) also explain the probability of being acquired (a positive, significant coefficient in Table 2).

In line with our expectations on the effect of pre-entry experience, we find indeed that spinoffs and experienced firms have higher hazards of acquisition. Thus, pre-entry experience increases the chance of survival as well as the chance of being acquired. The negative and significant effects of the *Experienced Firm* and *Spinoff* in the *x* vector also indicate that the effect pre-entry experience decreases with firm age as it does for firm survival in Table 1. Unexpectedly, we find no effect of *Years Parents Produced* on the probability of being acquired.

With respect to the effects of location-specific variables on the risk of being acquired, we found no significant effect of being located in one of the top 4 clusters. Yet, *Regional Firm Population* and *National Firm Population* have a positive and significant effect on the probability of acquisition while *Global Firm Population* has no effect. These results imply that being located in the vicinity of many other video game firms increases the chances of being acquired. Whether this indeed reflects the positive localization externalities firms accrue from co-location, which raises their value as an acquisition target, is difficult to say. It could also reflect that acquisition activity is sensitive to geographical proximity, although this latter interpretation is unlikely given that only 21 percent of all acquisition took place within the same region and 56 percent in the same country but outside the region. As expected, being a US firm increases the risk of being acquired, while being a Japanese firm significantly lowers the risk of being acquired in all models except for one (Odagiri and Hase, 1989).

With respect to the firm-level controls, we found that only *Multi-Product* firms and those with high *Review Scores* are more likely to be acquired, while *Multi-Activity* and *# Games* had no effect. The positive effect of review scores, which provides the best proxy for the quality of games, strengthens our belief that, indeed, acquisition is more often a sign of success than of failure. Indeed, acquisition can be motivated by getting hold of games code and trademarks as to be able to develop sequel versions.

*Table 2. Acquisition Model; ** ≤ 0.01, * ≤ 0.05*

Variable	6		7		8		9		10	
Top 4 Regions	-0.141		-0.192		-0.144		-0.160		-0.042	
	0.133		0.165		0.133		0.191		0.218	
Top 4 Regions * Spinoff			0.135							
			0.250							
Regional Firm Population²/100									-0.002	
									0.002	
ln(Regional Firm Population)							0.166	**	0.199	**
							0.067		0.074	
ln(National Firm Population)							0.232	*	0.221	*
							0.098		0.098	
ln(Global Firm Population)							-0.241		-0.230	
							0.159		0.160	
ln(Regional Population)							-0.155		-0.172	
							0.087		0.089	
ln(National Population)							-0.271		-0.255	
							0.165		0.165	
Experienced Firm	0.964	**	0.964	**	0.966	**	1.029	**	1.025	**
	0.213		0.213		0.213		0.219		0.219	
Spinoff	0.908	**	0.878	**	0.772	**	0.766	**	0.759	**
	0.210		0.218		0.264		0.272		0.272	
Years Parents Produced					0.015		0.012		0.011	
					0.017		0.017		0.017	
Cohort 1	-0.748	**	-0.748	**	-0.720	**	-0.837	*	-0.860	*
	0.224		0.224		0.227		0.315		0.316	
Cohort 2	-0.519	**	-0.520	**	-0.505	*	-0.498	*	-0.495	*
	0.217		0.217		0.218		0.229		0.229	
Multi-Activity	0.077		0.077		0.081		0.096		0.092	
	0.144		0.144		0.144		0.146		0.146	
Multi-Product	0.530	**	0.530	**	0.526	**	0.486	**	0.479	**
	0.146		0.146		0.146		0.147		0.147	
# Games	0.000		0.000		0.000		0.000		-0.001	
	0.002		0.002		0.002		0.002		0.002	
Review Scores	0.172	**	0.172	**	0.172	**	0.179	**	0.178	**
	0.052		0.052		0.052		0.054		0.054	
Japan	-1.211	**	-1.206	**	-1.229	**	-1.086	**	-0.813	*
	0.263		0.263		0.263		0.321		0.391	
USA	0.487	**	0.482	**	0.477	**	0.562	*	0.551	*
	0.118		0.119		0.119		0.277		0.278	
Constant	-5.427	**	-5.413	**	-5.431	**	1.864		1.733	
	0.239		0.241		0.240		3.072		3.076	
Experienced Firm * τ	-0.093	**	-0.093	**	-0.093	**	-0.097	**	-0.096	**
	0.023		0.023		0.023		0.023		0.023	
Spinoff * τ	-0.079	**	-0.080	**	-0.076	**	-0.078	**	-0.077	**
	0.025		0.025		0.025		0.025		0.025	
Cohort 1 * τ	0.009		0.009		0.009		-0.004		-0.002	
	0.032		0.032		0.032		0.036		0.036	
Cohort 2 * τ	0.060		0.060		0.059		0.048		0.049	
	0.037		0.037		0.037		0.039		0.039	
τ (Firm Age)	0.142	**	0.142	**	0.142	**	0.162	**	0.161	**
	0.031		0.031		0.031		0.033		0.033	
Number of Observations	20,794		20,794		19,698		19,698		19,698	
Log-Likelihood	-1090.527		-1090.381		-1090.145		-1033.447		-1032.855	

In sum, comparing the results on failure and on acquisition, we can conclude that the main determinants of firm survival from our theoretical perspective, being pre-entry experience and review scores, are also the main determinants of the risk of being acquired. This confirms our assumption that - for most firms - the event of being acquired should be considered as a sign of success.

7. CONCLUDING REMARKS

Evolutionary scholars have put forward a new theory of spatial clustering based on the spatial dimension of transmission of organizational routines between parent firms and spinoff firms, and have found evidence for a range of industries that spinoff dynamics, rather than localization externalities, explain the spatial concentration of industries. The main argument we have put forward in our study holds that, while negative localization externalities may well be proportional to the number of fellow competitors in line with recent empirical evidence, positive localization externalities may rise non-linearly as a consequence of increases in social network interactions within clusters.

We developed this hypothesis within the context of project-based industries where social networks function as an important repository of knowledge alongside organizational routines at the firm level. Paraphrasing Grabher (2002), we posited that project-based collaboration maximizes "recombinatory options" between a diverse range of skilled experts and that the potential for recombining expertise in project configurations rises non-linearly with the size of the cluster. Our empirical analysis on the video game industry indeed provides evidence that, while the number of competitors in a region lowers firm performance, its non-linear effect - reflecting the recombinatory potential - suggests a performance-enhancing effect. We thus suggest that, apart from the organizational routines that spinoff firms take with them from their parent firms, firms also benefit from variety in employee's expertise and personal networks in geographic clusters, and these benefits are expected to outweigh the negative localization externalities once a cluster reaches a critical scale allowing for rich network interactions. More generally, we can conclude that localization externalities in clusters are likely to be both positive and negative, with the former outweighing the latter when cluster size exceeds a critical threshold. This finding highlights the difference between traditionally organized manufacturing industries and project-based industries as far as the process of spatial clustering is concerned.

An important limitation of our study has been the lack of geo-coded network data of individuals involved in the development of video game development. That is, we have used network-theoretical arguments as a lens to probe the complex role of localization externalities for firms in the video game industry, without having been able to test the underlying assumptions directly with an explicit social network analysis at the level of individuals, for example, by defining ties by common team membership (cf. Uzzi and Spiro 2005; Breschi and Lissoni 2009). Balland et al. (forthcoming) investigated the drivers of dyadic relationships between video game firms, but they could not analyze social networks at the level of individuals, due to a lack of geo-coded data. A further step will be to analyse the social networks of professionals in project-based industries

such as the video game industry, and in particular the extent to which the frequency and importance of ties is affected by the geographical scale at which these ties occur.

A second contribution of our study has been our analysis of firm survival, where we differentiated between exits by failure and exit by acquisition as the latter are more often a sign of success rather than of failure in the video game industry. From the empirical analysis, we concluded that being acquired is best considered as a sign of success rather than as business failure, as the main determinants explaining survival (pre-entry experience, quality of games) also explain the probability of being acquired. This finding stresses the salience of distinguishing between types of exit. Evolutionary studies and other approaches relying on survival analysis should be careful in interpreting firm exit as a unidimensional outcome and we urge such research to distinguishing between the causes of exit and disentangle its associated economic effect.

In conclusion, our study suggests that studies in evolutionary economic geography should be more sensitive to industry specificities that are reflected in the exact nature of localization externalities as well as the different modes of performance. In particular, project-based industries have very specific features that render these different from the manufacturing logic on which much theorising in evolutionary economics has been based. Social networks function as a second repository of knowledge next to organizational routines, and the extent to which firms have access to such networks will greatly affect their ability to survive.

REFERENCES

Agarwal, R., Gort, M. (1996). The evolution of markets and entry, exit and the survival of firms. *Review of Economics and Statistics*, 69 (4): 567 – 574.

Agrawal, A. Cockburn, I. (2003). The anchor tenant hypothesis: exploring the role of large, local, R&D-intensive firms in regional innovation systems. *International Journal of Industrial Organization*, 21 (9): 1227 – 1253.

Appold, S.J. (1995). Agglomeration, interorganizational networks, and competitive performance in the U.S. metalworking sector. *Economic Geography*, 71 (1): 27 – 54.

Appold S. J. (2005) Location patterns of US industrial research: Mimetic isomorphism and the emergence of geographic charisma. *Regional Studies* 39(1): 17 – 39.

Asheim, B., Coenen, L., Moodysson J., Vang, J. (2007). Constructing knowledge-based regional advantage: Implications for regional innovation policy. *International Journal of Entrepreneurship and Innovation Management*, 7 (2-5): 140 – 155.

Asheim, B., Gertler, M. (2005). The geography of innovation: regional innovation systems. In: Fagerberg J., Mowery D. and Nelson, R. (eds.) *The Oxford Handbook of Innovation*, Oxford: Oxford University Press: 291 – 317.

Balland, P.A., De Vaan, M., Boschma, R.A. (forthcoming). The dynamics of interfirm networks along the industry life cycle: The case of the global video game industry 1987-2007. *Journal of Economic Geography*, forthcoming.

Bielby, W.T., Bielby, D.D. (1999). Organizational mediation of project-based labor markets: Talent agencies and the careers of screenwriters. *American Sociological Review*, 64 (1): 64 – 85.

Blossfeld, H.P., Golsch, K., Rohwer, G. (2007) *Event history analysis with Stata*. Mahwah, New Jersey: Lawrence Erlbaum Associates.

Boschma, R.A., Frenken, K. (2003) Evolutionary economics and industry location. *Review for Regional Research*, 23: 183 – 200.

Boschma, R.A., Frenken, K. (2011) The emerging empirics of evolutionary economic geography. *Journal of Economic Geography*, 11 (2): 295 – 307.

Boschma, R.A., Wenting, R. (2007) The spatial evolution of the British automobile industry: Does location matter? *Industrial and Corporate Change*, 16 (2): 213 – 223.

Breschi S., Lissoni, F. (2001) Knowledge spillovers and local innovation systems: A critical survey. *Industrial and Corporate Change*, 10 (4): 975 – 1005.

Breschi, S., Lissoni, F. (2009) Mobility of skilled workers and co-invention networks: an anatomy of localized knowledge flows. *Journal of Economic Geography*, 9 (4): 439 – 468.

Brown, J.S., Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science*, 2 (1): 40 – 57.

Buenstorf, G., Guenther, C. (2011). No place like home? Relocation, capabilities, and firm survival in the German machine tool industry after World War II. *Industrial and Corporate Change*, 20 (1): 1 – 28

Buenstorf, G., Klepper, S. (2009). Heritage and agglomeration: the Akron tyre cluster revisited. *The Economic Journal*, 119: 705 – 733.

Cattani, G., Ferriani, S., Frederiksen, L., Täube, F. (2011). Project-based organizing and strategic management. A long-term research agenda on temporary organizational forms. In: Cattani, G., Ferriani, S., Frederiksen, L., Täube, F. (eds.). *Project-based Organizing. Advances in Strategic Management*. London, UK: Emerald Group Publishing Limited.

Caves, R.E. (2000). *Creative Industries: Contracts between Art and Commerce*. Cambridge, Massachusetts: Harvard University Press.

Cefis, E., Marsili, O. (2006). Survivor: The role of innovation on firms' survival. *Research Policy*, 35: 626 – 641.

Cooke, P., Urange, M., Etxebarria, G. (1997) Regional innovation systems: Institutional and organisational dimensions. *Research Policy*, 26(4-5): 475 – 491

Currid, E., Williams, S. (2009). The geography of buzz: Art, culture and the social milieu in Los Angeles and New York. *Journal of Economic Geography* , 9 (5): 1 - 29.

Disney, R., Haskel, J., and Heden, Y. (2003). Entry, Exit and Establishment Survival in UK Manufacturing. *The Journal of Industrial Economics*, 51 (1): 91 – 112.

Engwall, M. (2003). No project is an island: linking projects to history and context. *Research Policy*, 32: 789 – 808

Eriksson, R. (2011). Localized spillovers and knowledge flows: How does proximity influence the performance of plants? *Economic Geography*, 87(2): 127 –152

Figueiredo, O., Guimaraes. P., Woodward. D. (2002). Home-field advantage: location decisions of Portuguese entrepreneurs. *Journal of Urban Economics*, 52: 341 – 361.

Folta, T.B., Cooper, A.C., Baik, Y. (2006). Geographic cluster size and firm performance. *Journal of Business Venturing*, 21: 217 – 242

Gann, D.M., Salter, A.J. (2000). Innovation in project-based, service-enhanced firms: the construction of complex products and systems. *Research Policy*, 29 (7-8), 955 – 972.

Girard, M., Stark, D. (2002). Distributing Intelligence and Organizing Diversity in New Media Projects. *Environment and Planning A*, 34 (11):1927 – 1949.

Gordon, I.R, Molho, I. (1995). Duration dependence in migration behaviour: cumulative inertia versus stochastic change. *Environment and Planning A*, 27 (12): 1961 – 1975.

Grabher, G. (2002). The Project Ecology of Advertising: Tasks, Talents, and Teams. *Regional Studies*, 36 (5): 245 – 262.

Grabher, G. (2004). Learning in projects, Remembering in networks? Communality, sociality, and connectivity in project ecologies. *European Urban and Regional Studies*, 11 (2): 99 – 119.

Heebels, B., Boschma, R. (2011). Performing in Dutch book publishing 1880-2008. The importance of entrepreneurial experience and the Amsterdam cluster. *Journal of Economic Geography*, 11: 1007-1029.

Hellmann, T.M. (2000). Venture capitalists. The coaches of Silicon Valley. In: *The Silicon Valley edge*. C.M. Lee, W.F. Miller, M.G. Hancock, H.S. Rowen (eds.): 276 – 294. Stanford, California: Stanford University Press.

Henry, N., Pinch, S. (2000). Spatialising knowledge: Placing the knowledge community of motor sport valley. *Geoforum* 31 (2): 191 - 208.

Ibert, O. (2004). Projects and firms as discordant complements. Organizational learning within the Munich software ecology. *Research Policy*, 33 (10): 1529 – 1546.

Johns, J. (2006). Video games production networks: value capture, power relations and embeddedness. *Journal of Economic Geography*, 6: 151 – 180.

Katz, M., Shapiro, C. (1985). Network externalities, competition and compatibility. *American Economic Review*, 75 (3): 424 – 440.

Kenney, M. Florida, R. (2000). Venture capital in Silicon Valley: Fueling new firm formation. In: *Understanding Silicon Valley. The Anatomy of an Entrepreneurial Region*. M. Kenney (ed.): 98 – 123. Stanford, California: Stanford University Press.

Kent, S.L. (2001). *The Ultimate History of Video Games: From Pong to Pokemon - The Story Behind the Craze That Touched Our Lives and Changed the World*. New York, New York: Prima Publishing.

Klepper, S. (1996). Entry, exit, growth and innovation over the product life cycle. *American Economic Review*, 86: 562 – 583.

Klepper, S. (2002). The capabilities of new firms and the evolution of the US automobile industry. *Industrial and Corporate Change*, 11: 645 – 666.

Klepper, S. (2007). Disagreements, spinoffs, and the evolution of Detroit as the capital of the U.S. automobile industry. *Management Science*, 53 (4): 616 – 631.

Klepper, S. (2010). The origin and growth of industry clusters: the making of Silicon Valley and Detroit, *Journal of Urban Economics*, 67: 15 – 32.

Kloosterman, R.C. (2010). Building a career: labour practices and cluster reproduction in Dutch architectural design, *Regional Studies*, 44 (7): 859 – 871.

Marshall, A. (1920). *Principles of Economics*. 8th ed. London: Macmillan.

Martin, R., Sunley, P. (2003). Deconstructing clusters: chaotic concept or policy panacea? *Journal of Economic Geography*, 3 (1): 5 – 35.

Nelson, R.R. and Winter, S.G. (1982). *An Evolutionary Theory of Economic Change*. Cambridge: Belknap Press.

New York Times, Richtel, M. (March 30, 2009). Video game makers challenged by the next wave of media. Page B3.

Niosi, J., Zhegu, M. (2010) Anchor tenants and regional innovation systems: the aircraft industry, *International Journalf of Technology Management*, 50 (3/4): 263 – 284

Odagiri, H., Hase, T. (1989). Are mergers and acquisitions going to be popular in Japan? An empirical study, *International Journal of Industrial Organization*, 7: 49 – 73.

OECD (2010). Territorial Grids of OECD Member Countries, http://www.oecd.org/dataoecd/32/4/42027551.pdf

Perretti, F., Negro, G. (2007). Mixing genres, matching people: A study in innovation and team composition in Hollywood. *Journal of Organizational Behavior*, 28: 563 – 586.

Pratt, A.C. (1997). The cultural industries production system: a case study of employment change in Britain, 1984–1991. *Environment and Planning A*, 29 (11): 1953 – 1974

Ranft, A.L., Lord, M.D. (2002). Acquiring New Technologies and Capabilities: A Grounded Model of Acquisition Implementation. *Organization Science*, 13 (4): 420 – 441.

Rogers, D.L. (2004). The End Game: How Top Developers Sold Their Studio, Gamasutra Features, http://www.gamasutra.com/features/20040303/rogers_01.shtml#

Saltzman, M. (2003). *Game Creation and Careers: Insider Secrets from Industry Experts*. Indianapolis, Indiana: New Riders Publishing.

Scott, A.J. (1997). The cultural economy of cities. *International Journal of Urban and Regional Research*, 21 (2): 323 – 339.

Scott, A.J. (2000). *The Cultural Economy of Cities; Essays on the Geography of Image-Producing Industries*. London, UK: Sage.

Sorenson, O., Audia, P.G. (2000). The social structure of entrepreneurial activity: geographic concentration of footwear production in the United States, 1940-1989, *American Journal of Sociology*, 106 (2): 424 – 462.

Staber, U. (2001). Spatial proximity and firm survival in a declining industrial district: The case of knitwear firms in Baden-Wuttemberg, *Regional Studies*, 35 (4): 329 – 341.

Stam, E. (2007). Why butterflies don't leave. Locational behavior of entrepreneurial firms. *Economic Geography*, 83 (1): 27-50.

Stinchcombe, A.L. (1965). Social Structure and Organizations. In: J.G. March (Ed.), *Handbook of Organizations* (pp. 142–193). Chicago, Illinois: Rand McNally & Company.

Storper, M. (1995). The Resurgence of Regional Economies, Ten Years Later: The Region as a Nexus of Untraded Interdependencies, *European Urban and Regional Studies*, 2 (3): 191 – 221.

Storper, M., Venables, A.J. (2004). Buzz: face-to-face contact and the urban economy. *Journal of Economic Geography*, 4: 351 - 370.

Stuart, T.E., Sorenson, O. (2003). The Geography of Opportunity: Spatial Heterogeneity in Founding Rates and the Performance of Biotechnology Firms. *Research Policy*, 32 (2): 229 – 253.

Suire, R., Vicente, J. (2009). Why do some places succeed when others decline? A social interaction model of cluster viability. *Journal of Economic Geography*, 9 (3): 381 – 404.

Sydow, J., Staber, U. (2002). The institutional embeddedness of project networks: The case of content production in German television. Regional Studies, 36 (3): 215 – 227.

Thompson, P. (2005). Selection and firm survival: Evidence from the shipbuilding industry, 1825–1914. *Review of Economics and Statistics*, 87: 26 – 36.

Tschang, F.T. (2007). Balancing the tensions between rationalization and creativity in the video games industry, *Organization Science*, 18: 989 – 1005.

Tylecote, A., Conesa, E. (1999). Corporate governance, innovation systems and industrial performance. *Industry and Innovation*, 6 (1): 25 – 50.

Uzzi, B., Spiro, J. (2005). Collaboration and creativity: The small world problem. *American Journal of Sociology*, 111(2): 447 – 504.

Vaan, M. de (2010). Interfirm networks in periods of technological turbulence and stability, working paper, Utrecht University.

Wennberg, K., Lindqvist, G. (2010). The effect of clusters on the survival and performance of new firms. *Small Business Economics*, 34: 221 – 241.

Wenting, R. (2008). Spinoff dynamics and the spatial formation of the fashion design industry, 1858-2005. *Journal of Economic Geography*, 8: 593 – 614.

Weitzman, M.L. (1998). Recombinant growth. *The Quarterly Journal of Economics*, 113 (2): 331 – 360.

Whitley, R. (2006). Project-based firms: new organizational form or variations on a theme? *Industrial and Corporate Change* 15 (1): 77 – 99.

Appendix

Table Descriptive Statistics and Correlation Matrix

	Variable	Mean	SD	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	**Top 4 Regions**	0.33	0.47	0.00	1.00	1.00																	
2	**Regional Firm Population²/100**	60.40	120.31	0.01	479.61	0.72	1.00																
3	**ln(Regional Firm Population)**	2.91	1.48	0.69	5.39	0.77	0.72	1.00															
4	**ln(National Firm Population)**	4.57	1.46	0.00	6.22	0.08	-0.05	0.12	1.00														
5	**ln(Global Firm Population)**	6.77	0.67	0.00	7.45	-0.12	0.12	0.05	-0.05	1.00													
6	**ln(Regional Population)**	14.99	1.23	10.21	16.95	0.67	0.49	0.70	0.17	-0.12	1.00												
7	**ln(National Population)**	18.36	1.01	11.59	19.52	0.36	0.15	0.33	0.79	-0.28	0.53	1.00											
8	**Experienced Firm**	0.27	0.44	0.00	1.00	0.03	0.01	0.04	-0.02	-0.07	0.08	0.02	1.00										
9	**Spinoff**	0.27	0.45	0.00	1.00	0.01	-0.01	0.04	0.14	0.17	-0.01	0.07	-0.37	1.00									
10	**Years Parents Produced**	2.23	4.64	0.00	28.00	0.05	0.03	0.09	0.15	0.19	0.04	0.10	-0.30	0.79	1.00								
11	**Cohort 1**	0.41	0.49	0.00	1.00	0.13	0.05	0.04	-0.04	-0.54	0.05	0.10	0.09	-0.21	-0.29	1.00							
12	**Cohort 2**	0.31	0.46	0.00	1.00	-0.01	0.04	0.00	0.06	0.19	0.03	0.00	-0.03	0.02	0.03	-0.57	1.00						
13	**Multi-Activity**	0.19	0.40	0.00	1.00	0.08	0.06	0.07	0.01	-0.12	0.07	0.06	0.10	-0.10	-0.11	0.27	-0.12	1.00					
14	**Multi-Product**	0.10	0.30	0.00	1.00	0.02	-0.02	0.05	0.04	0.05	0.01	0.01	0.06	0.02	0.00	0.12	-0.03	0.26	1.00				
15	**# Games**	5.70	23.82	0.00	878.00	0.04	0.01	0.07	0.04	0.01	0.04	0.04	0.12	-0.03	-0.05	0.16	-0.08	0.33	0.36	1.00			
16	**Review Scores**	2.52	1.20	0.00	5.00	0.05	0.03	0.06	0.02	0.04	0.04	0.03	-0.05	0.12	0.09	0.00	0.06	0.02	0.09	0.07	1.00		
17	**Japan**	0.18	0.39	0.00	1.00	0.52	0.75	0.51	-0.10	0.05	0.45	0.10	0.05	-0.07	-0.01	0.16	-0.03	0.09	-0.01	0.02	0.03	1.00	
18	**USA**	0.34	0.47	0.00	1.00	0.17	-0.20	0.09	0.61	-0.30	0.41	0.74	0.02	0.06	0.06	-0.03	0.06	0.00	0.00	0.01	0.05	-0.36	1.00