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Knowledge flows in high-impact firms: How does relatedness influence survival, acquisition and exit?

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Abstract: Following the impact on regional renewal and employment ascribed to rapidly growing firms (high-impact firms, HIFs), this paper argues that little is still known in economic geography and business studies today regarding the mechanisms influencing growth of such firms and, hence, the potential impact on regional employment. The aim of this paper is thus to explore how the qualitative content of skills (i.e. the degree of similarity, relatedness and unrelatedness) recruited to a firm during a period of fast growth influences its future success. Our findings, based on a sample of 1,589 HIFs in the Swedish economy, suggest that it is not only the number of people employed that matters in aiding the understanding of the future destiny of the firms – but also, more importantly, it is the scope of the skills recruited and their proximity to related industries.

Keywords: high-impact firms, skills, relatedness, labor flows

JEL codes: L25, R12, R23

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1. Introduction

Following the seminal work by Birch (1981), increasing interest in research and policy has been directed at the contribution of high-impact firms[1] (henceforth HIFs) to regional growth and employment (e.g. Acs and Mueller, 2008; Acs et al., 2008). So far, previous research has shown that HIFs are important job creators, exist in all sectors of the economy, tend to provide new products or services, and are younger than the average firm (Henrekson and Johansson, 2010). However, despite the bulk of research aiming at defining and evaluating the impact of HIFs, little is still known about how firms actually grow or which locational characteristics influence their growth (e.g. Davidsson et al., 2010; Audretsch, 2012; Delmar et al., 2013). Instead, the debate within economic geography and business studies primarily concerns the extent to which rapid firm growth is an urban or rural phenomenon (Lyons, 1995; Stam, 2005), without addressing the more fundamental issue of what it is that determines firm growth. In particular, the understanding of which types of skills are recruited to HIFs is highly under-researched, despite great interest in what types of human capital factors may help firms achieve and sustain rapid growth (McKelvie and Wiklund, 2010). In a study by Coad et al. (2013a) using matched employer-employee data, it was concluded that, compared to other firms, HIFs tend to hire groups that are "marginalized" on the labor market (e.g. younger individuals, immigrants, poorly educated people and so on), which suggests that these firms are less selective in their recruitment of skills and put more effort into in-house training.

Nevertheless, the question is still highly unresolved as to whether HIFs benefit relatively more from recruiting workers with previous experience rather than less experienced workers who are more committed and can be trained in-house (Lepak and Snell, 1999; Wennberg, 2009). Given recent insights on the role knowledge flows play in a firm's performance, it is reasonable to expect that it is insufficient to make a division between experienced and inexperienced workers, since the qualitative content of skills within these fast-growing firms is also likely to influence their future growth. For example, according to Boschma et al. (2009), it is crucial to

[1] In this paper we will use the term high-impact firm (HIF) to emphasize the dual impact of the firm on the economy, both through employment and revenue growth. Originally, the term HIF was used to classify enterprises using both sales effects and employment change (Acs et al., 2008).

consider that the influence of knowledge flows on company performance depends on the type of skills brought in to the company and whether these new skills add to the existing knowledge base. Their idea is that firms will perform better if new employees bring in knowledge that is new to the firm but technologically related to its existing knowledge portfolio. This is because the firm requires an absorptive capacity to understand, integrate and exploit the new skills in its organization (Cohen and Levinthal, 1990). This is in contrast to the recruitment of employees possessing the same skills as those already present in the firm; these add nothing new, and may even pose a competitive threat to other employees with identical skills.

In this respect it is reasonable to assume that regional characteristics are important for understanding the growth of HIFs. For example, following endogenous growth theory (e.g. Lucas 1988), it is clear that the local supply of labor is important and primarily dependent on existing regional labor market structures, which thus should influence both the quantity of supply and the type of human capital present in the region. Apart from this general aspect, the regional industrial structure is also likely to influence the future development of firms. As noted by Audretsch (2012), industrial clustering tends to improve the growth of firms; but equally important, in specialized regions labor pooling is likely to further facilitate the recruiting process and thus the prerequisite for growth (Marshall, 1890). Externalities derived from co-location can therefore be assumed to be important for HIFs, but in sparsely populated regions, often argued to be lacking in such externalities (Puga, 2010), recruiting appropriate skills is likely to become more important due to a relative shortage of proximate firms and general matching deficiencies. We therefore expect that the type of inflow of labor is more important in a non-metropolitan setting than in a metropolitan one, due to the lack of externalities in the region and a greater need to find the right competences early on because of a potential shortage of appropriate skills in smaller regions. In turn, this constitutes an important contribution since the impact of skills in various regional contexts (metropolitan and non-metropolitan) remains largely unexplored (Lyons 1995; Stam 2005; Eriksson and Hansen 2013).

We argue here that this line of reasoning is important in order to understand the growth and future fate of HIFs, since it is a firm′s human resources and access to new resources, as well as how these are combined, that shape its economic success (e.g. Penrose, 1959; Bathelt and Glückler, 2005). The aim of this paper is to

analyze how skill recruitment influences the destiny of HIFs in terms of survival, acquisition and exit. By means of a sample of 1,589 Swedish HIFs, we assess the extent to which recruiting labor from the same industry, from so-called skill-related industries or from unrelated industries affects their future courses of development (cf. whether they remain in business, are purchased, or exit the industry) over a ten-year period. In order to study how the regional portfolio of industries influences the firm's future destiny, we also assess the impact of industry specialization and related specialization.

The paper is thus based on recent evolutionary notions stressing the role of experience and path-dependency in general (e.g. Nelson and Winter, 1982; Klepper, 2002) and technological relatedness in particular (e.g. Neffke et al., 2011) for firm entry and survival at the regional level. According to this literature, regions branch into technologically related industries since related industries (experienced firms) are more likely to enter a region while unrelated industries (differently experienced) are more likely to exit. We argue that this line of reasoning is also applicable to the evolution of HIFs. The experience of the individual entrepreneur is important, as is that of workers employed at the growing firm, as these aspects influence how new resources are added on. Depending on how firms grow, they will either reinforce existing industry-specific resources or bring new variety in proportion to what type of skills they recruit. If this statement holds, recruiting labor characterized by skill-relatedness (i.e. skills from technologically related sectors) would prove to be the most important factor affecting continued company growth compared to similar or unrelated skills, because this brings related knowledge to the company and stimulates the creation of further variety, which adds something new yet related to the existing market conditions (Neffke and Henning, 2013).

This study potentially contributes to the existing literature in several ways. First, it will add to the discussion about what type of skills firms use as they grow and how this may influence their future success. While previous studies have highlighted the recruitment differences between HIFs and small firms (SMEs), the anatomy of growth still remains greatly overlooked in the existing literature (Coad et al., 2013a). Second, as noted by Audretsch (2012), existing literature has found only limited evidence for how locational characteristics influence HIF, and there is a great need to gain further knowledge on this topic. Third, this may prove to be important in relation to policy, since creating jobs is considered to be one of the greatest future

challenges for advanced capitalist economies. Gaining further knowledge on whether certain skills are more beneficial in this process or whether the mere growth itself is the major determinant of firms' future destiny is essential when matching labor demand and labor supply. Perhaps because of the lack of understanding regarding potential differences across space, general policy recommendations and strategies targeted at promoting start-up firms and regional development may fail in prescribing successful recipes (Rodriquez-Pose, 2010). Fourth, by studying the effects of labor flows in both metropolitan and non-metropolitan regions, and based on the assumption that small and rapidly growing firms have different recruitment demands compared to the rest of the firm population, this paper contributes to a deepened knowledge of the spatial prerequisites for firm growth.

The remainder of the paper is structured as follows: Section 2 begins with a short review of previous studies, before continuing with a conceptual justification for addressing the types of skills entering a fast growing firm, and the role of regional characteristics. This is followed by two empirical sections of which the first outlines data and methods and the second presents the results. The final section concludes the paper.

2. Conceptual background

Initially neglected by economists and business researchers, the impact of small business enterprises on national economic growth was primarily acknowledged in the late 1970s by Birch (1981). Birch's point was not just that small enterprises actually existed, but that they represented a substantial part of national employment and thus served as an important welfare driver. In addition, and much in line with the design of this paper, the dataset compiled by Birch allowed for the observation of the birth, death and growth of businesses (Acs et al., 2008). Consequently, the focus in both research and policy circles at least partially shifted away from large industries when addressing employment and business dynamics (Brock and Evans, 1989; Essletzbichler, 2004). In an overview of 20 different empirical contributions, Henrekson and Johansson (2010) concluded that HIFs of various definitions, apart from being the most important job creators, also exist in all sectors of the economy. This finding serves to strengthen the general assumption that small and rapidly expanding companies, although seemingly appearing out of nowhere, are important. Given this, the "discovery" of the rapidly growing small firm in the 1980s paved the way for policy recommendations aiming

at generating more so-called gazelles. However, this proved more difficult than expected, as there is also an ongoing discussion concerning entrepreneurs and public policy (Shane, 2009), which can be seen in relation to HIFs and their growing importance. Industrial policy intervention in Sweden, like in many other OECD countries, has been giving way to an economic policy of fixing market failures and picking winners (Brown and Mason, 2012), implying that the roles of the entrepreneur and the HIF are partly intertwined as it can be argued that accomplishing exceptional growth requires entrepreneurial skills. As such, encouraging HIFs is becoming an important tool for generating private sector employment.

In parallel with the policy discussion, there is also a theoretical debate concerning the size of the firm driving employment growth and whether it is the entry of several small firms (*mice*) or fewer larger ones (*elephants*) that makes a difference (Davidsson and Delmar, 2006). Previous research has shown that both types are important for generating employment growth (Henrekson and Johansson, 2010), as the continuous entry of new firms increases the likelihood of generating additional young HIFs. However, the geographical distribution of HIFs is uneven, which casts some doubt on their potential as generic job creators (Lyons, 1995). Based on Dutch data, Stam (2005) finds that rapidly growing firms are present in both rural and urban areas, but that it depends on the type of sector the HIF operates in. The Swedish context is different, especially because the population density in Sweden is much lower than in the Netherlands, which may generate some interesting deviations. As a result, Sweden has several regions that rely on a few concentrations of people and businesses located in comparatively isolated small cities lacking the access to significant agglomeration externalities (e.g. diversity of knowledge, as well as mass and services and infrastructure) associated with larger metropolitan areas (e.g. Jacobs, 1969; Borggren and Eriksson, 2014). Recruiting labor with a good market fit, and thus acquiring externalities derived from labor mobility, thus becomes crucial in the non-metropolitan areas of Sweden.

According to Penrose's (1959) theory of the growth of the firm, firms are conceptualized as a collection of different resources, and the composition of these resources determines their future growth. This means that firms will strive for new resources (or skills) and to complement their existing collection of resources. As noted by Foss and Ishikawa (2007) and Foss et al. (2008), the demand for new resources is linked to the

subjective view of managers as well as the heterogeneity of mental models and shared experiences that influence the way competences are used (Bathelt and Glückler, 2005). According to Coad et al (2013a), this implies that HIFs would seek to employ individuals with extensive human capital and industry experience but with diverging mental models. This is because, from a resource-based theory (RBT) perspective, firms need to expand their resources by hiring employees who offer complementary capabilities in order to sustain and even expand the scope of operations. However, while Coad et al. (2013a) find that HIFs are more likely to hire inexperienced and more "marginalized" labor to lower costs and facilitate rapid employment growth, their analysis of who HIFs hire does not consider the experience of the recruited workers in terms of what type of skills they actually bring in to the plant.

In line with search theory, another aspect of hiring and the associated costs thereof is related to the time spent searching for and finding suitable employees (e.g. Mortensen and Pissarides, 1999). The longer the time spent searching, the higher the costs, but also the better the match. In this context, it is reasonable to assume that firms choose an optimal strategy that places a limit on the amount of time they are willing to invest in searching for new employees. Since the potential for labor matching tends to be greater in large regions (Puga, 2010), whether a location is metropolitan or non-metropolitan will severely affect this decision given the prevalence of externalities that may compensate errant recruitment for a firm located in a metropolitan setting. According to Coad et al. (2013a), HIFs are less prone to invest time in finding the most optimal employee, because time spent on searching bears the opportunity cost of neglecting a growing pile of work tasks. Therefore, HIFs have a higher degree of urgency and cannot afford to hold out for long in hope of finding a perfect match. This argument implies that, in contrast to the RBT emphasis on finding complementary resources, HIFs may be expected to compromise the quality of hiring for the speed of hiring. Thus, based on Swedish data, Coad et al. (2013a) find that HIFs employ a much broader variety of experiences than what would be expected from a pure resource-based point of view.

It should also be kept in mind that recruitment is commonly regarded as a crucial driver for diffusing knowledge in corporate space and for firms to renew their knowledge base (e.g. Angel, 1991; Almeida and Kogut, 1999; Pinch and Henry, 1999; Malmberg, 2003; Eriksson & Lindgren 2009). Recruitment may also

hinder human capital development due to labor poaching. A high intensity of job-hopping may pose a threat to firms that they could lose key personnel to competitors, and may lower firms' incentive to train and upgrade the skills of their employees (Kim and Marschke, 2005; Combes and Duranton, 2006; Fallick et al., 2006). Moreover, Feldman and Ng (2007) show that highly skilled individuals not only bring human capital to the firm but also come at a higher cost and are more likely to search for other jobs unless they find sufficient promotion possibilities. Batt (2002) also finds that the costs for training new employees in-house may be lower than hiring highly skilled personnel. In all, this implies that the mobility of experienced workers may be an important medium for upgrading the internal knowledge base, but it may be more cost-efficient for HIFs to recruit employees with less formal or industry-specific experience than highly skilled individuals adding new, complementary knowledge to the existing resources. Since the cost of hiring is an important dimension to consider in relation to the growth of HIFs, we argue that the decision to hire employees from a cost-efficiency point of view is likely to influence the future fate of HIFs. In the short run it may be less costly to employ less skilled individuals, but the long-term costs in terms of jeopardized future survival may be extensive. We base this argument on recent evolutionary notions in economic geography that stress the role of technological relatedness in the understanding of regional structural change.

Evolutionary approaches to the study of HIFs are far from new (for a recent overview see Delmar et al., 2013). From an evolutionary perspective, learning and innovation are endogenous to the industry and idiosyncratic to the firm. The ability to learn is determined by the collective competence embodied in the firm, the knowledge it can apply, and the routines by which it manages its growth (Metcalfe, 1994; Dosi et al., 1995; Teece, 2003; Dosi, 2007). This highly path-dependent process is produced by a combination of variation, selection and retention processes, whereby firms compete for different resources defined by the industry they belong to. Whether a firm enters, survives or exits is thus a function of variation, selection and retention, and reflects the firm's relative fit within existing industrial conditions. As described by Delmar et al. (2013), the process of variation determines the new range of business activities entering an economy, whereas selection alters the relative importance of competing alternatives, which in turn influences the retention of firms and the imitation across firms. Coherent with Nelson and Winter's (1982) theory on the firm, selection is a function of the firm's competitive efficiency in comparison to other similar firms. The most successful

firms remain, which allows them to reproduce their business activities. Thus, firms with a better fit to the prevailing market conditions are more likely to remain and grow, whereas less viable ones are more likely to decline or exit. Building on this, firms that are taken over may be included in partnering enterprises targeting improved competitiveness. For example, M&A research has extensively addressed the role of synergies that stem from related resources, such as similar products, technologies, distribution channels and routines (e.g. Chatterjee, 1986; Sirower, 1997; Seth et al., 2000). If these resources are shared or efficiently combined, acquisitions can benefit from economies of scope and scale. Additionally, companies are reluctant to establish radically new resource combinations due to path dependencies (Nelson and Winter, 1982). If companies can benefit from acquiring supplementary or complementary industries, partnering likelihood is expected to increase.

All firms, and particularly new entries, face uncertainty concerning market acceptance and competition, which in turn influences their position in the industry and their search for improvement (Noteboom, 2009). Following Klepper (2002), a number of empirical studies in economic geography (e.g. Boschma and Wenting, 2007; Wenting, 2008; Brouder & Eriksson, 2013) show that the type of knowledge transferred from the parent company to a spin-off company matters for the survival of the entrant. In particular, experienced firms founded by entrepreneurs with a background in similar or related industries increase their survival to a considerable degree as compared to inexperienced firms. For example, in the early development stage of the UK automobile industry, firms were more likely to survive when entrepreneurs had experience from industries such as bicycle manufacturing, coach making or mechanical engineering (Boschma and Wenting, 2007). This was also the case when the region of entry had a strong presence of such related industries. These findings appear because the routines of the old firm are successfully transferred to the new one, which increases its market fit and endurance.

In line with Penrose's (1959) initial ideas, it is reasonable to expect that the type of knowledge entering the growing firm rather than the magnitude of the inflow per se will determine the extent to which the firm adds complementary resources, and how well these collective resources fit into the existing firm-specific mental models and market conditions. For real learning opportunities to take place, the firm requires an absorptive

capacity to understand and integrate new skills (or resources) in the organization (Cohen and Levinthal, 1990). According to Noteboom (2000), individuals with a greater overlap of competences may easily communicate with each other, but only those with some degree of non-overlapping competences can offer something new to be learned. Under this premise, the firm will be more capable of taking economic advantage of new skills. This is in contrast to the recruitment of employees possessing the same skills already present at the plant. According to Boschma et al. (2009), the effect of new skills on learning opportunities and firm performance is therefore dependent on the type of skills that are brought in to the firm rather than the magnitude of inflows per se, and the extent to which these new skills add to the existing knowledge base of the firm. Boschma et al. (2009) found that the inflow of skills related to the existing knowledge base of a plant had a positive effect on plant productivity growth, whereas the recruitment of new employees with skills identical to the existing knowledge base of the plant had a negative effect on plant performance. However, and contrary to this, Weterings and Marsili (2015) found that proximity to firms operating in the same industry positively affects firm survival among start-ups due to the pronounced specialization strategy of many new firms.

We attempt to address this aspect empirically by using the concept of skill-relatedness developed by Neffke and Henning (2013), who argue that a high intensity of labor flows between two industries may indicate a high degree of skill-relatedness between the industries. When factors like wage differentials are adjusted for, a high intensity of labor mobility between two industries indicates an exchange of skills providing high economic values for both parts. Consequently, it can be expected that firms employing many skill-related workers will be more productive due to the facilitation of knowledge spillovers, and their fit in the economic landscape will also be superior due to the complementary variety produced internally. This is reflected by the concept of regional branching, or industry diversification in a region, stressing that new regional variety arises from technologically related industries (Boschma and Frenken, 2007). As empirically demonstrated by Neffke et al. (2011), industries within the region branch into industries that are technologically related to pre-existing industries. This is because related industries are more likely to enter a region, whereas very dissimilar (unrelated) industries compared to the regional portfolio are more likely to exit. As shown by Boschma et al.

(2014), this is an important aspect of why Marshall's (1890) notion of labor pooling is important, and also why it may be reasonable to go beyond the traditional intra-industry perception of pooling externalities.

In this respect, the regional portfolio of industries is likely to influence both the availability of skills as well as the entry and the relative fit to existing market conditions. For example, Neffke et al. (2011) showed that regional industrial portfolios remain highly cohesive over time despite structural change. Marshall's (1890) notion of localization economies provided an early powerful explanatory framework for the location and growth of economic activities. The rationale is that firms in the same industry co-locate because they are assumed to benefit from a pool of specialized labor, higher demand for their products, the presence of specialized input suppliers, and access to knowledge of trade-specific secrets (e.g. Krugman, 1991; Potter and Watts, 2010; Audretsch, 2012;). This means that regional assets in terms of access to human and specific skills develop in close conjuncture with the regional industries (Lucas, 1988; Storper, 1997). Thus, the local availability of suitable skills for a given firm in a given sector is greatly dependent on the industrial portfolio of the region (Eriksson, 2009). If the firm is seeking to employ skills that are relatively peripheral to the regional portfolio it may be difficult finding appropriate skills, while it is far easier if it is possible to draw on the already existing labor pool. Moreover, most spin-off firms locate close to their parent company, which implies that the degree of regional specialization may influence the initial location decision despite the risk of competition and exit. This should be particularly evident in a country like Sweden, where inter-regional mobility is quite low – apart from the three metropolitan regions of Stockholm, Göteborg and Malmö – and most firms have to rely on the local supply of skills (Boschma et al., 2014).

However, although regional specialization is generally assumed to promote performance (Weterings and Marsili, 2015), according to Audretsch (2012) there is a scarcity of literature linking locational characteristics to the high growth firms, and the results are far from cohesive. For example, regional specialization may also imply fierce competition between firms since it requires them to innovate in order to stay competitive (Porter, 1998). In general, entry rates are high in specialized regions, which means that only firms with the best routines and competitiveness survive the initial selection process, and this process causes relatively high exit rates. However, as shown by Weterings and Marsili (2015), the effect of specialization on survival depends on

how "exit" is defined. New firms in specialized regions are more likely to exit by acquisition than by closure, which leads to the conclusion that M&A can be considered a successful business strategy as many new firms are in fact targeted and started for the purpose of later being acquired. A similar pattern can also be ascribed to start-ups in med-tech and bio-tech clusters in Sweden (Rekers and Grillitsch, 2013), where patent holders establish firms destined to be acquired at a later stage. Moreover, according to De Vaan et al. (2013), in the global video game industry exit by acquisition is best considered a sign of success rather than a firm failure. Based on this, we can suggest that both proximity to similar firms and recruitment of labor possessing similar skills favor the general firm population in that they counter exit by closure later. However, so far it has not been examined whether the same statement holds for HIFs.

In summary, according to the existing literature it is possible to conclude that HIFs should have a great impact on regional development due to their ability to create jobs. Given the potential lack of externalities facing non-metropolitan firms and HIFs as well as the rest of the firm population, it is reasonable to assume that the process of finding labor with the appropriate skills is more important than the equivalent process facing a firm in a metropolitan setting. Effects of labor inflow should therefore be more important in a non-metropolitan area than in the larger cities, where externalities and the positive effects (limited loss of time and money) of shortened job-matching processes may compensate firms recruiting similar or unrelated labor. As the literature review has shown, very little is still known about what it is that determines firm growth. In particular, the type of knowledge HIFs require during the growth phase still remains unknown, as does the role of different regional characteristics such as the industrial portfolio. Thus, the following sections will address whether the quantity or quality of labor inflow matters for firm survival, and the extent to which regional or related specialization matters.

3. Empirical analysis

There is no all-encompassing agreement on the definition of a rapidly and suddenly growing firm. Research on fast-growing small enterprises, and on the impact of small businesses in general, dates back to the late 1970s and early 1980s when Birch used the term "gazelle" for the first time, having in mind "an enterprise whose sales have at least doubled for the most recent four year period" (1981). The metaphor was intended to

illustrate a small firm with 20 or fewer employees, suddenly moving (i.e. growing) very rapidly for a short period of time. Hence, the gazelle deviated from the general pattern of stable, long-term economic growth. Building on this, the two main features of an HIF are sudden and unexpected revenue as well as employment growth, which can be illustrated by the fleeing gazelle (Acs et al., 2008; Coad et al., 2013a). More recent and less frequently used indicators have been value added and productivity (Daunfeldt et al., 2010).

We measure HIFs using both employment and revenue growth based on a selection of small firms (1-10 employees) from the entire stock of Swedish firms during the period 1996 to 1999. The late 1990s in Sweden was characterized by financial recovery and steady growth, but the crisis of the early 1990s had, for example, a severe impact on several commercial banks that needed substantial state loans to survive. We therefore chose the years 1996-1999 as this period contains important firm growth components. The sample is derived from a matched employer-employee dataset, which is a collection of register data on individual attributes (education, change of workplace, etc.) along with features of plants including NACE industry code, size, geographic location and age (e.g. Eriksson 2009). We stipulate the following HIF criteria: a) total employment of 1-10 people between 1996 and 1999, b) employment growth quotient (Acs et al., 2008) and revenue growth quotient (similar to employment growth but using net revenue growth instead) of ≥2 for at least one of the four years of observation, and c) stabilized (meaning that they all remained in business) between 2000-2003. Given these criteria, we arrive at a sample of 1,589 (1.1%) HIFs – from the total population of small firms in Sweden – displaying exceptional growth and economic impact. We also use a sample of 71,178 (51.6 %) small firms (henceforth SMEs), based on the same stability criterion mentioned above, to compare our results with SMEs in general (Figure 1). While it may be argued that the HIF criteria are too strict, our intention is to understand company performance in relation to internal staff growth and revenue at the very top of small growth firms. Limiting our selection to only include firms employing 1-10 people is in accordance with Birch's (1981) initial findings, concluding that an overwhelming majority of all new jobs was created by firms employing fewer than 20 people. It also corresponds to Acs and Mueller's (2008) notion to separate HIFs from "mice" ("main street mice", making up the bulk of the economy) and "elephants" (big firms, growing additionally). Since previous studies have elaborated on the impact of regional specialization for the success of start-ups (Weterings and Marsili 2015) and on the different recruiting

strategies between SMEs and HIFs (Coad et al. 2013a), our main focus will be the HIF population; however, we will also draw a comparison with a sample of SMEs.

The data used cover the years 1996-2010, divided into three phases of the HIF lifecycle. Phase 1, 1996-1999, is the initial phase during which the firm grows in accordance with the criteria stipulated above. Previous studies on knowledge-intense industries (Coad et al., 2013a) have used either employment or profit growth, motivated by the argument that this metric separates firms requiring skilled recruits (generating profit growth) from those requiring non-skilled recruits (generating employment growth). However, we do not exclude certain industries in this study, as previous studies (Stam, 2005; Henrekson and Johansson, 2010; Coad et al., 2013a) have shown that HIFs can be found in any industry. Phase 2 of the selection covers the years 2000 to 2003, when the HIFs stabilize in terms of growth and survival. In order to control for short-term growth ending in immediate buyout or exit, we exclude HIFs that close during this phase. Thus, we only allow for surviving HIFs during a period of economic resurgence after the dot-com crash in 2000. Compensating for initial short-term survival following a period of rapid growth is in line with previous studies on HIFs emphasizing the ability to endure the first critical years of operation (Stam, 2005). This also allows for an extended period of observation of the lifecycle of the HIFs and the patterns of growth. Finally, Phase 3 of the time period, from 2004 to 2010, is when we observe the destiny of the HIFs. Given what we know from the literature on HIFs, by this time very few of the firms will display any remarkable signs of growth.

Figure 1 about here

As demonstrated in Figure 1, the growth of the HIFs is primarily illustrated by increasing numbers of employees and growth in value added during a phase of "gazelle growth" between 1996 and 2000. It is also evident from Figure 1 that rapid growth in value added occurs shortly prior to when the recruiting processes begins, indicating that financial growth precedes employment growth. Annual mean growth of both HIFs and SMEs continues to be positive for most of the studied years. There are two downturns, one in 2008 and another in 2010, possibly indicating that the firms have reached maturity from an industry lifecycle perspective and that the financial crisis of 2008 is beginning to take its toll.

Variables

We distinguish between three different destinies when constructing our binary dependent variables – *survival*, *acquisition* and *exit*. Separately, they signal the future destiny of the HIFs after phases of growth and stability. The FAD (*Företagens och arbetsställenas dynamik)* database is used to observe the future destinies of the HIFs and to perform the analyses (Andersson and Arvidsson, 2006; Andersson and Klepper, 2013). The FAD database is an estimation prepared by Statistics Sweden for monitoring crucial events, such as survival, acquisition and exit during company lifecycles ranging from 1986 to 2010. The estimation is based on mapping the bulk of the firms' labor force within two consecutive years (Andersson and Arvidsson, 2006; Neffke and Henning, 2013).

Using total labor inflow, we derive three possible types of labor flows (similar, related and unrelated) based on the skill-relatedness measure introduced by Neffke and Henning (2013), which captures the transferability of human capital across sectors, given sector-specific wage and growth differentials. This division follows similar studies on the relationship between economic growth, related variety and different types of labor flows (e.g. Frenken et al., 2007; Boschma and Iammarino, 2009; Boschma et al., 2014). Accordingly, in this paper we study labor flows between pairs of industries implying approximately 500 different industries using four-digit NACE compatible classification codes. Individuals moving between related industries thus fall under the category of related inflow of labor, whereas those moving between unrelated industries fall under the category of unrelated labor and intra-industry flows are categorized as similar inflows. Out of 188,790 available industry combinations, 9,979 combinations (5.3%) can be considered skill-related at the national level (Neffke and Henning, 2013). In order for an individual to have changed employment according to our operational definition, it is required that the individual is active on the labor market for two consecutive years and changes employment during these years by switching to a plant owned by another firm. Further, to specifically assess whether the regional industrial portfolio and local market opportunities influence the destiny of HIFs (e.g. Stam, 2005; Penrose, 1959), we also included two different location quotients capturing related specialization and industry specialization, respectively. These relate to the analyses of 72 functional regions, defined by the Swedish Agency for Economic and Regional Growth. This regional analysis is based

on observed commuting patterns between the 290 Swedish municipalities, together with investment patterns and historical economic trends that are likely to determine future regional development paths. With its consideration of both past and future trends, this spatial unit is particularly suitable for longitudinal analyses. Despite the limitations of measuring actual linkages that produce externalities, the location quotient is often used in studies of regional sector specialization (Stam, 2005; Andersson, 2006; Bishop and Gripaios, 2009). The use of location quotients allows us to examine whether HIFs have branched into regions where related industries are present, which allows them to capitalize on pre-existing technologies and the proximity to related skills. The location quotient is defined as follows:

$$\mathrm{LQrel} = \frac{\left(\frac{N\ rel\ FA}{N\ FA}\right)}{\left(\frac{N\ rel\ Swe}{N\ Swe}\right)} \qquad (1)$$

where N rel is the number of skill-related workplaces in the FA region and Sweden, respectively, and N is the total number of workplaces (regionally and nationally). LQrel exceeding 1 indicates related specialization in the region, since there is a concentration of related firms in the region as compared to the national average. Analogously, since the geographic clustering of industries is identified as an important determinant of firm growth (Porter, 1998; Wetering and Marsili, 2015), we create a measure of the concentration of firms within the same industry in the region as compared to the national average (LQsim) to indicate regional industry specialization (which occurs if LQsim exceeds 1).

Previous studies on HIFs have used age, size and sector when describing company characteristics and performance (Henrekson and Johansson, 2010), which are variables identified here as well. When compensating for type of industry, we use the three largest industries based on the two-digit NACE codes (SNI). These taken together account for 1,224 (77 %) of the HIFs and 48,475 (68 %) of the total number of sampled SMEs included in this study. Based on the same classification as in Nutek (2000) and Boschma et al (2009), the following dummies are included:

- Labor-intensive services (LIS), the single industry containing the largest amount of HIFs, consist of firms operating in logistics, construction and retail.

- Finance (FIN) includes all HIFs operating in the so-called KIBS (knowledge-intensive business services), and is characterized by high levels of human capital and concentrated in urban areas.
- Capital-intensive services (CIS) consist of firms operating in service industries requiring large investments.

Further, we measure the age of the firm together with size (number of employees), since both age and size are likely to make firms more persistent. We also measure the mean length of education of employees in 1999 (Edu99). Finally, we compensate for geographic location and divide our HIFs into five different regional divisions using the 72 functional regions mentioned above.

Table 1 about here

In Table 1 we find that the HIF sample means are relatively unchanged for the relatedness indicators (LQrel and Share_relinflow) as well as for the education length measurements (Edu99). Firm size and total inflow of labor vary according to the different destinies, whereby acquired firms are mostly larger but younger than the average HIFs. In contrast, exiting firms are smaller in size than both surviving and acquired firms. The share of unrelated inflow of labor is the largest of the three different categories of inflows, which indicates that both SMEs and HIFs are less selective in their search for labor. The share of related inflows of labor is the smallest (11%), and smaller than what Boschma et al (2014) previously identified on data including high-skilled flows among the entire population of firms in Sweden (i.e., 36%). Comparing the different shares of labor inflows of HIFs with those of the SMEs in Table 1 reveals that HIFs hire a marginally larger share of labor with related skills and that SMEs hire a slightly higher share of unrelated labor. This is somewhat unexpected given that SMEs, compared to HIFs, are not in a situation requiring rapid recruitment and thus have more time to spend on searching for the most fitting labor. As expected due to the HIF growth criterion, total inflow of labor and firm size are larger for the HIF sample means, irrespective of destiny, compared to the SME equivalent.

Regional divisions and types of industries

Table 2 below demonstrates industry concentrations in the economy, share of national population (POP), share of HIFs and share of SMEs per region. This is followed by the industries described previously. In Table 2 it is evident that the spatial distribution of HIFs in Sweden is not disproportionally larger (or smaller) in any region but rather follows the population distribution and the distribution of SMEs fairly well, with the largest difference being the distribution in the metropolitan division. This is in line with findings from the Netherlands (Stam, 2005) and the US (Audretsch, 2012). However, since Sweden is much more sparsely populated than the Netherlands, for example, this is somewhat surprising and indicates that rural locations and milieus – despite often lacking human capital and urban variety (Jacobs, 1969; Glaeser, 2000) – still manage to harbor a share of the HIFs equal to the rural share of the population. Therefore, we have a strong indication of the multiplicity of HIFs and of the existence of rapid firm growth outside larger urban areas as well. However, as noted by Stam (2005), this varies slightly depending on type of region. In Table 2 we find that knowledge-intensive manufacturing (KIM) and finance (FIN) constitute the industries that are overrepresented among the HIFs in metropolitan areas. This indicates that the growth of so-called KIBS is strongly biased towards urban areas (Hansen and Winther, 2010; Bryson et al, 2012). In the next regional division in Table 2, which is regional centers with a university (Univrc), we find that there is an overrepresentation of HIFs operating in capital-intensive services (CIS) and that the share of total HIFs found in these regional centers is lower than the population share. Apparently, the proximity to research facilities and human capital does not result in a comparatively higher share of HIFs. Regional centers with a college (collrc) have a larger share of HIFs than regional centers with a university. The most overrepresented industry among the HIFs in such regions is labor-intensive manufacturing (LIM). LIM is an industry that does not require human capital to any greater extent, which leads us to believe that a good supply of low-educated personnel, as well as proximity to relatively large markets in comparison with semi-peripheral and rural regional divisions, contributes strongly to the presence of HIFs in LIM in this type of regional setting. HIFs operating in the public sector (PUBL) are strongly underrepresented compared to the share of public SMEs, which indicates that small public firms are less prone to rapid growth. Finally, there are some indications of a concentration of KIM as well as other capital (OC) sectors in semi-peripheral areas of Sweden. Again, this suggests a considerable complexity of HIFs, including their economic and geographic extent.

Table 2 about here

4. Results

In the analyses we use logistic models on the three binary dependent variables (survival, acquisition, exit). The regression outputs displayed in Table 3 follow a stepwise procedure for each destiny. Model A consists of the location quotients and the controllers and Model B adds an additional indicator of total inflow of labor, while in Model C we add similar, related and unrelated inflows (removing the total inflows from Model B). The use of a stepwise procedure for analyzing destinies allows for the observation of the partial effects of each factor and of whether it is location quotients (related specialization and industry specialization), total inflow of labor or type of inflow that matters the most. All models are weighted on company size (number of employees in 1999) to reduce the risk of the smallest firms having too great an influence on the estimation results. The variety of labor flows in small firms tends to be restricted, and there is a risk that non-weighted models would not fully capture the underlying mechanisms of the studied processes because small firms can have too strong an influence due to their sheer numbers. We use the odds ratio (O.R.) to study the relative importance of each covariate, which when exceeding 1 indicates a positive influence and when below 1 indicates a negative influence, or odds (e.g. Balland et al., 2013).

Starting with Model A, the estimates show that industry specialization (similarity) has a relative odds below 1 in both the survival model and the exit model, while the odds exceed 1 in the acquisition model. This means that HIFs located in specialized regions are less likely to survive but also less likely to exit. This is expected, since a high concentration of firms in similar industries is likely to trigger further concentration of the industry (Marshall, 1890), but also to lead to increased competition and foreclosures of non-profitable enterprises (Porter, 1998), especially if entry rates are high in the region (Weterings and Marsili, 2015). An alternative to exit would be take-over, which is apparent in Table 3 where industry specialization (LQsim) is associated with an increased relative probability of being acquired by another firm. Thus, while industry specialization seems to foremost influence a lower likelihood of survival and a higher likelihood of

acquisition, it makes pure market exit less likely. This is in line with previous findings on the effects of spatial concentration on M&A (Weterings and Marsili, 2015; De Vaan et al., 2013), and needs to be discussed in relation to what is considered a successful business strategy. For example, Weterings and Marsili (2015) find that specialization increases the likelihood of exit by M&A for start-ups in all industries regardless of the growth rate, since many firms deliberately become specialized to facilitate M&A. Related specialization (LQrel), on the other hand, increases the chance of survival and decreases the probability of being acquired, but has no significant influence on exit. The first finding confirms previous findings on regional branching (Neffke et al., 2011), suggesting that regional economies branch into related industries since firms in such industries are more likely to enter a region and also to survive. However, while according to this perspective, related specialization should also decrease the risk of exit, we can find no significant support for this in this sample of HIFs. Relatedness also reduces the risk of being acquired by another firm, which could be because acquisitions often follow a path-dependent pattern (Nelson and Winter, 1982). In other words, firms tend to acquire resources similar to their existing knowledge base, and the threshold for acquiring different resources may be higher.

Table 3 about here

Turning to the models on inflows (B and C) it is evident that recruiting, or employment growth per se, is not the main determinant of future success as a high number of inflows reduces the chances of survival and exit (an O.R. below 1), but increases the probability of being acquired (B). This is in line with previous studies on the impact of labor flows on plant performance. The influence of total labor flows is negligible; it is rather the type of inflow and how well the influence adds to existing resources that should determine whether the new knowledge has an economic impact (cf. Boschma et al., 2009).

The inflows of different types of skills displayed in Model C demonstrate that a high degree of similar inflows is associated with higher relative odds of being acquired and lower relative odds of exit.[2] The relative odds of survival for similar inflows are not significant. The case can be made that an inflow of labor with similar skills will strongly increase a firm's chances of being acquired, because it can easily be incorporated into existing organizations as they upgrade their portfolios in a path-dependent manner (Nelson and Winter, 1982). An increased likelihood of being acquired among firms with large shares of inflow of similar labor can also be explained by the importance of synergies originating from similar products, technologies, routines, etc., leading to the efficient sharing of resources (Chatterjee, 1986; Sirower, 1997). The contradictory finding that similar inflows also decrease the risk of exit (decreased relative chance of closure in Model C) is most likely explained by the increased likelihood of being acquired, as HIFs are primarily taken over by other firms instead of completely exiting the market. Increased specialization through both spatial concentration (as noted above) and inflows of labor with similar skills should be regarded as a business strategy targeted at future acquisition (Weterings & Marsili, 2015; De Vaan et al., 2013). Hence, our findings are in line with previous findings and strengthen the notion that specialization is often a means to an end when HIFs, as well as the general firm population, seek operational ways to be acquired. It is also notable that acquisition remains a frequent firm destiny, even though we controlled for early exit in the time period (2000-2003) immediately following the phase of expansion.

Firms with inflows of labor with related experiences are associated with an increased relative chance of survival. This is in line with studies on related variety, demonstrating that recruits with neither too similar nor too unrelated knowledge stimulate interactive learning that enables the firm to grow (Boschma et al., 2009). The HIFs follow this logic and capitalize on the related skills and knowledge of the newly employed during the phase of expansion, whose contribution is a relative diversification of resources which increases the firm's chances of remaining in business (Neffke et al, 2011). However, a large share of related inflows decreases the likelihood of being acquired. In contrast to the case concerning similar inflows, this can be explained by the

[2] We also estimated the inflow variables without the two regional specialization indicators (LQsim, LQrel) to reduce the risk of endogeneity. This did not change the results of the inflows in any of the models.

fact that these firms add something new to the market and therefore differ so greatly from existing firms that they are less attractive and hence less likely to be acquired, due to the path dependency of organizations (Nelson and Winter, 1982). Although only significant at the 10% level, related inflows also decrease the risk of exit (Model C). This can be connected to the increased probability of survival, making the HIFs more resilient to closure based on the related skills of their newly employed, therefore contributing to regional branching (Neffke et al., 2011).

Considering unrelated inflows, all significant at the 0.01 level, our estimates demonstrate that heterogeneous knowledge also increases the chances of survival, but less so than related flows (O.R. = 1.27 as compared to O.R. = 1.46). Unrelated inflows further increase the relative likelihood of being acquired and decrease the relative risk of exit. The positive effect of unrelated inflows on survival may be somewhat unexpected, since too much cognitive distance is commonly associated with difficulties in knowledge absorption and learning. However, it may be the case that this subset of small fast-growing firms has particular prerequisites for their growth. Unrelated inflow during the phase of expansion may work as a diversifying factor that the firm can capitalize on during later phases of maturity, which would particularly enhance its resistance to exit. In all, our findings suggest that the type of inflow, rather than the magnitude of inflows per se, is important for the likelihood of survival and of being acquired. Fast growth (in terms of employees) is more important for reducing the risk of exit.

Table 3 also demonstrates the effects of the respective controllers on the models. HIFs operating in the finance branch (FIN) have a negative probability of surviving, and a positive probability of being acquired or closed (all models). As expected, increasing firm age enhances the likelihood of survival in all models, whereas younger firms are more likely to be acquired. These findings are consistent when further variables are added to the models. HIFs located in regional centers with a university (Univrc) are more likely to survive. This is expected, given the supply of human capital and the proximity to a relatively large variety of urban functions and services available in this location. No significant differences between metropolitan regions and the other types of regions are identified concerning survival. However, odds ratios for being acquired and for exit are significant in all models for Collrc and semi_peri regions, which implies that, in

comparison to HIFs in metropolitan regions, firms located in these types of regions are more likely to be acquired and less likely to exit. Contrary to theories on urbanization economies (Jacobs, 1969) and on the benefits of human capital for urban economic growth (Glaeser, 2000), and further assuming a lack of human capital in rural milieus, we find that HIFs located in rural areas have a positive probability of survival in all three models (albeit insignificant in Model B when the total number of inflows is accounted for). Comparing this with a similar set of models on the SME population (not reported), the results indicate that both total inflows and all three types of labor inflows positively influence survival, thus emphasizing the importance of quantity rather than quality. This can be contrasted with the findings demonstrated in Table 3, showing that the type of inflow matters to a great extent during a period of rapid growth of human resources.

Although neither previous studies (e.g. Stam, 2005; Audretsch, 2012) nor our descriptive statistics (Table 2) find evidence of any disproportional differences in HIF occurrences across space, the results of our regression show that there indeed may be regional differences influencing survival, acquisition and exit that are worth looking at more closely. Therefore, separate regressions were run on the 772 (48.6%) HIFs located in the three metropolitan regions in Sweden (Stockholm, Göteborg and Malmö) and the 817 HIFs located in the remaining local labor markets.[3] Basically, three general findings deserve special attention. First, growth itself in terms of many new employees (Sum_inflow) has little to do with the success of HIFs in metropolitan regions (only a lower risk of exit), while the positive odds of being acquired, as noted in Table 3, is mainly a non-metropolitan feature. It is also in non-metropolitan regions where the total increase in employees reduces the chance of survival. Second, not only is the total growth of employees more important in non-metropolitan regions; the type of skills recruited also matters more in these regions. For example, it is only in non-metropolitan regions where a diversified (related and unrelated) inflow of skills increases the probability of survival, while the type of inflow is of no significance in metropolitan regions – and neither are related inflows for the likelihood of being acquired. Third, the externalities derived from industry specialization and related specialization also differ across space. The externalities of industry specialization due to increased

[3] Since there would be too few observations in many of the smallest regions, we only distinguished between metropolitan and non-metropolitan regions. This is also relevant in the Swedish case, since the three metropolitan regions are the only ones with thick enough labor markets to enjoy significant urbanization economies.

competition and local demand identified in previous literature (cf. Audretsch, 2012) that could not be found in the general model (Table 3) are actually present in metropolitan regions. In these regions, related specialization also triggers positive externalities for survival, while it is in non-metropolitan regions that related specialization increases the likelihood of acquisition as well as of exit. Thus, while the locational characteristics influencing HIFs, following Porter (1998), have traditionally been focused on the role of industry specialization, these findings show that regional preconditions for HIFs vary. Outside metropolitan regions, which in the Swedish case tend to be less diversified regions with thinner labor markets and less local demand, the type of skills recruited is of great importance while access to local competitors or collaborators in the region is more important in metropolitan regions. Labor market externalities thus serve a greater purpose in non-metropolitan areas than in metropolitan settings, where there is a proximity to externalities derived from urbanization economies (Jacobs, 1969). This implies that policies aiming at increasing the local supply of qualified labor are of great relevance if one aims to promote HIFs outside the economic core regions, while more structural aspects like access to markets and other similar and related firms are more important in metropolitan regions. Separate regressions were run on the SME population in order to determine whether any differences across space existed in the larger sample that would deviate from the HIF sample presented above. Again, all types of labor inflow influence survival and acquisition positively, and exit negatively, in the SME population regardless of whether the firm is located in a metropolitan or non-metropolitan region. Thus, this indicates that HIFs are more dependent on the type of new skills entering the firm and the spatial setting where it operates than is the case for SMEs in general.

Finally, to address whether these findings differ, not only across space but also across different groups of sectors, separate regressions were run on FIN, LIS and CIS (Table A2 in the Appendix). In short, related inflow of labor is most important for survival in finance. Related specialization (LQrel) has no positive or significant effect on survival in any of the industries; however, industry specialization (LQsim) as well as a similar inflow of labor have a strong positive effect on survival in capital-intensive services (CIS). This indicates that HIFs operating in CIS benefit from co-location, which is in agreement with Marshall (1890), while the recruitment of similar labor does not harm the firm in a later phase. On the contrary, survival for

HIFs operating in LIS is positively affected by related inflows of labor and negatively affected by industry specialization.

5. Concluding remarks

In this paper we have analyzed a topic that, despite being highlighted as an important driver for regional job creation, remains less explored: namely, the extent to which different types of skills, together with locational characteristics, influence the evolution of rapidly growing firms. Embedded in the literature on technological relatedness and resource-based theory, our empirical analysis has shown that the survival of a fast-growing firm, in comparison to the closing and the acquisition of firms, is most strongly associated with an inflow of related labor. This appears to support the argument that recruiting labor characterized by skill-relatedness – i.e. skills from technologically related sectors (Boschma et al., 2009; Neffke and Henning, 2013) – is the most important resource for continued firm growth. An explanation for this may be found in the related diversification process taking place, whereby the related skills and knowledge brought in to the firm contribute to its continued growth without generating disproportionate costs due to too-great cognitive distances. We have also seen that, depending on whether the setting is metropolitan or non-metropolitan, proximity to other companies with related specialization is associated with survival; firms operating in a metropolitan region are more likely to survive when located in proximity to firms in related industries. Again, this can be explained by the notion of regional branching whereby existing regional resources are utilized together with the related diversification of skills present in the region (Neffke et al., 2011). In contrast, regional industry specialization leads to take-overs and exits among HIFs, which are due to increased competition and path-dependent acquisition (Porter, 1998; Nelson and Winter, 1982). However, our results also show that these processes vary across space since the type of labor entering the firm is of more relevance outside the metropolitan regions, while specialization (both industry-specific and related sectors) is more important in metropolitan regions, which points to the fact that there is no one-size-fits-all policy for promoting job creation through HIFs.

Perhaps equally important is the question of whether the studied effects of labor mobility and proximity to related or similar industries on the survival of HIFs found in this paper are comparable to similar studies on

the general firm population (e.g., Stam, 2005; Audretsch, 2012; Weterings and Marsili 2015). We do find similar evidence in this paper supporting the view that specialization increases the likelihood of future exit by acquisition (Weterings & Marsili, 2015). Also, inflows of skill-related labor increase the likelihood of future success (Boschma et al, 2009; Brouder and Eriksson, 2013). We also find that the variety of different industry experiences entering HIFs are similar to those of the SME population, but that the type of inflow matters more for the future success of HIFs than for SMEs, for which the total number of inflows is of greater significance. However, we find some discrepancies in comparison to previous research, most notably the relatively low share of related inflows for small firms as compared to unrelated flows, as well as the negligible importance of regional specialization in non-metropolitan regions for future survival and exit by acquisition. The latter finding counters recent contributions supporting the importance of co-location (Stam, 2005; Audretsch, 2012).

In relation to the debate concerning what type of skills HIFs recruit (Lepak and Snell, 1999; Wennberg, 2009; Coad et al., 2013a), this paper makes one explicit contribution. Our findings indicate that it is not a matter of how fast the number of employees (total inflow) increases but rather the experiences of recruited labor during the growth period that strongly influence whether the firm will survive, be acquired or exit. In particular, our findings are in line with the literature on relatedness, arguing that labor flows from related industries, as compared to labor flows from the same industries (similarity) or from completely different industries (unrelatedness), enhance plant performance (e.g. Boschma et al., 2009; Eriksson 2009; Östbring & Lindgren 2013; Timmermans and Boschma, 2014;). Thus, our findings clearly indicate that the type of skills acquired during the growth phase of HIFs strongly influences the future of the firm. An explanation for this can be found in the recruitment of complementary labor during growth, which later proves to be a successful strategy for the capacity of the firm to stay in business compared with a firm that recruits similar labor and/or trains in-house during the growth phase. However, we have also seen that HIFs with inflows of unrelated labor have an increased relative likelihood of survival, which indicates that recruiting a variety of skills is beneficial during growth phases. This is especially apparent in non-metropolitan areas, where proximity to similar or related industries is less important and even drives exit. A need to swiftly cover several new areas of expertise within the growing firm is likely to explain why recruiting unrelated labor has a positive effect on long-term survival. This finding confirms Coad et al. (2013a), in the sense that the skills HIFs recruit tend to be

heterogeneous. However, while they do not consider the industry experience of the recruits, we can – by doing just that – show that recruiting diverse skills (related or unrelated) is far better than recruiting similar skills, or just any skills. This is because relying too much on industry-specific knowledge adds nothing new in comparison to existing competitors, who may be much older and thus use their existing resources more efficiently. In contrast to the conclusions by Coad et al. (2013a), our findings therefore support the RBT suggestion that growing firms need complementary skills to sustain (Penrose, 1959). Further, in order to explain the inflow of labor with similar skills to firms bound to be acquired, the case may be that the acquiring firm may be (whether it is aware or unaware of this) feeding similar skilled personnel to the firm about to be acquired prior to the actual acquisition.

Moreover, our results indicate that there are no universal processes influencing whether an HIF survives, is acquired or exits. Rather, our results imply that there are clear differences across space (as well as groups of industries) in terms of the extent to which, and what type of, inflows matter. Also, the influence of regional characteristics such as degree specialization (industry and related) also varies between metropolitan and non-metropolitan regions. Apart from confirming the idea that regional industries and regional skills co-develop in a path-dependent manner, implying that the labor pool of certain regions is endowed with particular setups of skills (e.g., Lucas, 1988; Storper, 1995), we also show that the impact of regional specialization on HIF survival is far from being as straightforward as often claimed in the few previous empirical studies (e.g., Audretsch, 2012). Particularly industry specialization, due to its competitive externalities and vast demand, is expected to increase performance, and it is mainly a metropolitan phenomenon. For firms in non-metropolitan regions, the type of skills acquired is of greater importance. This is reasonable to expect, since access to externalities related to both localization and urbanization economies in larger regions may imply that firms located outside these densely populated areas need to be much more careful in recruiting just the right type of skills to remain in business.

The findings presented here may therefore have important policy implications, given the assumed importance of HIFs in regional job creation within policy circles. More specifically, assuming a tight time schedule that puts pressure on both the recruiting process and the long-term choices of geographical location, rapidly

growing firms should seek to employ labor possessing complementary skills. However, this may be easier said than done, as the supply of labor with desired prerequisites may be scarce. To facilitate HIF growth outside the economic core regions, more efforts than simply supporting start-ups are thus needed. In particular, there needs to be an effort to secure the supply of skills, which could be done either through local education or by promoting mobility. Rather than focusing only on the regional industrial portfolio or other common locational characteristics, the local labor pool and the skills it embodies should receive much more attention and be regarded as a natural ingredient and a necessity, given the role of different types of experiences outside the metropolitan areas.

The existence of a population of resilient HIFs outside the largest urban regions indicates that the "urban assumption" underlying successful firms needs to be challenged. However, it also indicates that, from a regional development perspective, struggling regions with thin labor markets may harbor rapidly growing firms despite a lack of human capital, urbanization economies or vast supplies of services. Further, the survival of these firms ultimately rests on their ability to recruit skill-related labor rather than on their proximity to related or similar firms. Future studies could therefore strive to gain further knowledge about how geographical differences influence the growth and survival of HIFs. Given the difficulties facing many rural regions in securing job creation, we suggest that future studies would benefit from posing the question of why rapidly growing firms, such as HIFs, emerge in rural and semi-peripheral areas and milieus. Haugen & Lindgren (2013) were able to show that forest ownership is an important factor for micro-firm (1-10 employees) performance in rural areas. Their results also indicated that micro-firms located outside urban core areas perform better, which according to their line of argument may be due to an ongoing resource transfer between forest properties (by definition, located outside urban areas) and micro-firms having the same owner. From a Nordic perspective this is a reasonable assumption, because in these countries there are several hundred thousand private forest owners, among whom there are numerous owners of micro-firms. Areal resources located in rural and semi-peripheral areas may well play an important role in the emergence and evolvement of HIFs.

Finally, future studies would also benefit from expanding the time frame of analysis. The late 1990s, which this study focuses on, saw the "gazelle" growth of particularly HIFs in the ICT sector in Sweden. The rise of a "new" sector of the economy resulted in an under-supply of, for example, computer programmers, despite the parallel growth of the Swedish higher educational system (Andersson et al., 2004). Consequently, employers were frequently forced to hire personnel who were unable to meet the levels of expertise required for the job, or who were self-taught. Due to this, it can be assumed that firms often hired labor with unrelated rather than similar experience. This is an important contextual factor that influences the flows of labor observed in this paper, which other studies could address by focusing on particular industries over time.

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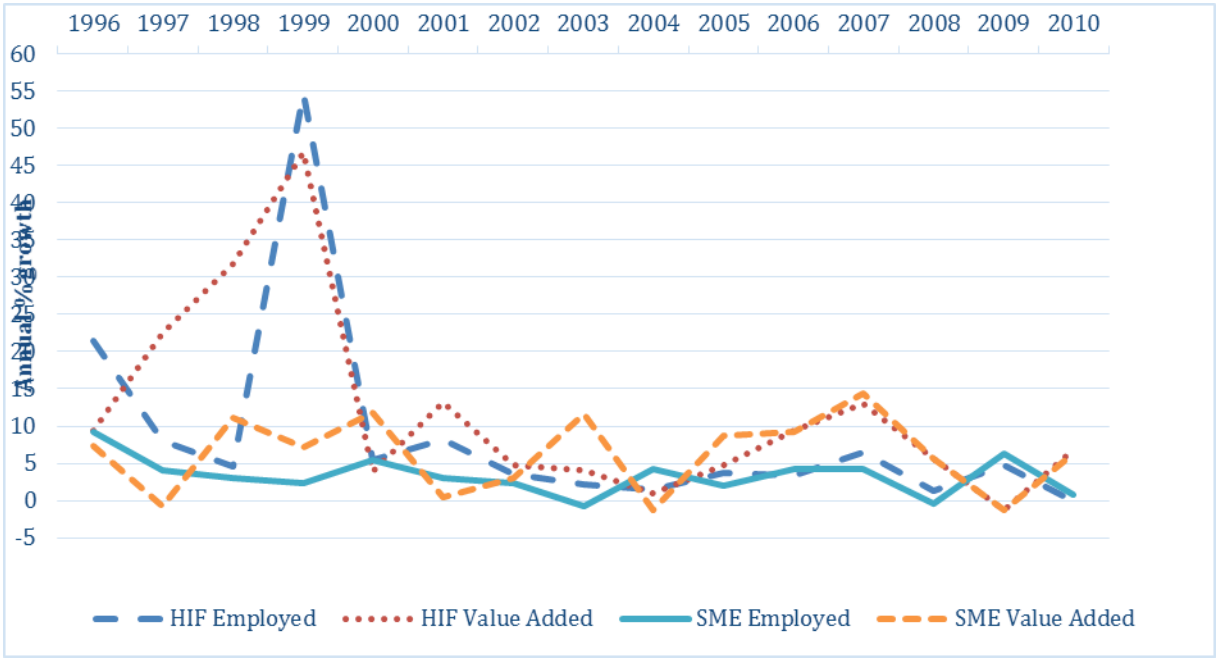

Figure 1: Annual employment and value added growth (%) of 1,589 HIFs and 71,178 SMEs between 1996 and 2010.

Table 1. Variable definitions, destinies and sample mean.

Variable	**Definition**	**SMEs**	**HIFs**			
Destinies		*Total*	*Total*	*Survive*	*Acquired*	*Exit*
Survive	Dummy variable = 1 if firm survives throughout the studied time period according to FAD register	0.63	0.66	1.00		
Acquired	Dummy variable = 1 if firm is acquired during the studied time period according to FAD register	0.16	0.14		1.00	
Exit	Dummy variable = 1 if firm is closed during the studied time period according to FAD register	0.21	0.20			1.00
Inflows						
Share_siminflow	Share sim inflow of total labor inflow 1996-1999	0.21	0.21	0.20	0.24	0.23
Share_relinflow	Share rel inflow of total labor inflow 1996-1999	0.09	0.11	0.11	0.13	0.11
Share_unrelinflow	Share unrel inflow of total labor inflow 1996-1999	0.70	0.68	0.69	0.63	0.66
Sum_inflow	Total number of labor inflows 1996-1999 (log)	0.64	1.34	1.35	2.11	0.80
Location quotient						
LQsim	Industry specialization (Location quotient similar firms)	1.38	1.57	1.54	1.64	1.60
LQrel	Related specialization (Location quotient related firms)	1.00	1.01	1.01	1.01	1.02
Controllers						
LIS	Dummy variable = 1 if firm is classified as Labor-intensive services (NACE = 45, 50-52, 55, 90, 93, 95)	0.42	0.48	0.49	0.44	0.47
FIN	Dummy variable = 1 if firm is classified as Finance (KIBS) (NACE = 65-67, 72, 74).	0.15	0.15	0.14	0.15	0.20
CIS	Dummy variable = 1 if firm is classified as Capital-intensive services (NACE = 60-64, 70, 71)	0.12	0.14	0.13	0.18	0.15
Age99	Firm age in 1999, years	9.32	6.22	6.30	5.50	6.46
Firmsize99	Firm size in 1999, number of employees	3.89	9.19	9.42	12.19	6.35
Edu99	Mean length of education per employee, years	10.96	11.15	11.13	11.13	11.23
Metro	Dummy variable = 1 if firm is located in Stockholm, Göteborg or Malmö functional region	0.46	0.49	0.49	0.47	0.50
Univrc	Dummy variable = 1 if firm is located in regional center with university	0.18	0.16	0.16	0.19	0.15
Collrc	Dummy variable = 1 if firm is located in regional center with college	0.21	0.22	0.21	0.21	0.23
Semi_peri	Dummy variable = 1 if firm is located in local labor market with minimum 40,000 inhabitants	0.07	0.06	0.07	0.08	0.04
Rural	Dummy variable = 1 if firm is located in local labor market with maximum 40,000 inhabitants	0.08	0.07	0.07	0.05	0.09
N		**71,178**	**1,589**	**1,043**	**224**	**322**

Table 2. Regional type of location and industry of HIF and total population of small firms in 1999

Regional division	POP	HIF	SME	KIM	KIM_HIF	LIM	LIM_HIF	PUBL	PUBL_HIF	FIN	FIN_HIF	CIS	CIS_HIF	LIS	LIS_HIF	OC	OC_HIF
Metropolitan	49.2	48.6	45.7	53.4	58.0	35.5	27.7	45.3	51.7	64.7	66.5	43.1	39.4	47.2	48.6	26.0	35.7
Univerrc	18.1	16.3	17.7	15.3	12.0	18.1	14.9	18.4	15.0	13.3	13.1	19.8	23.5	17.5	15.7	25.2	25.0
Collrc	20.6	21.5	21.4	19.0	17.0	25.2	34.8	20.5	21.7	14.5	12.7	21.2	22.2	20.6	22.5	28.1	19.6
Semi_peri	6.1	6.5	7.2	6.5	9.0	10.8	12.8	7.0	3.3	4.2	3.3	7.1	7.2	6.8	5.4	9.1	14.3
Rural	6.1	7.1	7.9	5.9	4.0	10.3	9.9	8.8	8.3	3.3	4.5	8.8	7.7	7.8	7.8	11.6	5.4
Sum %	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Population size, number		1589	71178	3249	100	4693	141	8646	60	10443	245	8490	221	29542	757	5887	56

Note: We exclude capital-intensive manufacturing and R&D due to an insufficient number of observations.

Table 3. Binary logistic regression on HIF destiny survive, acquired and exit 2004-2010. Odds ratio and standard errors (in brackets) are reported. Significant at 0.1 (*), 0.05 (**) and 0.01 (***) levels.

	Model A			**Model B**			**Model C**		
	Survive	*Acquired*	*Exit*	*Survive*	*Acquired*	*Exit*	*Survive*	*Acquired*	*Exit*
Inflow									
Share_siminflow							0.977	1.599***	0.733***
							(.068)	(.083)	(.093)
Share_relinflow							1.457***	0.754**	0.808*
							(.097)	(.128)	(.123)
Share_unrelinflow							1.273***	1.167***	0.682***
							(.046)	(.060)	(.060)
Sum_inflow				0.973***	1.046***	0.950***			
				(.004)	(.004)	(.009)			
Location quotient									
LQsim	0.888***	1.149***	0.933***	0.899***	1.130***	0.939***	0.888***	1.153***	0.933***
	(.010)	(.010)	(.019)	(.010)	(.010)	(.019)	(.010)	(.011)	(.019)
LQrel	1.206**	0.629***	1.212	1.190*	0.641***	1.228*	1.218**	0.600***	1.173
	(.098)	(.128)	(.125)	(.098)	(.129)	(.125)	(.099)	(.129)	(.126)
Controllers									
LIS	0.875***	0.967	1.158**	0.863***	1.003	1.151**	0.903**	0.958	1.136**
	(.048)	(.061)	(.064)	(.048)	(.061)	(.064)	(.048)	(.062)	(.064)
FIN	0.503***	1.471***	1.925***	0.498***	1.520***	1.942***	0.506***	1.451***	1.935***
	(.066)	(.082)	(.086)	(.066)	(.082)	(.086)	(.066)	(.082)	(.086)
CIS	0.530*	2.408***	0.950	0.541***	2.343***	0.982	0.553***	2.225***	0.962
	(.062)	(.072)	(.088)	(.062)	(.072)	(.089)	(.063)	(.074)	(.090)
Age99	1.035***	0.954***	0.987**	1.028***	0.967***	0.980***	1.038***	0.955***	0.984***
	(.004)	(.005)	(.005)	(.004)	(.005)	(.006)	(.004)	(.005)	(.005)
Firmsize99	0.997***	1.005***	0.983***	1.001	0.999	0.992***	0.996***	1.005***	0.987***
	(.000)	(.000)	(.002)	(.001)	(.001)	(.002)	(.000)	(.000)	(.002)
Education99	1.141***	0.934***	0.887***	1.159***	0.904***	0.899***	1.136***	0.933***	0.891***
	(.018)	(.022)	(.023)	(.018)	(.022)	(.023)	(.017)	(.022)	(.023)
Univrc	1.141**	0.865**	0.948	1.079	0.986	0.938	1.163***	0.861**	0.934
	(.053)	(.068)	(.069)	(.054)	(.068)	(.069)	(.054)	(.061)	(.069)
Collrc	1.048	1.152**	0.802***	1.015	1.232***	0.778***	1.045	1.168**	0.794***
	(.050)	(.061)	(.067)	(.050)	(.061)	(.067)	(.050)	(.061)	(.067)
semi_peri	1.033	1.472***	0.374***	1.012	1.552***	0.356***	1.045	1.497***	0.372***
	(.075)	(.085)	(.142)	(.075)	(.086)	(.142)	(.076)	(.085)	(.142)
Rural	1.169**	0.405***	1.898***	1.118	0.447***	1.815***	1.157*	0.410***	1.854***
	(.078)	(.120)	(.090)	(.078)	(.120)	(.090)	(.078)	(.121)	(.090)
N	1,589	1,589	1,589	1,589	1,589	1,589	1,589	1,589	1,589
-2 Log Likelihood	17591.652	12634.853	11229.592	17543.892	12525.972	11196.280	17550.907	12591.251	11186.945

Table 4. Binary logistic regression on HIF destiny survive, acquired and exit 2004-2010 in metropolitan regions (Stockholm, Göteborg and Malmö) and non-metropolitan regions. Odds ratio and standard errors (in brackets) are reported. Significant at 0.1 (*), 0.05 (**) and 0.01 (***) levels.

	Survive				**Acquired**				**Exit**			
	Metro	*Non-Metro*	*Metro*	*Non-metro*	*Metro*	*Non-metro*	*Metro*	*Non-metro*	*Metro*	*Non-metro*	*Metro*	*Non-metro*
Inflow												
Share_siminflow			0.723***	1.149			2.242***	1.296**			0.802	0.680***
			(.102)	(.095)			(.125)	(.118)			(.143)	(.125)
Share_relinflow			0.961	1.921***			1.092	0.611***			1.147	0.587***
			(.140)	(.140)			(.188)	(.183)			(.170)	(.187)
Share_unrelinflow			1.011	1.328***			1.266**	1.251***			0.914	0.530***
			(.071)	(.063)			(.096)	(.080)			(.089)	(.085)
Sum_inflow	1.009	0.883***			1.008	1.151***			0.944***	0.969**		
	(.006)	(.008)			(.007)	(.009)			(.013)	(.016)		
Location quotient												
LQsim	1.145***	0.934***	1.137***	0.883***	0.901	1.093***	0.909	1.153***	0.899**	0.952**	0.900*	0.947***
	(.049)	(.010)	(.049)	(.011)	(.065)	(.010)	(.064)	(.012)	(.064)	(.019)	(.064)	(0.19)
LQrel	1.843***	0.990	1.966***	1.176	0.453***	0.687**	0.388***	0.613***	0.776	1.555***	0.786	1.417**
	(.174)	(.121)	(.175)	(.123)	(.225)	(.162)	(.225)	(.163)	(.223)	(.151)	(.225)	(.153)
Controllers												
LIS	1.147*	0.798***	1.161**	0.772***	0.875	0.964	0.839*	1.055	0.876	1.446***	0.882	1.374***
	(.071)	(.065)	(.071)	(.067)	(.096)	(.080)	(.095)	(.082)	(.090)	(.092)	(.090)	(.093)
FIN	0.706***	0.380***	0.705***	0.311***	1.425***	1.423***	1.376***	1.759***	1.265**	3.293***	1.237*	3.439***
	(.088)	(.105)	(.087)	(.106)	(.112)	(.131)	(.111)	(.130)	(.112)	(.136)	(.112)	(.137)
CIS	0.515***	0.678***	0.535***	0.602***	3.542***	1.349***	3.287***	1.475***	0.494***	1.432***	0.488***	1.450***
	(.094)	(.085)	(.095)	(.087)	(.109)	(.100)	(.110)	(.103)	(.152)	(.117)	(.154)	(.121)
Age99	1.017***	1.038***	1.014**	1.061***	1.007	0.940***	1.011	0.911***	0.959***	0.998	0.966***	1.001
	(.006)	(.006)	(.006)	(.006)	(.008)	(.008)	(.008)	(.008)	(.008)	(.008)	(.008)	(.008)
Firmsize99	1.002	1.014***	1.006***	0.995***	1.009***	0.986***	1.008***	1.006***	0.977***	0.995**	0.965***	0.994***
	(.003)	(.001)	(.002)	(.000)	(.003)	(.001)	(.002)	(.000)	(.005)	(.003)	(.004)	(.001)
Education99	.956**	1.353***	0.965	1.393***	1.061**	0.825***	1.068**	0.799***	1.021	0.763***	1.005	0.765***
	(.024)	(.028)	(.023)	(.028)	(.031)	(.034)	(.030)	(.034)	(.029)	(.037)	(.029)	(.037)
Univrc		0.892		0.898		2.406***		2.469***		0.567***		0.542***
		(.087)		(.088)		(.128)		(.132)		(.103)		(.103)
Collrc		0.886		0.872*		2.867***		3.060***		0.443***		0.438***
		(.083)		(.083)		(.122)		(.125)		(.098)		(.098)
semi_peri		1.007		0.893		3.179***		3.753***		0.217***		0.214***
		(.100)		(.099)		(.136)		(.135)		(.158)		(.158)
Rural												
N	772	817	772	817	772	817	772	817	772	817	772	817
-2 Log Likelihood	8185.424	8968.257	8175.322	9178.332	5689.032	6518.681	5648.788	6740.109	5472.289	5600.660	5490.091	5544.652

Appendix

Table A1: Correlation matrix. ** Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).

	Share_siminflow	Share_relinflow	Share_unrelinflow	Sum_inflow	LQsim	LQrel	LIS	FIN	CIS	Age99	Firmsize99	Education99	Univrc	Collrc	Semi_peri	Rural
Share_siminflow	1															
Share_relinflow	-.043	1														
Share_unrelinflow	-.144**	-.077**	1													
Sum_inflow	-.192**	.141**	.320**	1												
LQsim	-.022	.004	.014	.052*	1											
LQrel	.020	-.021	-.053*	-.008	.006	1										
LIS	-.003	-.021	-.078**	-.110**	-.084**	-.039	1									
FIN	-.034	.003	.033	.053*	-.043	-.013	-.407**	1								
CIS	.133**	-.029	-.033	.008	-.026	.006	-.383**	-.172**	1							
Age99	-.025	-.045	-.109**	-.183**	-.017	-.016	.061*	-.083**	-.010	1						
Firmsize99	.095**	.130**	.261**	.745**	.062*	-.010	-.078**	-.013	-.026	-.087**	1					
Education99	-.052*	.011	.056*	.093**	-.019	.014	-.203**	.459**	-.156**	-.101**	.025	1				
Univrc	.039	-.016	-.043	-.001	-.056*	.019	-.015	-.037	.079**	.001	.013	-.031	1			
Collrc	-.014	-.006	.023	-.042	.014	.064*	.022	-.092**	.006	.025	-.003	-.170**	-.231**	1		
Semi_peri	.024	.014	.004	.024	.064*	.021	-.041	-.056*	.012	-.027	.066**	-.065**	-.116**	-.138**	1	
Rural	.001	.005	-.023	-.018	.225**	.122**	.020	-.042	.011	-.003	-.008	-.066**	-.121**	-.144**	-.072**	1

Table A2. Binary logistic regression on HIF destiny survive, acquired and exit 2004-2010 in the three largest industries in the HIF sample: Finance, Capital-intensive services (CIS) and Labor-intensive services (LIS). Odds ratio and standard errors (in brackets) are reported. Significant at 0.1 (*), 0.05 (**) and 0.01 (***) levels.

		Finance			**CIS**			**LIS**	
	Survive	*Acquired*	*Exit*	*Survive*	*Acquired*	*Exit*	*Survive*	*Acquired*	*Exit*
Inflow									
Share_siminflow	0.895	7.003***	0.237***	1.613***	0.703*	0.701	0.900	1.417**	0.907
	(.199)	(.284)	(.300)	(.167)	(.191)	(.275)	(.104)	(.140)	(.127)
Share_relinflow	3.109***	0.784	0.257***	1.025	0.000***	27.731***	1.426**	1.461*	0.411***
	(.308)	(.487)	(.378)	(.337)	(1.549)	(.387)	(.158)	(.194)	(.218)
Share_unrelinflow	0.828	6.782***	0.334***	2.323***	0.417***	1.233	1.034	1.596***	0.643***
	(.133)	(.236)	(.165)	(.149)	(.175)	(.211)	(.070)	(.095)	(.089)
Location quotient									
LQsim	1.082	2.813***	0.185***	2.125***	0.401***	0.719**	0.890***	1.125***	1.030
	(.118)	(.142)	(.201)	(.145)	(.207)	(.137)	(.028)	(.026)	(.026)
LQrel	1.340	1.649	0.430**	0.164***	3.703***	6.377***	1.188	1.477**	0.547***
	(.328)	(.503)	(.400)	(.421)	(.469)	(.566)	(.144)	(.188)	(.184)
Controllers									
Age99	0.989	1.015	0.994	1.073***	0.914***	1.006	1.031***	0.962***	0.982**
	(.012)	(.016)	(.017)	(.012)	(.015)	(.017)	(.006)	(.005)	(.008)
Firmsize99	1.002	0.982***	1.013**	0.959***	1.076***	0.926***	1.023***	0.962***	0.996
	(.004)	(.005)	(.004)	(.004)	(.006)	(.013)	(.004)	(.005)	(.004)
Education99	0.969	1.200***	0.955	1.444***	0.791***	0.678***	1.043	1.058	0.900***
	(.039)	(.054)	(.049)	(.054)	(.063)	(.073)	(.030)	(.040)	(.038)
Metro	3.863***		0.688	1.580**	1.380	0.198***	1.051	1.517**	0.673***
	(.266)		(.322)	(.236)	(.293)	(.303)	(.129)	(.199)	(.145)
Univrc	5.151***		0.097***	1.207	1.015	0.692	0.776**	2.378***	0.737*
	(.265)		(.317)	(.230)	(.292)	(.264)	(.138)	(.206)	(.158)
Collrc	6.824***		0.083***	1.932***	0.779	0.370***	0.924	2.237***	0.581***
	(.284)		(.348)	(.228)	(.289)	(.278)	(.132)	(.199)	(.152)
semi_peri	5.037***		0.202***	1.113	1.804**	0.301***	1.643***	1.885***	0.218***
	(.373)		(.439)	(.289)	(.341)	(.383)	(.179)	(.241)	(.265)
N	245	245	245	221	221	221	757	757	757
-2 Log Likelihood	2716.836	1771.493	1728.647	2167.639	1649.882	1154.876	7209.040	4681.974	5145.750