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## **The impact of high-tech acquisitions on the regional economy: Evidence from Ireland**

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### **Abstract**

Abstract State of the art: In spite of the importance of high-tech startups to economic growth, the impact of exit via acquisition has received relatively little attention in the literature (Brown and Mason 2014; Mason and Harrison 2006). It is well established that policy makers understand the risk associated with underperforming or failing firms, but there does not appear to be consideration for the risk associated with successful firms who become acquisition targets. This 'acquisition risk' can result in relocation, consolidation, downsizing and closure, resulting in negative returns to the local economy. Research Gap: Acquisition often results in a positive outcome for the acquiring company, and the entrepreneur who 'cashes-out', but there is very little evidence on the effect of acquisition on the local economy, especially of privately held companies. This research contributes to the area by reporting post-acquisition closure rates and the post-acquisition 'entrepreneurial recycling' activities of the lead entrepreneur after they 'cash-out'. Theoretical Arguments: It is widely accepted that high-tech startups drive economic growth. This has caused government policy to focus on the promotion of technology startups. We know that high-tech IPOs are a driver of economic growth and job creation, but a growing body of literature views acquisition of small high-tech firms as a means of acquiring new technology. Extant M&A literature is often associated with job losses, with profitable firms acquiring less profitable firms, with a view to increasing efficiency and profitability. Foreign acquirers account for the majority of high tech acquisitions in

Ireland, mainly based the US and the UK. Therefore, we must assess whether it makes sense to continue to incentivize development of high tech firms using government funds, if the end result is foreign acquisition.

Method: The paper is based on evidence from a longitudinal study of the performance of the Irish Software cluster. The original database identified all independent software development firms in Ireland in 2001 and the CEOs (by name) were surveyed in 2002. 117 CEOs responded to the survey (population of 258) resulting in a response rate of just under 46%. In phase two (2007 and 2011) all firms in the database were tracked and updated; documenting exit rates, routes of exit (acquisition, IPO, MBO, failure), country of origin of acquirers, deal size, time to exit, and sector distribution, using a number of different sources. Phase three (2014) consisted of a follow-up to check the post-acquisition exit and survival rates of the 58 firms that had been acquired up to and including December, 2011. In order to measure the level of entrepreneurial recycling, the current roles of cashed-out CEOs were examined using online databases. Results: After 10 years 62 firms (24%) had closed. In addition, 66 firms (25.6%) had completed an exit. Of those, two (>1%) completed a public offering (IPO), six (2%) went through a management buy-out (MBO) and 58 (22.5%) were acquired. Over the period 2001 to 2011, 55% of all acquisitions in Ireland were made by cross-border companies, but that number rises to 81% for software acquisitions. By the end of 2014, 22 software development firms (38%) founded prior to 2002, and acquired over the period 2002-2011, had formally exited following acquisition, and approximately 5% of acquisitions attracted significant sums of money (>€50million) indicating that large deals are the exception not the rule.

50.8% of cashed-out CEOs started new ventures and another 10.5% actively investing in other start-ups. However, only a small proportion of the CEOs of acquired firms (5.3%) remained in post following acquisition.

# The impact of high-tech acquisitions on the regional economy: Evidence from Ireland

## Abstract

High-tech start-ups play a vital role in technological innovation and are often acquired by large, established firms with the resources and capabilities to successfully launch products in the market. While acquisition is seen as a win-win for both entrepreneurs and established firms, less is known about how these acquisitions affect regional economies—many of which provided incentivizing resources to the high-tech start-ups. Therefore, our research examines the effect of high-tech acquisitions on regional economies. We propose that policy makers may not properly account for the acquisition risk associated with successful (and therefore often acquired) technology start-ups. To examine this topic, we compiled a database of all independent Irish software development firms in operation in 2002 and tracked these firms to 2011. In 2014 and 2016 we conducted follow-up studies. We report exit rates and routes, indigenous versus foreign acquisitions, post-acquisition status, and entrepreneurial recycling. By 2014, approximately half of the firms were still trading, one fourth had closed, and one fourth had been acquired. Of the acquisitions, 81% were by foreign acquirers, suggesting a loss to incentivizing entities. However, we also find strong evidence of “entrepreneurial recycling,” with over 50% of cashed-out CEOs starting new ventures and another 10.5% actively investing in other start-ups.

## Introduction

High-tech start-ups are important conduits for translating scientific knowledge into commercial products and processes, and play a vital role in the development and diffusion of innovation (Elango, Lahiri, and Kundu, 2013; Storey and Tetther, 1998; Uhlenbruck, Hitt, and Semadeni, 2010). As such, these start-ups are generally viewed as having greater potential to become important producers and employers in the regional economy (Acs, 2011; Kauffman Foundation, 2013). Therefore, policymakers in many countries—and at various levels of government—seek to increase the number and viability of high-tech start-ups by providing incentives such as access to funding, start-up support such as business development centers and incubators, technology grants, infrastructure improvements, and tax breaks (Shane, 2013). These incentives are expected to encourage innovation, increase employment, build the tax base, and increase the overall

standard of living in a regional economy. However, high-tech start-ups may not have the physical resources and managerial capabilities necessary to launch and/or establish products, services, or business models in the larger market. This often leads to acquisitions by larger, established firms whose strengths include funding access, brand recognition, developed marketing strategies, a strong customer base, and established distribution channels. In an increasingly globalized economy with lower search costs, larger firms may find it easier to “purchase” innovation rather than develop it internally. For example, Google, Inc. spent more than \$17 billion U.S. from 2012 to 2014 on small technology companies, averaging one acquisition a week with a mean purchase price of \$163 million U.S. (Bloomberg, 2014).

Policymakers appear to understand—and compensate for—the risk associated with poor-performing or failing firms, but do they consider there may also be risk associated with successful and surviving firms which become acquisition targets? We use the term “economic incentive risk” to refer to the risk to the incentivizing entity—most often the regional economy—when high-tech firms relocate, consolidate, downsize, exit, or are acquired. In this study we examine one aspect of economic incentive risk: that of acquisition risk. Even though it is studied less than other exit routes (e.g. initial public offering [IPO]), exit by acquisition is the most common exit route (Schweinbacher, 2008). Furthermore, acquisition of privately-held start-ups account for the majority (by volume) of exit by acquisition (Desyllas and Hughes, 2008). Our purpose in this paper is to examine acquisition risk in privately-held, high-tech start-ups and to provide evidence that will guide policy makers and future researchers. To examine this topic, we track the complete population of privately-held indigenous software development firms in Ireland from 2002. We document exits (IPO, management buyout

[MBO], acquisition, and failure) to 2011, the post-acquisition status of acquired firms in 2014, and track current (2016) status of the founders to examine incidents of entrepreneurial recycling.

Despite the centrality of high-tech start-ups to economic growth and technology policy, the impact of exit by acquisition to incentivizing entities has received scant attention in the literature (Brown and Mason, 2014; Mason and Brown, 2013; Mason and Harrison, 2006) and represents an important contribution to the current literature. Through an examination of exit rates, exit routes, foreign versus indigenous acquisition, post-acquisition status, and entrepreneurial recycling for an entire sector of firms in a single country, we provide clarity surrounding the impact of acquisitions on a regional economy. In addition, our follow-up study of the exited founders is an opportunity to test Mason and Harrison's (2006) construct of entrepreneurial recycling (the tendency of cashed-out entrepreneurs to reinvest profits and expertise into regional economies).

We begin with a discussion of high-tech economic growth policy followed by the role of exit by acquisition in these policies and the impact of acquisitions on the regional economy. We then present our methodology followed by the results and a discussion of our contributions and implications of this research.

### **High-tech economic growth policy and innovation**

The importance of high-tech start-ups for innovation-driven economic growth has gained widespread acceptance in Western economies (OECD, 2001; Storey and Tether, 1998; The Kauffman Foundation, 2008; World Economic Forum, 2011). As a result, the promotion of technology start-ups has become the focus of government policy. For example, President Barack Obama's *Strategy for American Innovation* (The White House, 2013) seeks to promote

high-growth and innovation-based entrepreneurship. In Ireland, the objective is to have a significant number of large, globally trading, “innovation-intensive companies” that are owned and headquartered in Ireland (Department of the Taoiseach, 2010).

Research demonstrates that high-tech start-ups contribute disproportionately to a region’s economic health through job creation and economic growth (e.g., Audretsch, Lehmann, Paleari and Vismara, 2016; Henrekson and Johansson, 2009). Shane (2009, p. 146) argues that entrepreneurs in high-growth firms “will take people out of poverty, encourage innovation, create jobs, reduce unemployment, make markets more competitive, and enhance economic growth.” Banking on this perspective, policymakers around the globe engage in the quest to build and attract high-tech companies and most accept that financial support and/or institutional intervention is justified at different stages in the innovation cycle. At the early stage of the cycle, governments support innovation through—among other policies—direct investment in basic R&D programs at universities, regulation, infrastructure, tax relief provisions, and incubation assistance.

At the commercialization stage the focus moves to funding, and governments provide a myriad of developmental and supportive programs—including angel and venture capital networks—to increase the funding supply available for early stage companies (Da Rin, Nicodano, and Sembenelli, 2006). In Europe, the creation of a productive venture capital market has led to the development of government-managed venture capital (GVC) funds (Guerini and Quas, 2016). Although some research questions the effectiveness of these funds (e.g., Grilli and Murtin, 2014), Guerini and Quas (2016) demonstrate that GVC funding is significantly and positively related to receiving private venture capital. That is, government funding acts as a signal to private equity markets. Equity investors provide both financial and business expertise to

developing firms, and research confirms that venture capital is three to four times more powerful than corporate R&D in promoting innovation (Kortum and Lerner, 2000). In addition, venture capitalists and angel investors fulfil an important role in mitigating agency problems between entrepreneurs and institutional investors by structuring deals that provide for monitoring and control of shareholders' interests (Bergemann and Hege, 1998). This combination of inputs provides improved governance and operations in portfolio firms and lower capital constraints, leading to stronger growth and performance (Kerr, Lerner, and Schoar 2011).

At the later stages in the innovation cycle, the focus of policy interventions shifts to company development programs and even support for new stock markets (Michelacci and Suarez, 2004) to provide exit options for investors and entrepreneurs. New stock markets have had a large positive impact on the innovation ratios of high-tech and early stage entrepreneurial firms in Europe (Da Rin, Nicodano, and Sembenelli, 2006). In summary—high-tech start-ups are important for innovation-driven economic growth, and policymakers provide incentives and assistance to these companies with the hope they will create jobs and drive more competitive markets, thereby enhancing economic growth.

### **The role of exit by acquisition in high-tech economic growth policy**

The outcome of a majority of high-tech start-ups is an exit (DeTienne, 2010). This is due to many factors, including the inherent risk associated with developing a new technology; the quest for dominant design (many enter the market and a few win big) (Suarez, Grodal, and Gotsopoulos, 2015); the funding structure (e.g., equity investment) possibly requiring an exit to reward investors (Gompers and Lerner, 1999; Ragozzino and Blevins, 2016); insatiable growth fueling the need for more investment (Lindholm-Dahlstrand and Cetindamar, 2000; Mason and

Harrison, 2006); and high-tech start-ups often being acquired by larger established firms since they provide those firms a means of acquiring new technology (Ahuja and Katila, 2001; Blonigen and Taylor, 2000; Brown and Mason, 2014; Desyllas and Hughes, 2008; Graebner and Eisenhardt, 2010; Hussinger, 2010).

Different theoretical perspectives suggest that firms can increase technological knowledge through make-or-buy decisions (or some combination of the two). In a study of 6106 international high-tech acquisitions over the period 1984-2000, Desyllas and Hughes (2008) find that acquisition likelihood is negatively related to a firm's commitment to internal R&D, supporting the premise that firms with lower in-house R&D are more likely to pursue acquisitions. In addition, sourcing technological knowledge via acquisition can be quicker and less risky (Chakrabarti, Hauschildt, and Suverkrup, 1994; Desyllas and Hughes, 2008). Similar to angel investors and venture capitalists, acquirers can fulfil an important role in the growth and internationalization of high-tech firms, especially if they have the necessary complementary resources and acquisition experience (Lindholm-Dahlstrand, 2000; Lindholm-Dahlstrand and Cetindamar, 2000).

However, the extant literature on mergers and acquisitions (M&A) is also associated with downsizing and job losses (Lehto and Böckerman, 2008). Mergers and acquisitions have been found to have a negative effect on growth across OECD (Organisation for Economic Co-operation and Development) countries, except for the growth of the services sector (Doytch and Cakan, 2011). Therefore, a key concern regarding the economic impact of high-tech start-ups is whether acquisitions of growing firms are compatible with government ambitions to create large-scale, indigenous technology firms. In 2011, the acquisition by Hewlett Packard of Autonomy, the U.K.'s largest software company, raised concerns about the protection of



strategic industries from foreign acquisition. Tony Burke, Assistant Secretary for Manufacturing with the trade union Unite, stated “It would be a dreadful shame if this acquisition followed form—job losses, investment drain and worst of all, new technology and skills ebbing out of our economy” (Guardian, 2011, p. 3).

Essentially, does it make sense to use limited governmental funds to develop and grow high-tech ventures if those ventures are subsequently acquired by foreign companies? At the regional level, what is not clear is the extent to which these acquisitions create, destroy, or transfer value from target firms and the regional economy. More generally, the shift in the balance of entrepreneurial exit modes away from IPO and toward acquisition calls for a greater understanding of the impact of acquisitions in the innovation economy. Mason and Brown (2013) point out:

“More needs to be known about how the acquisition of local HGFs (high growth firms) affects the entrepreneurial dynamism of a local economy. At the very least, policy-makers should try and monitor the way in which foreign acquisition affects the performance and economic impact, either positively or negatively, of HGFs in any given local economy” (p. 222).

### **The impact of acquisitions on the regional economy**

There is still relatively little empirical evidence on the impact of acquisition on the regional economy (Brown and Mason, 2014; Mason and Harrison, 2006). One reason for this is access to data. It is easier to track the performance of public or private firms that IPO because of publicly available information. Private firms that are acquired often become subsumed into a large organization and may cease to be an independent reporting unit. Thus, it can be difficult to

disentangle the post-acquisition performance of the target firm from the performance of the acquirer. In a review of the limited empirical evidence on the impact of acquisition on regional economies, Mason and Harrison (2006) identify three consistent negative effects. First, there may be a loss of managerial expertise in the regional economy when management positions and operations roles are consolidated back to the head office of the acquiring firm (Ashcroft, 1988; Bhagat et al., 1990; Leigh and North, 1978; Turok and Richardson, 1991). Second, acquisition and international acquisition in particular may have adverse effects on the regional economy if the new owners switch sources of supplies—especially producer services such as accountancy, legal, and advertising—resulting in an indirect job loss. Third, they also suggest that while acquisitions can lead to increased output in the short run, they may also lead to higher closure rates and job losses in the long run. More recent studies of disaggregate employment change provide important evidence on the impact of acquisitions on the economy (Brown and Medoff, 1988; Burghard and Helm, 2015; Conyon et al., 2002; Gugler and Yurtoglu, 2004; McGuckin and Nguyen, 2001; Xiao, 2015). A Swiss study found that overall employment in acquired firms fell from an average of 21.75 full-time equivalent employees in 2001 to an average of 18.52 employees in 2005 (Burghardt and Helm, 2015). However, Xiao (2015) found a positive effect on employment in Sweden when the acquirer was a domestic multinational enterprise (MNE). As these studies focused on employment change over time, only surviving enterprises were included. A large-scale study of acquisition in the entire population of U.K. SMEs (small and medium-sized enterprises) found that acquisitions lead to a decline in productivity and an increase in the likelihood of exit in acquired firms (Foreman-Peck and Nicholls, 2013). This suggests that the impact on the regional economy and employment would be much higher if failed enterprises were included.

The risk of closure may be even higher in tech-tech acquisitions because the primary motivation of a private technology firm to acquire another may be the appropriation of the intellectual property and/or pipeline of potential products and services (Graebner and Eisenhardt, 2010). Thus, established acquirers may have little subsequent use for the target firm once the technology has been successfully grafted onto its own resource base (Puranam, Singh and Zollo, 2006). In addition, if the acquisition does not deliver the technology solution required, the acquirers may have little option but to cut losses by closing the acquired company. Finally, some report a more sinister explanation, whereby the acquirer's motive is to kill or delay the entrance of a superior competing technology (ACOST, 1990).

Counteracting the negative effects of acquisitions, Mason and Harrison (2006) examine the positive potential for “entrepreneurial recycling”—when cashed-out entrepreneurs reinvest some of the profits and expertise into the regional economy. This is phenomenon rarely examined outside of Silicon Valley (Bahrami and Evans, 1995). Mason and Harrison (2006) tracked the post-acquisition activities of the lead founders of five Scottish high-tech firms and discovered that the cashed-out founders reinvested in the regional economy by: (a) creating new ventures, (b) investing in venture capital funds for other start-ups, (c) enhancing regional entrepreneurial and innovation infrastructure of the regional economy, (d) endowing various community activities and institutions such as universities, and (e) engaging in civic activities such as board memberships. Existing research already reports that individuals who have previously been involved in business formation are more likely than members of the general population to try again (GEM, 2013; Hessels, 2010). This research also aligns with the literature on “habitual entrepreneurship” (Wright, Robbie, and Ennew, 1997). “Habitual entrepreneurs” are individuals who have an ownership interest in two or more firms and can be described as either

“serial” and/or “portfolio” (Beresford, 1996; Ucbasaran et al., 2008; Ucbasaran et al., 2015; Wright et al., 1997). “Serial entrepreneurs” are those who have sold/closed at least one business and currently have an ownership stake in another, while “portfolio entrepreneurs” are those who have an ownership stake in two or more independent businesses (Wright et al., 1997). The assumption is that cashed-out entrepreneurs would have more resources and greater expertise than the general population of entrepreneurs, and are thus even more likely to become habitual founders. Empirical evidence confirms that cashed-out entrepreneurs, for the same reasons, make ideal angel investors (Mason and Harrison, 1994; Mason and Harrison, 2006).

In summary, the outcomes associated with acquisition could be either negative or positive for the regional economy; however, the evidence is scant on the acquisition of privately-held companies, particularly their effect on the regional economy.

## **Methodology**

Software development is the dynamo of the ICT sector. It is a truly globalized sector with high levels of international trade, acquisition, and R&D (OECD, 2010). In the 1990s, Ireland—along with other emerging clusters such as Cambridge (U.K.), Finland, Sweden, and Israel—gained a reputation for software development following the “Silicon Valley model,” which from the start focused upon product and export (Sterne, 2004) rather than the provision of services or customizations for the regional market (which was more prevalent in other European countries). Because of this product-and-export focus, a successful venture capital industry emerged to fund these companies, and in the absence of a well-developed IPO market, trade sales became the exit mechanism of choice. Thus, software development companies in Ireland provide an excellent laboratory for the examination of high-tech acquisitions.

To examine our research question we conducted a longitudinal study of the cluster. In Phase 1 (2001), we compiled the original database identifying all independent software development firms in Ireland. We surveyed the CEOs (by name) in 2002. Out of the 258 total population 117 CEOs responded, resulting in a response rate of just under 46%. The size of the firms averaged 26 employees, but 37% had less than 10. Over half had sales of less than €635,000 and only 10% had sales greater than €3.8M. The founders were predominantly male, with just three female founders represented in the sample. The firms were led by a mix of inexperienced and experienced founders, such that 24% had no prior management experience while 23% had more than 10 years of management experience. Reflecting the relative youth of the software industry at the time, the firms were on average six years old, with a median age of four years. This is reflected in the age structure of the CEOs as well in that just 20% of founders were over 45 years old.

In Phase 2 (2007 and 2011), we tracked and updated all firms in the database, documenting exit rates, routes of exit (acquisition, IPO, MBO, and failure), acquirer country of origin, deal size, time to exit, and sector distribution. We sourced this information from FAME (a commercial credit rating database available from Bureau van Dijk), the Companies' Registration Office (CRO) database (the Irish government's company registration database), and Zephyr (a specific database covering information on M&As, IPOs, private equity, and venture capital deals). We also used the following web-based sources of information: (a) ENN.ie (ElectricNews.Net Ltd.), an online provider of information to the Irish ICT sector over the period 1999-2011, and (b) online archival searches of the *Sunday Tribune* and the *Sunday Business Post*. In addition, industry expert and author John Sterne provided valuable information on firms which were difficult to locate. In firms where accurate status could not be determined from secondary sources, we contacted the firms directly.

In Phase 3 (2014), we conducted an additional follow-up to check the post-acquisition exit and survival rates of the 58 firms that had been acquired, up to and including December 2011. In addition, because the literature suggests that cashed-out founders of acquired firms are prime candidates for new venture creation both as founders and investors (Mason and Harrison, 2006), we examined the current roles of cashed-out CEOs using Fame (Bureau van Dijk.com) DueDil (DueDil.com), LinkedIn.com and online searches of the journals and newspapers. We examined only the roles of the founding CEO rather than the entire founding team, and we examined only the CEO's current role (as opposed to their entire history after departure from the focal firm). A complete entrepreneurial history would have made for richer data, and it is likely that our process underrepresents the extent of entrepreneurial recycle in the sample; however, this is—to our knowledge—the first study of the entire population of cashed-out CEOs. Results from Phases 2 and 3 are presented in the next section.

## **Results**

### ***The Survey Population—Exit Rates and Routes***

Despite the growth of online information and commercial databases, one of the most difficult tasks for researchers is tracking privately-held exited companies. In its tracking study of U.S. venture capital-backed firms (funded over the period 1999-2000) the NVCA reported an 18% failure rate, but was unable to find an additional 35% of firms that they concluded remained either “private or unknown,” and/or “quietly failed” (NVCA 2014, p. 8). We first examine the exit rates and routes of exit of the population of 258 independent software development firms. By 2014, 130 firms (51%) were still trading, 62 (24%) had closed, and 66 firms (25.6%) had completed an exit. Two (<1%) completed a public offering (IPO), six (2%) went through a

management buy-out (MBO), and 58 (22.5%) were acquired. See Figure 1 and Table 1 below for more detailed information.

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*Insert Figure 1 and Table 1 about here*

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### ***Indigenous versus foreign acquirers of Irish software firms and closure rates***

Table 2 provides origin details for the acquirers of the 58 acquisitions identified in the study, as well as comparison information from total acquisitions over the period. Figure 2 provides a graphic representation of that information.

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*Insert Table 2 and Figure 2 about here*

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Firms from the U.S. accounted for 43% of acquisitions of Irish software companies, followed by the U.K. and Ireland (19% each), Europe (12%) and the rest of the world (7%). In comparison to acquisitions by all sectors (see Figure 2), software companies were more likely to be acquired from firms outside of Ireland and less likely to be cross-border acquisitions. Firms from the U.S. accounted for 15% of all acquisitions and 43% of software acquisitions, and firms from the U.K. accounted for 28% of all acquisitions, but only 19% of software acquisitions. We also compared the closure rates of foreign to indigenous acquisitions. Of the 11 locally-acquired firms, 4 (36.4%) were no longer trading in 2014. This compares to 18 of the 47 (38.3%) foreign acquisitions.

### ***Acquisition under financial distress***

At least five of the acquisitions were made under conditions of financial distress. Prior to acquisition, receivers had been appointed to Cinehub, Cognotec, Buytel, Marrakech, and Flexicom. An examination of these five indicates that all had received external funding and, under these circumstances, investors are likely to have realized investments at a considerable discount (if at all). Cognotec, for example, was credited with producing the world's first automated foreign exchange trading system and was a leading light in the Irish software cluster for over two decades. The firm had several investment rounds and was valued at over €400 million at its peak. The firm went into receivership on January 23, 2010 and was sold by February 15, 2010 to First Derivatives for €3.5 million. The firm continues to operate in Dublin under the name of its acquirers (First Derivatives), albeit with a reduced turnover of €5 million and a significantly reduced workforce of 40 employees. Two of the five firms to which receivers had been appointed—Cinehub and Buytel—no longer have a presence in Ireland, and neither do their acquirers—indicating that these firms no longer contribute to the regional economy. Three of these distressed firms continued to trade post-acquisition.

### ***The post-acquisitions status of targets***

Phase 3 focused on the post-acquisition performance of the 58 targets in 2014. At least three post-acquisition trading forms were identified, including the following: (a) independent subsidiary trading under the target's original name, (b) independent subsidiary trading under the acquirer's name, and (c) independent subsidiary established (in some cases under a new name) as a patent-holding company to facilitate the payment of licensing fees from the acquirer to the owners of the target.



Table 3 presents the results of the post-acquisitions tracking analysis for the 58 acquired companies. Of these, 36 were registered as trading either as wholly owned subsidiaries using the target firm's trading name (35%), the acquirer's trading name (22%), or as patent-holding firms (5%). These patent-holding firms have offices in Ireland, but do not appear to be trading—22 (38%) had formally closed following acquisition. Of these, seven had dissolved both target and acquirer, eight were in liquidation or receivership, and seven were no longer registered. Thus, after acquisition, approximately two thirds of the firms were ongoing entities and one third had closed.

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**Insert Table 3 about here**

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### ***Entrepreneurial recycling***

Our examination of entrepreneurial recycling after the acquisition consists of three components: financial recycling (the financial resources available), new venture creation (the creation of new ventures), and new venture support (engagement in other entrepreneurial activity).

### ***Financial recycling***

Table 4 provides detailed information of each acquisition, including the name of the target company, the name of the acquiring firm and its country of origin, time to exit, and deal size. Time to exit refers to the difference between the company's start date—as reported in Fame and/or the CRO—and the date of the company's acquisition, as reported in Zephyr and/or the company's press release. Exit times ranged from three to 28 years and the average time to exit was 9.5 years.

Deal size refers to the price (in Euros) paid for the acquisition. The selling price of smaller, private-firm acquisitions often goes unreported; fortunately, we were able to find information on 27 of the 58 deals. While larger deals attract media attention and lead outsiders to think that there is “easy money” to be made in software, in our sample, acquisitions above the €50 million ceiling were rare. Only three companies, for which information is available, were sold for amounts greater than €50 million. These included the sale of Eontec to Siebel Systems for €108 million, the sale of Havok to Intel for €79 million, and the sale of Orbiscom to Mastercard for €73 million. In addition, seven firms were acquired for sums between €20 million and €50 million. The average selling price was €24.2 million, but the median was €14 million. In 2014, the U.S. National Venture Capital Association (NVCA) reported that deals with undisclosed sale prices are historically “fairly diminutive” and are—in many case—fire sales. Therefore, it is likely that the average selling price for the remaining 31 undisclosed firms was much lower than the median of €14 million.

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**Insert Table 4 about here**

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#### *New venture creation and venture investment*

We identified five post-acquisition roles for the 57 active lead founders (one CEO had retired), including founder of a new firm (habitual entrepreneur), investor or director in a new tech start-up, senior manager in an existing technology firm, and other employment. We found that 29 of the 57 lead founders (51%) created a new firm—approximately two thirds of these new firms were software development firms, one fourth were consultancy firms, and the remainder were in miscellaneous sectors. See Table 5 for more detail.

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**Insert Table 5 about here**

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Six of the 57 (10%) active lead founders are currently invested in and/or have a director role in a new technology start-up, 17 (30%) have taken a senior manager role in a technology firm, and two (4%) have sought other employment. In summary, more than half of the founders of software development teams have re-engaged in an entrepreneurial start-up, and the majority of those are in software development or consultancy. Another 10% are investors or directors, and 30% have taken senior roles in technology firms.

### **Discussion and Conclusion**

An examination of the exit rates and routes for the entire population of indigenous software development firms in Ireland in 2001 indicates closure or failure rates similar to those for software development firms in other countries. This may be due to low entry barriers and minimal production costs (which encourage entry); however, surviving firms have large R&D expenditures due to intense competitive dynamics and rapid product life cycles (Li et al., 2010). So while it is easy to start a software firm, it is much more difficult to be competitive.

Fifty-eight firms (approximately one fourth) were acquired while less than 1% completed a public listing. Our finding that an acquisition is the primary exit route for high-tech start-ups is indicative of the trend away from IPOs toward acquisitions. In 2016, the NVCA reported that the number of U.S. IPOs fell from an annual average of 638 (from 1995 to 2000) to 189 (from 2010 to 2015). The decline has been marked by rise in the number of mergers and acquisitions from an annual average of 288 to 914 over the same time periods. The decline in the number of IPOs has

also coincided with the emergence of companies with valuations of one billion dollars or more, which includes companies like Uber and Airbnb that choose to remain privately-held. These companies are referred to as unicorns.

Our research also indicates that foreign acquisitions account for the major share of all acquisitions, suggesting that the primary motive is technology appropriation or strategic asset-seeking (Dunning and Narula, 1995). For example, when Intel purchased Dublin-based Trinity College spin-out Havok, the importance of the intellectual property was made very clear by Renee J. James, Vice President and General Manager of Intel's Software and Solutions Group. In the company's press release, James noted that Havok was "a proven leader in physics technology for gaming and digital content" that would "become a key element of Intel's visual computing and graphics efforts." (Intel Press Release, 2007) Havok's technology is used in over 500 games, including Call of Duty and Skylanders, and to drive the special effects in movies such as the Harry Potter and Matrix series. Superior technological capability was also very much the motive for the decision of Chase Franklin, the CEO of QPass Inc., to acquire Altamedius, which he describes as "best of breed" financial-grade payments technology.

Technology appropriation or strategic asset-seeking activities by foreign acquirers are likely to end in a loss to incentivizing entities. Given the small size of the Irish market, acquirers are less likely to be attracted to Irish targets for market expansion motives, which might increase employment and innovation. However, Ireland does provide a base from which to serve the European market, and we identified limited evidence that acquirers have strategically targeted Irish firms with an existing European customer base as a vehicle to penetrate the European market. For example, when U.S.-based Ariston Global acquired Interactive Enterprises—a developer of service activation and management solutions for broadband operators—founder

Steve Dubnik was fully aware of the importance of the company's foothold in international markets. In a press release from Ariston Global, he stated, "As a European headquartered business with offices in the Asia Pacific region, Interactive Enterprise provides Ariston Global with a much-desired stronghold from which to build its growing worldwide services" (Ariston Global, 2008). Market expansion was also an important strategic goal in the acquisition of Point Information Systems—a developer of telemarketing software systems for call centers—by U.S.-based internet banking and solutions firm S1:

By acquiring Point, S1 will fulfil several of its previously stated strategic goals, specifically: strengthening its multi-channel enterprise solution with Point's strong call centre applications, extending its insurance product family and customer base, and enhancing its leadership position in Europe with Point's strong presence in the U.K. and Germany. (S1, 2002)

The high post-acquisition failure rate (38%) raises the question of whether the money spent to incentivize and grow these firms results in positive returns for the regional economy. A case in question is Galway-based software firm Am-Beo (the name means "real time" in Gaelic), which specialized in developing rating and revenue settlement systems for the telecom industry. It was founded in 2000, and received approximately €6 million in research and development from the Irish government investment agency Enterprise Ireland as well as €16 million in venture capital. By 2003, the firm had losses of €20 million and was the subject of two acquisitions. It closed in 2013 with large losses. The high post-acquisition closure rate suggests a significant negative impact on the regional economy in terms of output, employment, skills, and technology. Fully one third of the acquired firms no longer operate in Ireland, supporting our proposition that policymakers may not adequately compensate for "acquisition risk"—the risk that successful

technology start-ups will be acquired and the support provided by the incentivizing entity will be either swept into the acquiring firm or wasted.

In our sample, only 5% of acquisitions attracted significant sums of money (> €50 million). An obvious limitation of our study is the lack of detailed investment information for the whole sample, but it is clear that “big deals” are the exception rather than the rule. These big deals are small in number but are highly visible and attract media attention, feeding a public perception that such deals are commonplace; it may also lead policymakers to overestimate the contribution of acquisitions to regional development and growth. The corporate finance literature has long suggested that “glamour acquisitions” (Rau and Vermaelen, 1998; Sudarsanam and Mahate, 2003) attract publicity that can lead to overpayment. In the context of high-tech SME policy, the small number of big deals indicates, at best, a modest potential for finance recycling. This raises serious concerns about the role of acquisitions in financing the growth of high-tech start-ups. Large-scale acquisitions and IPOs generate greater liquidity and returns for both investors and entrepreneurs, which are essential to creating long-term economic growth. The evidence presented here suggests that small-scale acquisition activity supports a vibrant start-up ecosystem at best, but does little in the pursuit of the holy grail of regional policymakers—which is to create large-scale, high-tech firms capable of competing internationally.

We also examined whether acquisitions lead to entrepreneurial recycling, which would indicate a positive—but until recently, unexamined and unmeasured—aspect of acquisitions. We found that over 60% of active lead founders were re-engaged in entrepreneurial activity (in either new venture creation or as investors and directors), suggesting that entrepreneurial recycling is prevalent in high technology start-ups, and which may indicate a dynamic, self-perpetuating start-up ecosystem. This is an interesting area of research and one that has received limited

attention in the literature. Not surprisingly, of the founders who re-engaged in new ventures, most went back to the sector they knew best and founded software development firms. However, some focused on the business development side of venture creation and started management or technology consultancy firms. A small number started businesses or became self-employed in completely different sectors—one became a consultant for eye surgeons, one a self-employed trader, one the owner of a healthcare footwear firm, and one a parenting/education consultant. In sum, there is strong evidence of entrepreneurial recycling in the form of new business creation. There is also evidence that the market values the learning that occurs during bouts of self-employment, as nearly 30% of founders took managerial posts in other businesses. There is little evidence to suggest that the target firms realize ambitions to grow the ventures via acquisition, as only a few founding CEOs (5%) retained their positions post-acquisition.

Future research is indicated to examine the full range of entrepreneurial recycling that occurs. For example, how much learning occurred from the first venture to the second? Did those who founded ventures outside of software development have less success? How did the relationships formed during the previous venture impact the new start-up? Are founders more or less likely to seek an acquisition with their second venture? This is a very intriguing new area of scholarly research which will help with policy decisions.

In addition, the findings regarding entrepreneurial recycling contribute to the research arguing that firms and owners are “coterminous” (Rosa and Scott, 1999) and exit the regional economy together. This is clearly not the case with high-tech acquisitions, where in over 50% of the cases, the cashed-out CEOs re-engaged in new venture creation. This study is one of the first to take a more holistic approach by examining the post-acquisition closure rates and entrepreneurial recycling activity in a high-tech cluster.

This study suffers from a number of limitations, and the lack of detailed investment information for the whole sample is certainly one of the largest. Future research examining detailed investment information and exit rates and routes in both foreign and regional acquisitions could build upon our initial findings to better explicate the losses (or gains) to regional policy makers.

We began this research by asking the question, “Do incentivizing entities and policymakers properly consider the acquisition risk associated with successful (and therefore often acquired) technology start-ups?” Our results indicate both negative and positive answers to this question. The high number of foreign acquisitions and high percentage of post-acquisition failures would suggest that policymakers should re-examine acquisition risk as a component of the incentivizing decision. Conversely, the high level of entrepreneurial recycling (which has rarely been measured) may help to alleviate those risks.



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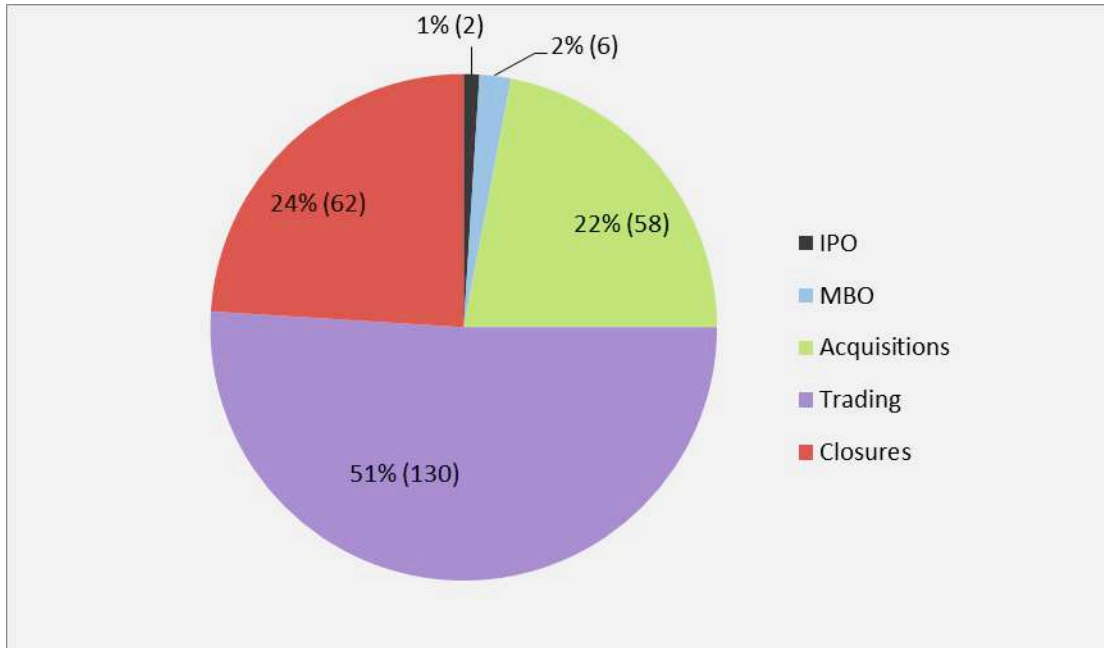
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**Figure 1: Exits from the Irish Software Sector 2001 – 2011**



**Table 1: Exits from the Irish Software Sector 2001 - 2011**

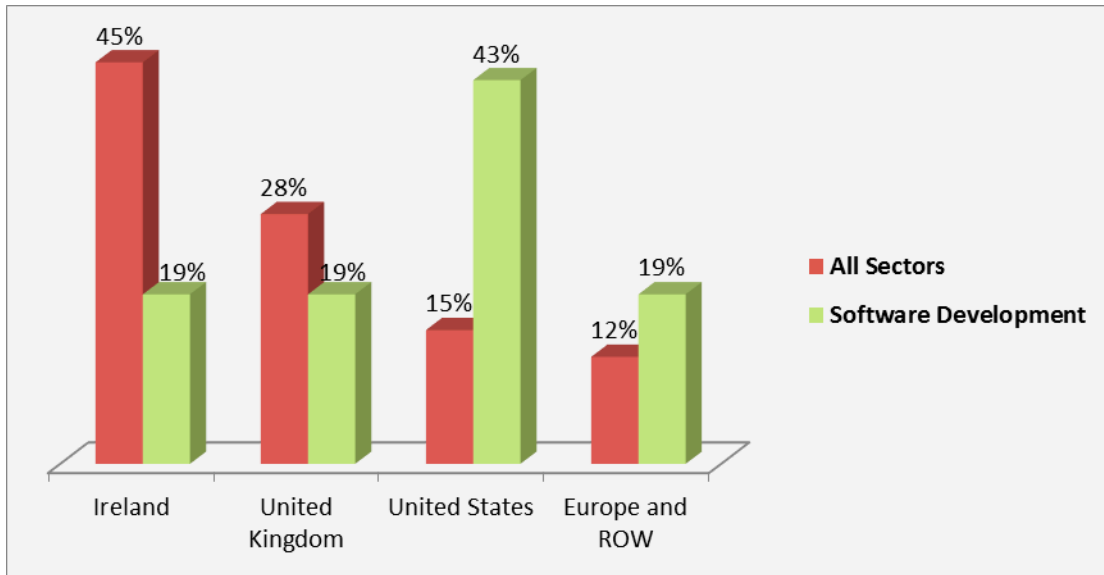
<b>Exit from the Irish Software Sector 2001 – 2011</b>	<b>Number of firms</b>	<b>Percentage %</b>	<b>Cumulative %</b>
<b>IPO</b>	2	1	1
<b>MBO</b>	6	2	3
<b>Acquisition</b>	58	22	25
<b>Trading</b>	130	51	76
<b>Closure</b>	62	24	100
<b>TOTAL</b>	<b>258</b>	<b>100</b>	



**Table 2: The Country of Origin of Acquirers' of Irish Companies**

<b>Country of Origin Of Acquirer</b>	<b>All Sectors Number of firms</b>	<b>All Sectors %</b>	<b>Software Development Number of firms</b>	<b>Software Development %</b>
<b>Ireland</b>	452	45%	11	19%
<b>United Kingdom</b>	281	28%	11	19%
<b>United States</b>	150	15%	25	43%
<b>Europe and ROW</b>	126	12%	7 4	12% 7%
<b>TOTAL</b>	<b>1109</b>	<b>100%</b>	<b>58</b>	<b>100%</b>

**Figure 2: Acquisitions in Ireland; Software Development versus All Sectors**



Source: All sectors Zephyr Database from Bureau Van Dijk (2011) Mergers and Acquisitions 2001-2011

**Table 3: Post-acquisition Status of the 58 Acquired Companies**

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	Trading Status	
Registered as trading normally		
Using targets name	20	
Using acquirer's name	13	
Patent Holding Company- limited trading	3	
Total Trading Normally		36
Dissolved/Failed		
Both target and acquirer	7	
In liquidation	6	
In receivership (Target) acquirer dissolved	2	
No longer registered	7	
(Target Dissolved and Acquirer not de/registered in Ireland)		
Total Dissolved /Failed		22

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Software companies, founded prior to 2002, acquired over the period 2002-2011, exited by 2014  
Target's trading status as of the end of 2014

**Table 4: Characteristics of acquisitions in the Irish software cluster**

<b>Target Company</b>	<b>Acquiring Company</b>	<b>Country of Origin</b>	<b>Time to Exit (in years)</b>	<b>Sale Value (€)</b>
Eontec	Siebel Systems now Oracle	US	10	108
Havok	Intel	US	7	79
Orbiscom Ireland Ltd.	Mastercard	US	9	73
Allfinanz Ltd	Munich RE	DE	22	48
Similarity Systems	Informatica Corporation	US	7	44.8
Changing Worlds	Amdocs	UK	7	42
Acra Controls	Curtiss-Wright Corporation	US	19	42
Redcircle Technologies	Zamano	IE	14	24
XIAM Limited	Qualcomm	UK	9	20.8
Cape Technologies Ltd.	WeDo Consulting	PT	7	20
Mentec Group Ltd.	Calyx	IE	11	16
Electronic Paper	ThirdForce	IE	16	15
Performix Technologies Ltd	NICE	IL	8	14
SteelTrace	Compuware	US	5	14
Microsol Ltd	Crompton Greaves	IN	17	11
Marrakech	AMT-SYBEX Group./ Glenshane B.V.	/NL	10	10.7
Eland Technologies Ltd.	SITA	CH	4	10
Sepro Telecom Ltd	Opennet	IE	3	10
eWare	ACCPAC Computer Associates	SA/US	5	6
Raidtec Corporation Ltd.	Plasmon	UK	4	5
Eirnet Technologies Ltd.	PMS	UK	6	4.8
Cognotec Autodealing Ltd	First Derivatives	UK	16	3.5
CardBASE Technologies.	ID Data Corp	UK	11	3
Opsis	IRIS	UK	12	2.4
WBT Systems	Horizon Technology	IE	10	2
Flexicom	EuroConex/US Bankcorp	US	13	1.5
Raven/Coretime	Sage	UK	4	1
Altamedius Ltd.	QPass Inc.	US	7	--
AM-beo	Prime Carrier	IE	5	--
Aran Technologies Ltd.	Tektronix Communications	US	19	--
Bantry Technologies Ltd.	Gemalto	FR	8	--
	Homisco Inc.	US	3	--
Braxtel Communications				
Buytel	Biometric Security Ltd	UK	9	--
Cape Clear Software	Workaday	US	8	--
Cinehub	Cast & Crew	US	15	--
Comnitel Technologies	WatchMark Corporation now IBM	US	5	--
Crannog Software Ltd.	Fluke	US	9	--
Datacare Software Group	Compushare	AU	24	--
Deecal International Ltd.	First Data Corporation	US	28	--
Halcyon Systems Ltd	Intentia/ Lawson Software	US	6	--
ITS Limited	Ceridian	US	19	--
Interactive Enterprise Ltd.	Ariston Global USA	US	9	--
ItsMobile	Alphira/ Payzone	IE	5	--
Kadius Systems Ltd	Big Picture Software	IE	3	--
LabSys Ltd	VWR International Ltd	US	15	--

<b>Target Company</b>	<b>Acquiring Company</b>	<b>Country of Origin</b>	<b>Time to Exit (in years)</b>	<b>Sale Value (€)</b>
Lake Communications	Inter-tel / MITEL Corp	US	5	--
LeT Systems Ltd.	Trimble USA	US	11	--
Macalla Software Limited	Roamware	US	12	--
MCS Int. Marine Computational Systems	John Wood Group PLC	UK	7	--
m-iSphere Ltd.	Zamano	IE	10	--
Navarasoft Ltd	RAM Mobile Data	NL	3	--
Network365 Valista	AePona	UK	10	--
Point Information Systems	S1 Corporation	US	5	--
Prime Carrier Ltd.	Flint telecom	IE	11	--
Transware Ltd	Welocalize, Inc.	US	6	--
Trapedza	Misys	UK	5	--
Voxpilot	Tetco Technologies now Devoteam SA	FR	7	--
WS2	Fleetmatics	IE	6	--

**Table 5: Primary roles of cashed-out entrepreneurs**

	<b>Primary</b>	<b>Primary</b>	<b>Cumulative</b>
		<b>%</b>	<b>%</b>
<b>1 Habitual founders</b>			
CEO new tech firm	18	31.6	31.6
CEO new consultancy firm	7	12.3	43.9
CEOs or self-employed in Misc. sector	4	7	50.9
<b>Total habitual</b>	<b>29</b>	<b>50.9</b>	<b>50.9</b>
<b>2 CEO/CTO acquired firm</b>	3	5.3	56.1
<b>3 Senior manager role in tech firm</b>	17	29.8	86.0
<b>4 Investor director in tech ventures</b>	6	10.5	96.5
<b>5 Other Employment</b>	2	3.5	100
<b>Total</b>	<b>57</b>	<b>100</b>	

**Note:** Refers to the role held in 2014 of the main founder of firms acquired over the period 2002-2011.