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**Going local: placing entrepreneurial microgeographies in a larger regional context**

Mary Donegan and Nichola Lowe

Urban and Community Studies, University of Connecticut, Storrs, CT, USA; Department of City and Regional Planning, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

**ABSTRACT**

As cities seek to promote innovation, they are increasingly investing in localised institutional entrepreneurial supports. Some institutions are hyperlocal, operating within distinct geographic sub-spaces and funnelling entrepreneurial ventures within spatially bounded microgeographies. In this paper, we focus on the University of North Carolina, where actors from the business school helped build a unique web of hyperlocal entrepreneurial supports that reinforced core educational and research missions but also culminated in proximate university business incubators. We examine how this programmatic changes correspond to a marked increase in entrepreneurial intensity as well as ageographic tightening of firms in and around the campus. Yet we also find evidence for an additional effect, namely an earlier launch of entrepreneurial firms based on less-tested technologies. The results speak to the power of institutional actors in shaping entrepreneurial activities while raising broader questions about the impact of university programming on regional industry and innovation.

**KEYWORDS**

Microgeography; bioscience; entrepreneurship; academic entrepreneurship; innovation

1. Introduction

Institutional support is essential for regional entrepreneurship. But questions remain about the appropriate scale of institutional intervention and the resulting effects on entrepreneurial decision-making (Block 2008; Schrank and Whitford 2009; Feldman and Lowe 2017). Within regions, a select group of institutional supports can be classified as hyperlocal microgeographic – in so far as their entrepreneurial influence is highly concentrated within a neatly bounded geographic sub-space (i.e., a microgeography). From incubators and co-working spaces to accelerators and innovation districts, these localised supports aim to both place entrepreneurial ventures on successful paths while funnelling them within spatially bounded microgeographies, in turn, shaping and reshaping the innovation landscape. As cities – and especially neighbourhoods or specialised districts within them – seek to promote a robust innovation economy, they are increasingly investing in localised institutional supports with the goal of intensifying innovation-enhancing interaction and related entrepreneurial activities. The resulting spatial configurations speak to the power of institutional actors in shaping small-scale innovative geographies, but also raise broader
questions about the effects these institutions have on entrepreneurial decisions and behaviour.

Scholars of economic development and geography have begun to critically evaluate the role hyperlocal institutional supports play in the entrepreneurial experience (Mack and Credit 2016; Clayton, Feldman, and Lowe 2018). We extend this nascent field by considering how universities actively shape the microgeography of entrepreneurial activities within their more immediate surroundings. Universities are well positioned to act as hyperlocal – or microgeographic – institutional anchors. While they have long supported regional economic development by fostering innovation through investments in education and research (Luger and Goldstein 1997; Goldstein and Drucker 2006; Etzkowitz 2003), their intensified commitment to entrepreneurial development means they can also act as integrating magnets, drawing in and motivating entrepreneurial actors and activities. Recent research on entrepreneurial microgeographies has primarily focused on localised institutions that, from day one, start with an explicit and intentional entrepreneurial mission (Mian, Lamine, and Fayolle 2016; Clark, Huang, and Walsh 2010). Yet, established institutions, including prominent research universities, can also re-evaluate existing missions to increase entrepreneurial influence and impact. By documenting this transformation, we gain insights into how changing institutional practices influence the visibility, prominence and performance of affiliated entrepreneurial. Equally, we can draw lessons to inform similar strategies by other established institutions, including sharing cautionary details of the unanticipated effects such changes might have on the timing and intensity of regional entrepreneurship.

In this paper, we examine the University of North Carolina at Chapel Hill’s (UNC) increased commitment to entrepreneurial development, and the corresponding impact on the geography and characteristics of life science entrepreneurial firms founded by UNC employees between 1990 and 2012. UNC is an especially compelling case. Compared to other prominent research universities, UNC was notably delayed in supporting entrepreneurship thanks in part to a protracted ethical debate over its academic purpose and value (Goble 2013; Donegan 2019). But this initial resistance provided an opportunity for multiple, decentralised nodes of entrepreneurial support to emerge within UNC – some of which set up a variety of sanctioned entrepreneurial spaces and incubators. Many of these supports target life sciences firms, giving us an opportunity to observe how deepening institutional supports affect entrepreneurial decisions, practices and geographies over time.

Using both a series of interviews and a novel dataset on start-up firms founded by academic entrepreneurs from UNC (Feldman and Lowe 2015), we trace the emergence of this unique web of entrepreneurial supports at UNC, ultimately showing how actors concerned with reinforcing UNC’s core educational and research missions were the driving force behind programming. We ultimately focus on a key programming component: the creation of university-sanctioned, life sciences-oriented incubators, both on campus and in close off-campus buildings. We examine these spaces as a form of ‘radical co-location’ (Olson et al. 2002), placing research, teaching, and commercial science in tighter quarters, before tracing how these spaces influenced micro-level decisions around academic life sciences entrepreneurship.

Before describing our data sources and findings in greater detail, we first review the literature on university entrepreneurship. We then outline our main findings: that UNC’s
increased commitment to academic entrepreneurship corresponds to three notable shifts in entrepreneurial practice. First, we observe an upward trend in new life science establishments founded by UNC entrepreneurs. Second, we find a growing spatial concentration of UNC’s entrepreneurial firms around the university – a tightening microgeography, physically separating them from other regional life sciences firms. Third, we find an unanticipated consequence: UNC life science start-ups are now more likely to launch with earlier phase technology compared to previous counterparts. We suggest these trends are interconnected and reinforcing; firms launching earlier and with less developed technologies become increasingly dependent on support from their home institution. We conclude with reflections on how UNC’s programming may impact the larger Research Triangle region, either directly by inserting breaks in micro-geographic patterns of knowledge sharing and interaction (Kabo et al. 2014; Gieryn 2002), or indirectly by disrupting critical social networks that underpin regional clusters (Whittington, Owen-Smith, and Powell 2009).

2. The entrepreneurial university

American universities have greatly expanded their commitment to entrepreneurship in recent decades. Entrepreneurial-supporting universities, like universities that supported technology commercialisation more broadly, were once limited to an elite group of prominent research institutions (Bradley, Hayter, and Link 2013; Etzkowitz 2003; Wright, Birley, and Mosey 2004; Siegel and Wright 2015; Rothaermel, Agung, and Jiang 2007). Today, many more universities actively promote academic entrepreneurship and seek to foster the entrepreneurial ‘spirit’ throughout campus, relying on a broad array of in-house entrepreneurial champions and channels by using a dense network of complementary and reinforcing institutional supports (Rose and Patterson 2016; Bradley, Hayter, and Link 2013; Etzkowitz 2003; Wright, Birley, and Mosey 2004). This institutional complexity stands in stark contrast to the story set out in the early literature on academic technology transfer. That literature, based largely on the aforementioned select group of elite institutions, described a process that was highly centralised around the university’s technology transfer offices (TTO). The linear process of technology commercialisation and transfer was best described as a pipeline, beginning with a faculty scientist making a laboratory discovery and disclosing it to a technology transfer office, at which point the office would make decisions relating to patents and marketing before ultimately licencing it to either an existing firm or a start-up. The extent to which university scientists produced and disclosed innovative technologies was a focus of the early literature, which also emphasised internal campus culture, the strength and organisational structure of the TTO, and the technology transfer professionals housed in that office (Bercovitz et al. 2001; Bradley, Hayter, and Link 2013; Rothaermel, Agung, and Jiang 2007).

Early TTOs prioritised licencing to large corporations in part because licencing was thought to provide guaranteed income streams (Wright, Birley, and Mosey 2004; Siegel and Wright 2015). Over time, the technology transfer model expanded to emphasise commercialisation opportunities through the creation of university-affiliated start-up firms. Yet, this entrepreneurial reprioritization – and the institutional expansion that arose alongside it – was not inevitable (Lowe and Feldman 2008). Siegel and Wright (2015) point to three overarching external forces that led universities to shift priorities towards entrepreneurship, including increased competition among elite peer institutions,
pressure to please alumni donors who favour business formation, and the rise of government funding to support entrepreneurial activities, most notably the federally funded SBIR/STTR programmes (Lanahan and Feldman 2015). Internal financial pressures have been important, too, as universities now view entrepreneurial spin-offs as a viable and complementary high risk, high reward option (Siegel, Veugelers, and Wright 2007).

Non-revenue motivations are also an important factor in this institutional shift from licencing to entrepreneurial prioritisation. Etzkowitz (2003), for example, links university support for entrepreneurship to increased recognition that entrepreneurial skills could be nurtured and taught on-campus – thus linking entrepreneurship to the university’s core teaching function, and a centring of entrepreneurial activity around the campus. Universities have created new courses with the goal of helping students and faculty develop entrepreneurial awareness and skillsets. The end result is that entrepreneurship has become infused into the broader curriculum, both through new university programmes, offices, and initiatives but also via courses, minors, and majors offered by existing departments or schools (e.g. economics, business; Wright, Birley, and Mosey 2004; Wright et al. 2009).

Campus support for entrepreneurship has also grown as universities have come to frame entrepreneurship as a means to strengthen institutional commitments to advancing the broader public good (Lester and Piore 2004). Beyond expanding support for entrepreneurship to offices of outreach and engagement, that broader goal has led to a rethinking of who entrepreneurs are and what their companies should focus on. Campus venture programmes once limited to tenured faculty in the sciences developing patentable technologies are now open to students, post-doctoral fellows, staff, and even alumni. And universities are encouraging more participation by expanding the umbrella of what counts as ‘useful’ entrepreneurship to elevate ‘mission-driven’ social ventures as equally important to those developing patentable technologies or driven by narrower profit-motives (Shah and Pahnke 2014).

Yet, universities have also leveraged support for academic entrepreneurship to address long-standing goals of redeveloping surrounding neighbourhoods perceived as distressed or uninviting to the university community. Research universities have long created research parks to promote large-scale industrial development (Luger and Goldstein 1991), and separately the physical redevelopment of surrounding neighbourhoods to achieve a variety of non-industrial goals (e.g., student recruitment, safety, improving relationships between campuses and surrounding jurisdictions; O’Mara 2012; Ehlenz 2016). The recent uptick in innovation districts across the country is just one example of how these two goals can be merged (Drucker and Kass 2015), with districts both housing innovative entrepreneurial companies and developing surrounding parcels to meet university needs. For public universities, in particular, the purposeful embedding of entrepreneurship can be linked to pressure from state and municipal governments to keep benefits of economic development local. The globalisation of scientific knowledge has increased pressure on university cities to retain jobs, income and prestige associated with local universities (Addie, Keil, and Olds 2015). While the location of growth through licenced technologies is difficult to predict, academic entrepreneurs are more likely to found companies close to their home university (Dahl and Sorenson 2009) and remain invested in the region over time. In this context, direct promotion of academic entrepreneurship, including the creation of incubators or other dedicated spaces, can signal
a public university’s commitment to supporting their local economy and with it, garner favour from state legislators and other policy-makers (Donegan 2019).

As this review indicates, academic entrepreneurship is not simply a means for universities to generate immediate revenue through additional technology licencing – it is more closely tethered to a broader set of university concerns ranging from teaching and land development to local economic development and political standing. Taken together, the result is a thorough reorienting of how the university thinks about the technology development process and academic entrepreneurship in particular (Bradley, Hayter, and Link 2013; Siegel and Wright 2015) – and a clear interest in retaining the university as a central player, both socially and geographically, in the entrepreneurial region. And it is not just top-level administrators that are making a stronger entrepreneurial case. Siegel and Wright (2015) have noted the emergence of a diverse array of influential ‘stakeholders’ that enable American universities to expand their entrepreneurial reach. Drawn not just from technology transfer offices but also from business, medical and other professional schools, as well as university economic and community development offices, these actors have the potential time and to shape and reshape on- and near-campus entrepreneurial activities and priorities (Lowe and Gertler 2009).

Significant scholarly attention has focused on whether university supports have created more – and more productive – firms. Less explored is how universities’ ever-expanding entrepreneurial pushes reshape micro-level decisions of academic-affiliated firms and those of other firms in the region. A critical lever of influence is the allocation of space – including university business incubators and related facilities use agreements – in which academic firms are nurtured and developed. Yet interactions within these spaces can alter the organisational and technological calculus of nascent entrepreneurs. In writing about Cornell’s Biotechnology Building, Gieryn (2002) observes that creating a physical space to centre scientific activity on campus ‘becomes the architectural means through which this reconfigured science gets “built-in” and stabilized,’ even if ‘impermanently’ (p. 36). Following this, campus entrepreneurial spaces are the structural representation and reinforcement of changing campus entrepreneurial logics. They not only anchor and promote a reinforcing web of entrepreneurial supports and programmes but also normalise a blurring of lines between university functions of research, commercialisation, teaching, and nearby land and economic development. As universities strengthen their commitment to fostering a broad array of entrepreneurial spin-offs and link emergent physical spaces to an evolving set of wrap-around supports, there is even greater potential to affect formative entrepreneurial decisions – including fundamentals such as when to launch a firm, where to locate it and whether or not it should even exist. And these decisions not only reinforce the entrepreneurial mission and identity of the university, but they can also alter the long-term technological landscape of the surrounding region.

Beyond institutionalising practices, these spaces have the opportunity to shape network ties and knowledge spillovers in a region. Scholars have long noted the importance of local network ties for sharing tacit knowledge and resources (Whittington, Owen-Smith, and Powell 2009) – and the fact that such micro-geographic patterns of interaction as influenced by new spaces for entrepreneurial companies may alter the types of social interactions upon which knowledge production is based (Kabo et al. 2014; Gieryn 2002). With this possibility in mind, we turn to our case study of the University of North Carolina at Chapel Hill (UNC).
3. Data sources and empirical strategy

We use a mix of data sources and methodologies to capture UNC’s changing institutional approach towards entrepreneurial ventures and resulting effects on entrepreneurial decision-making. Our main focus is on life sciences entrepreneurial ventures founded by at least one UNC faculty entrepreneur (from here, 'UNC-parented firms') between 1990 and 2012. This time period begins before UNC had a campus-based technology transfer office and ends after UNC had deployed wide-ranging entrepreneurial supports. Life science firms present an ideal case for a longitudinal analysis. The industry has high fixed costs, an uncertain and long-term payoff structure, haphazard funding, and a frequent need for specialised lab space that is both expensive and difficult to find (Pisano 2006); start-up firms are especially sensitive to institutional supports and entrepreneurial programming. Life science was also among UNC’s target industries when it first developed its technology transfer programme, and the industry remains central to UNC’s programming. For example, Carolina Kickstart, one of UNC’s best-known entrepreneurial support programmes, focuses primarily on life sciences firms. Finally, the life sciences industry in the Research Triangle region is among the country’s largest (Feldman and Lowe 2011; Feser, Sweeney, and Renski 2005). While early scholarship focused on the prominence of the region’s satellite branch plants, recent scholarship emphasises the growing entrepreneurial environment (Lowe and Feldman 2018; Luger and Goldstein 1991). As a result, regional life science firms – including UNC-parented firms – should have increased access to a growing set of firms in the region and the robust institutional structures that have emerged to support the industry (e.g., like the North Carolina Biotechnology Centre, numerous incubators and accelerators). These broader sets of external supports create an environment where UNC-parented firms have both on- and off-campus options for support, meaning that there is no a priori assumption that UNC-parented firms would deepen their reliance on UNC.

To document the rich institutional history and transformation at UNC, we interviewed seven key actors in the region: four current or former UNC employees and three individuals with no university ties, but who were otherwise considered experts on the UNC’s entrepreneurial history. Expert interviews were recorded and transcribed or summarised in detail. We also draw on archival materials, including published histories or internal campus documents, to contextualise and confirm interview findings. Related to this, we reviewed a variety of research and strategy reports that map UNC’s entrepreneurial ecosystem and document its evolution.

To capture the effects of this institutional change on entrepreneurial decision-making, we rely on three firm-level data sources. The first source is the PLACE: Research Triangle database (PLACE), a propriety database with records of technology-based firms in North Carolina’s Research Triangle Park region from 1960 to present, including the universe of known recent entrepreneurial firms. Information in the database draws from a variety of public and proprietary sources, including LinkedIn, incubator tenant lists, university technology transfer offices, company websites, Secretary of State filings, newspaper articles, etc. (see Feldman and Lowe 2015 for a discussion of the database and content validation guidelines). The database includes information on entry type, distinguishing entrepreneurial firms from other types of technology-based companies or establishments (e.g. branch plants, joint partnerships). Each firm-specific record also includes information on the first known location for a firm or establishment, including whether they initially launched
within or outside the North Carolina Research Triangle region. The date established field contains a calendar so that users can enter the specific date that an establishment opened. The database company description field provides detailed information on company history, business activities, product and product development, company partnerships, etc. Each entry also provides extensive founder information, including educational and work history information. For our analysis, we were most interested in companies with at least one founder with a work history at UNC; these are UNC-parented firms. We use these data to identify the number of UNC-parented firms established over time, a key firm-level outcome in the paper.

Using these fields, we narrowed our list to include all life science companies founded in the Research Triangle region between 1990 and 2012. We next drew data from the North Carolina file of the National Establishment Time Series (the NETS), a private database developed by Walls and Associates based on data from Dun & Bradstreet. The NETS includes each establishment’s yearly street addresses, allowing us to determine the first address for all entrepreneurial firms in our sample. To match our sample of PLACE firms to their records in the NETS, we used an algorithm in SAS based on SAS’s COMPGED function, which determines the Levenshtein distance between two string variables. For each firm in our sample, the algorithm calculated the distance between the firm’s name and each company name in the North Carolina NETS file. We limited the algorithm’s output to the 20 ‘best’ NETS companies – that is, the 20 firm names in the NETS file with the lowest distance values to each sample firm from the PLACE database. Two researchers independently reviewed the NETS options for each sample firm, using double coding to select the correct match.

After merging the PLACE and NETS data, we then conducted semi-structured interviews with life science entrepreneurs. We selected firms using a stratified sampling approach, ultimately drawing 12 entrepreneurs that founded firms between 1990 and 2012. Additionally, we conducted interviews with life science founders in the region that lacked a formal UNC affiliation. This included several firms with founders with work connections at other regional universities, including Duke University (Duke) and North Carolina State University (NCSU). These additional interviews offered a comparative institutional perspective but equally helped us identify what is particularly unique to the UNC entrepreneurial experience.

3.1. Methodology

A key formative decision for a founder is where to locate their company. Given that most entrepreneurs will remain within their home region (Dahl and Sorenson 2009), that decision can entail the choice of locating within a dedicated entrepreneurial facility or a general purpose building. For academic entrepreneurs with a strong cushion of university programming beneath them, a third option – university business incubators –

1The database’s thirteen-country Triangle region reflects the state planning region. Since all but five of entrepreneurial companies were founded in the core three counties of Durham, Orange, and Wake, we chose to focus on this core and exclude those five companies.
2We relied on NETS data licenced by UNC. The NETS data can also be purchased directly from Walls and Associates.
3See Staum (2007) for a discussion fuzzy matching using COMPGED in SAS.
4For a longer discussion of this process, see Donegan (2016). Our matching algorithm is available upon request.
may be available. UNC’s provision of business incubators remains a cornerstone of their system of entrepreneurial supports. Starting in roughly 2009, and as will be covered in Section 4 below, UNC rolled out a series of both on and off-campus incubation options. Despite their varied nature, the incubators share one common feature: they were all either on UNC’s campus or nearby. Their establishment in 2009 allows for a natural break in the 1990–2012 study period. Entrepreneurial reliance on this type of support should result in the average UNC firm established between 2009 and 2012 being closer to campus when compared to UNC firms before 2009.

Institutional support is not limited to regional universities, as broader sets of institutional actors and interventions affect the range of entrepreneurial activities in a region — including where firms first locate. While UNC was developing locational options for UNC-parented firms, numerous private incubators, accelerators, and life science-oriented office buildings opened in the region. Thus, while an observed shift among UNC-parented firms could be the result of firms locating in the university’s incubators, such a shift could also reflect locations in these other spaces. This makes it difficult for us to attribute an inward shift to UNC’s incubation policies alone. To address the potential conflationary effect of these non-university spaces, we include a control group of firms comprised of non-university-parented firms — or firms founded by individuals with no ties to a university in the region. These firms can locate in private spaces but cannot locate in UNC incubators. Using a difference-in-differences approach we compare the spatial shift among UNC-parented firms to the shift among these control non-university-parented firms.

We do not intend for this group of firms to be viewed as ‘matches’ for our set of UNC-parented firms. Just as UNC-parented firms reflect the universe of life science firms emerging from UNC in the study period, our control group represents the universe of non-university-parented firms. Nor do we argue that UNC-parented and non-UNC-parented firms necessarily occupy identical stages in the life sciences industry, with identical needs for spaces. On the contrary, it is plausible that UNC developed incubation policies with its own firms in mind, and as a result, tailored university-affiliated spaces to fit specific needs among UNC-parented firms. While a statistically significant shift inwards towards UNC among UNC-parented firms — and the lack of a significant trend amongst non-university-parented firms — suggests that this form of entrepreneurial support has been critical for UNC-parented firms, we also look to our qualitative data to validate the result.

We identified each company’s initial location using the Address First file in the NETS, which provides the establishment’s first known address. Given that study firms are in the biosciences, we used a centroid for the UNC’s hospital complex in Chapel Hill as a proxy for UNC’s location. We measured the distance between each firm’s initial address and UNC’s location, in feet. All geocoding was done using batch geocoding services from Texas A&M Geoservices.

Initial tests showed the distances of both the UNC-parented and non-university-parented firms are not normally distributed and are instead right-skewed. We used Wilcoxon Mann Whitney tests to establish if there were differences between the groups

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5 UNC is not the only university in the region to have expanded entrepreneurial programming during the study period, and including firms with links to either Duke and/or NCSU might introduce bias into the control group.

6 Available at http://geoservices.tamu.edu/Services/Geocode/.
of firms, since a two-sample t-test requires normal interval data. Using Wilcoxon Mann Whitney, we can test for significance in the relationship between an ordinal independent variable (e.g., a ‘0’ for UNC-parented firms founded between 1990 and 2008, and a ‘1’ for UNC-parented firms founded between 2009 and 2012) and a non-normal, interval dependent variable (distance in feet from UNC). Since the test can only accommodate two groups of firms at a time, we ran the test four separate times.

4. Entrepreneurial supports at UNC

UNC’s modern technology development system is inseparable from both its latecomer status to technology transfer and initial reticence in supporting the commercialisation of university research. A scientist on UNC’s campus in the 1980s characterised UNC as being ‘hostile to commercialisation’ (UNC Staff Member A, 26 January 2016), and in the early 1980s, technology transfer at all three of the Research Triangle Park region’s research-intensive universities – UNC, Duke and NCSU – lagged behind their national peers (Donegan and Feldman 2019; Bercovitz et al. 2001). In response, in 1983 UNC-system President William Friday created a technology transfer committee. Their commissioned study determined that the best technology transfer system would be a regional technology transfer institute, and in 1986 the presidents of Duke, UNC, and NCSU decided to form a joint licencing group. In 1988, the Triangle University Licencing Consortium – or TULCO, as it came to be known – opened its doors (Goble 2013).

Despite UNC’s formal entry into technology transfer, a former UNC employee commented that, ‘UNC was . . . coming to grips with what it meant to be in the tech transfer business . . . [and they] continued still to struggle, culturally [and] philosophically, with just how deeply involved they wanted to be,’ (UNC Staff Member B, 18 February 2016). Early entrepreneurial experiences reflected ambivalence towards commercialisation among UNC faculty and staff, particularly as it related to entrepreneurship. At the time, UNC had what Goble (2013) describes as ‘a non-existent internal entrepreneurial culture,’ (p. 111). As one illustration, a staff member whose campus laboratory was conducting contract research with commercial firms recalled a rather tense exchange in the early 1990s with a high-ranking university administrator. The administrator informed the professor in charge of the lab that the on-campus work must cease entirely and demanded they stop using university office space for this work. The founder obliged and moved the company off-campus, though lacking formal institutional support they ultimately chose to sell the business to a larger corporation (UNC Entrepreneur A, 19 January 2016). Critical here was that the firm had developed modelling techniques that outside companies were willing to pay contracts for – but that relied on publicly available software, meaning UNC was limited in its ability to licence a technology.

The approach that UNC took towards this company – essentially casting it aside, given difficulties in licencing a technology – was not inconsistent with UNC’s priorities. A UNC staff member noted that throughout the 1990s, UNC ‘preferred to have the innovation licenced as technology to an outside industry.’ But in the process, they also ‘actively discouraged entrepreneurship,’ (UNC Staff Member C, as quoted in Stern 2013, p. 5). A faculty member with entrepreneurial aspirations noted that in the 1990s UNC’s Office of Technology Development (OTD, as UNC’s TTO is known) was ‘obstructive and
hard to deal with at the time [and] trying to make as much money for the university as they could’ (UNC Entrepreneur B, 28 January 2016). As Siegel and Wright (2015) note, UNC was not unique during this period. Many early technology transfer offices devoted little attention to university start-ups, as such a focus ‘would divert attention from potentially lucrative “block-buster” patent licensing deals,’ (p. 582).

Yet even as entrepreneurs reported having difficult experiences transferring technology off-campus, nascent entrepreneurial programming had begun to emerge at UNC. Critically, however, it was not under the purview of UNC’s OTD. Rather, entrepreneurial support initially centred around UNC’s Kenan-Flagler Business School (Kenan-Flagler). In 1986 – the year UNC, Duke and NCSU formed TULCO – Kenan-Flagler formed the Kenan Institute, a centre dedicated to economic development and business-related research. In 1992, Kenan-Flagler established the Centre of Entrepreneurial Studies as an explicit move to ‘formalize’ the school’s interest in entrepreneurship education and research (Feldman et al. 2009).

Early efforts by Kenan-Flagler to support entrepreneurship complicated the relationship between research commercialisation and university revenue. The Business School initially sought to sidestep UNC’s formal but conflicted relationship with technology transfer. Staff at Kenan-Flagler acknowledged the limitations with UNC’s traditional revenue-focused model:

[often … when [UNC] faculty sold innovations and intellectual property to private firms, the ideas would simply be shelved, in many cases because the firms who bought them could not identify (or did not want to prioritize finding) a market opportunity to capitalize on the innovation . . . . With much of UNC’s intellectual property never making it to market, the university’s investments in research . . . were failing to create the broader economic and social impacts [that were seen as] part of the university’s mandate. (p. 6; italics added)]

Kenan-Flagler recognised entrepreneurial development as a means to enhance the impact of university research but equally sought to forge stronger connections to the traditional public university mission to educate and promote broader economic and social impacts (Feller 2004; Goldstein 2010; Goldstein, Bergman, and Maier 2013; Luger and Goldstein 1997).

Linking first to UNC’s core educational mission, Kenan-Flagler rolled out a new, semester-long course in 1999, now known as Launching the Venture. The course contains four modules designed to help enrolled students, faculty, and staff gain the business skills needed to create a new company, including writing business plans, raising funds, and connecting to local industry and strategic partners. An overarching goal is for academics to learn the skills necessary to retain complete control over their entrepreneurial venture – as opposed to limiting that role to ‘scientific founder’ while relying on a ‘surrogate entrepreneur’ from outside the academy to manage the ‘firm’s’ day-to-day operations (Franklin, Wright, and Lockett 2001).

Launching the Venture was thus critical in setting the tone of UNC’s enduring model of non-surrogate entrepreneurship. The course also marked an early, visible success for Kenan-Flagler’s programming – in addition to faculty and students, three university deans enrolled in its first year alone. Yet the increasing prominence of Kenan-Flagler’s entrepreneurial programming did not occur without conflict. A staff member at Kenan-Flagler reported that, by the late 1990s, there was an ‘adversarial relationship between Launching the Venture and
[OTD],’ (UNC Staff Member C, as cited in Stern 2013, p. 7). Nonetheless, by 2004 Kenan-Flagler’s Launching the Venture-based programming had ‘primed’ UNC to compete nationally for a Kauffman Campuses Initiative grant (Feldman et al. 2009, p. 25). As a result, the Kenan Institute was positioned as ‘a natural host for the initiative’ when UNC was selected as one of the eight pilot universities (Feldman et al. 2009, p. 27).

The resulting effort – the Carolina Entrepreneurship Initiative (CEI) – drew on the strength of what the university did well: ‘education, research, and venture creation,’ (Feldman et al. 2009, p. 27). The touted educational portion of CEI included an undergraduate entrepreneurship minor and a graduate certificate in entrepreneurship; research programming supported seminars and faculty fellowships. Programmatic supports for venture creation subsumed Launching the Venture and added supports like the Carolina Challenge (a student business plan competition, with a $50,000 prize; Feldman et al. 2009). UNC’s selection came with a $3.5 million grant from the Ewing Marion Kauffman Foundation; when combined with a 2:1 match from UNC, the Carolina Entrepreneurship Initiative (CEI) emerged as a 5-year, $10.5 million entrepreneurial programming force, based in Kenan-Flagler.

In writing about the CEI in a UNC-sponsored publication, Feldman et al. (2009) remarked that ‘[t]here is something for everyone’ in the CEI programming (p. 27). This inclusive programming approach reflects the long-established holistic approach that Kenan-Flagler and its Kenan Institute had taken with early entrepreneurial programming, emphasising education and basic research before venture creation. Importantly, the CEI was not designed to centralise entrepreneurial programming on UNC’s campus. Instead, CEI funding and framework aided entrepreneurial advocates in engaging other university stakeholders, in turn securing broad support to create a diffused, yet reinforcing system of entrepreneurial programming. In this regard, the CEI provided a means to reorient UNC’s Office of Technology Development in ways to ensure entrepreneurship became central to university licencing (UNC Staff Member C, as cited in Stern 2013). UNC’s OTD now streamlines technology licencing to prioritise a faculty member’s use of her own technology to form a company. Reflecting on this institutional change, one UNC employee stressed that ‘UNC’s policies are “faculty friendly,”’ insofar as they allow faculty members to participate in the spinoff of firms with a university licence of the technology they invent and become involved in an appropriate role in the venture moving forward’ (UNC Staff Member C, 22 June 2016).

In addition to this important ‘cultural’ change, Kenan-Flagler through CEI has also shaped UNC’s model of entrepreneurial incubation. Here too we find evidence of a flexible and adaptive institutional strategy, such that incubation of UNC-affiliated entrepreneurial companies is neither limited to one form, nor confined in time and space. Starting in 2009, entrepreneurial founders at UNC were given a range of options for where to locate a new company. On campus, UNC repurposed existing Facilities Use Agreement (FUAs) to allow entrepreneurial firms to inexpensively use existing campus laboratory space and equipment. FUAs have been used to convert small spaces within UNC campus buildings for multiple companies, a move UNC considers ’dedicated incubation.’ But FUAs have also supported ‘ad hoc’ incubation practices (Rose and Patterson 2016), whereby temporary space is carved out in a more piecemeal fashion, even by allocating a portion of a desk or scientific ’bench’ within an established campus research laboratory. A third option is for entrepreneurial firms to locate off-campus
within university-managed or owned facilities. Carolina Launchpad is a notable example of an off-campus incubator, opening in 2009 in leased space roughly four miles from UNC’s main campus in Chapel Hill before moving closer to campus. Both on-campus and off-campus incubators were developed with direct, ongoing consultation with staff at Kenan-Flagler.  

4.1. Shifting microgeographies

UNC’s transition from a university with an underdeveloped technology transfer programme to one with a holistic set of reinforcing supportive institutions has had profound influences on UNC-parented start-ups. There has been a marked increase in the number of UNC-parented companies over time. Table 1 includes the number of UNC-parented and non-university-parented firms recorded in the 1990–2008 and 2009–2012 time periods – with 2009 offering a natural break given the introduction of campus incubation space. Between 1990 and 2008, UNC faculty members created roughly 3 firms per year, for a total of 56 firms over an 18-year period. In contrast, during a short three-year span from 2009 to 2012, 26 new firms were launched, amounting to close to 7 new firms per year.  

The recent relative ease of receiving a licence from UNC has been critical to increasing UNC-parented firms. An entrepreneur of a company founded in 2003 reported that ‘the biggest thing you should emphasise [at an investor conference] was that you got a licence out of the University of North Carolina at Chapel Hill,’ (UNC Entrepreneur C, 20 April 2016), reflecting both the difficulty and length of time it took to get a licence from UNC for an entrepreneurial firm. In contrast, an entrepreneur of a firm founded in 2010 reported that OTD had been a ‘helpful resource,’ and that staff had helped find complementary co-founders (UNC Entrepreneur D, 18 August 2014).

UNC’s intensified commitment to entrepreneurship has also generated geographic effects. In this case, it is useful to compare UNC-parented life science firms to their non-university-parented counterparts. Admittedly, UNC-parented firms in life sciences have always been located closer to UNC’s campus compared to non-university-parented life science firms. In the 1990–2008 time period, and as seen in Table 2, the average UNC-parented firm was 27,117 feet closer to UNC than an average non-university-parented firm (75,141 vs 48,024 feet, respectively), and in the 2009–2012 time period, the difference between average firms from each group rose to 37,272 feet (69,668 vs 32,296 feet, respectively). Moreover, the difference in

Table 1. Descriptive statistics, entrepreneurial bioscience firms and distance from UNC (in feet).

<table>
<thead>
<tr>
<th>Firm Parentage</th>
<th>Study period</th>
<th>Firms</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNC</td>
<td>1990-2008</td>
<td>56</td>
<td>48,024</td>
<td>32,415</td>
<td>2,470</td>
<td>136,745</td>
</tr>
<tr>
<td></td>
<td>2009-2012</td>
<td>26</td>
<td>32,296</td>
<td>41,089</td>
<td>6,181</td>
<td>162,354</td>
</tr>
<tr>
<td>Non-university</td>
<td>1990-2008</td>
<td>218</td>
<td>75,141</td>
<td>36,349</td>
<td>6,420</td>
<td>159,875</td>
</tr>
<tr>
<td></td>
<td>2009-2012</td>
<td>23</td>
<td>69,668</td>
<td>38,738</td>
<td>8,796</td>
<td>154,563</td>
</tr>
</tbody>
</table>

7Reflecting the varied nature of UNC’s entrepreneurial supports, facilities and programming vary significantly, making generalisations about programming difficult (Clayton, Feldman, and Lowe 2018).

8There were 218 non-university-parented firms between 1990–2008 compared to only 23 between 2009–2012. This observed decline reflects a broader regional industrial event in the 1990 to 2008 time period: a series of mergers, particularly at GlaxoSmithKline. Associated layoffs and voluntary departures included generous severance packages and mobile patents that spawned a large number of non-university-parented firms. Those events were not replicated in the 2009–2012 time period. See Feldman and Lowe (2015) for a full discussion.
distances from UNC was statistically significant in each of the two time periods. As Table 3 shows, however, between the 1990–2008 and 2009–2012 time periods there is a statistically significant difference in the distance of UNC-parented firms to UNC (48,024 vs. 32,296 feet, respectively). Yet, there is no corresponding statistically significant change in the non-university-parented firms’ average distance from UNC (75,141 vs 69,668 feet, respectively). In other words, while UNC-parented firms shifted inwards to UNC by a statistically significant amount, non-university-parented firms did not.

Figures 1 and 2 contain box plots of the distance from UNC to UNC-parented and non-university-parented firms, respectively, in both time periods. The boxes contain a median line and the range from the 25th to 50th percentiles, excluding outliers; the whiskers contain the

| Study period | Mean Distance by Firm Parentage | Wilcoxon Two-Sample Statistic | Two-sided Pr > |Z|
|--------------|---------------------------------|-------------------------------|----------------|
| 1990-2008    | Non-university | 75,141 | 48,024 | −5.0348 | <.0001 |
|              | UNC             | 69,668 | 32,296 | 3.4559 | 0.0005 |

Table 3. Within-group test statistics, measuring the difference in distance (feet) to UNC.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>UNC</td>
<td>48,024</td>
<td>32,296</td>
<td>−3.0146</td>
<td>0.0034</td>
</tr>
<tr>
<td>Non-university</td>
<td>75,141</td>
<td>69,668</td>
<td>−0.7327</td>
<td>0.4644</td>
</tr>
</tbody>
</table>

Figure 1. Distance of UNC-parented firms to UNC, in feet, with medians, quartiles, and outliers.
The remainder of the non-outlier range. The proximity of UNC-parented firms to the university is clear, as is the tightening around UNC between the time periods; the 75th percentile of firms in the 2009–2012 time period, for example, is well below the 1990–2008 median. The distance range between the 25th and 75th percentiles diminishes dramatically, as does the entire range (excluding outliers). While UNC-parented outliers in the later time period appear further away than outliers in the early period, these likely reflect aberrations in founding structure or space; one firm, for example, comprised of a team of NCSU faculty and just one UNC faculty member decided to locate closer to NCSU. It is clear from the plots that non-outlier firms’ inward shifts drove the statistical conclusion, as outliers in the latter period are even further away. The plots in Figure 2, in contrast, display very little movement between time periods.

In many cases, the availability of incubation space helped draw UNC-parented firms closer to campus. UNC staff have long believed that proximate incubation options were necessary for academic entrepreneurs, and in recent years have dedicated considerable effort to constructing facilities for life science entrepreneurs in particular (Goldstein and Glaser 2012; Donegan 2019). Given the dual-career nature of academic entrepreneurs (Lacetera 2009; Meyer 2003), this subset may find proximity to UNC helpful in merging their academic and entrepreneurial careers.

Yet, decisions to locate in UNC’s incubators also reflect an increasing dependency on UNC’s entrepreneurial resources, which speaks to a third observed trend: more recent UNC-parented companies are based on younger, less-tested technologies. Through our interviews and review of OTD data, we find an increasing number of UNC firms launch well before patentable technology is on the horizon. Trends associated with Launching the Venture,
which remains a cornerstone of UNC’s entrepreneurial programming even after the CEI formally ended, reinforce this. Enrolled Launching the Venture teams must commit to founding their company within 18 months, yet teams are increasingly drawn from the student competitions that remain from CEI programming (Feldman et al. 2009; Stern 2013).

Two UNC-parented firms, founded in 2010 and 2011, exemplify this reliance on early technology. The first was established when two professors and a PhD student co-founded a life sciences company soon after taking Launching the Venture. Still, 4 years after the company’s formation, the company’s technology remains ‘in the developmental process,’ (UNC Entrepreneur F, 22 July 2014). The second company also included a student founder; when, as a master’s student, the student won a departmental design competition, their professor encouraged them to enrol in Launching the Venture and found a company. As founders, the student and their professor applied for a patent three full years after establishing the company (UNC Entrepreneur G, 23 July 2014). Neither company F or G have since added patents. A technology transfer professional in North Carolina compared UNC to strong private universities and commented that:

The things coming out of Chapel Hill … may be spinning out too early … Venture capitalists [are saying] ‘I don’t know that you’ve tested this properly, and I view it as a riskier investment, so I’m not as likely to invest in you because you’ve not done the building of the infrastructure, the validation testing, the things to ensure that you’ll be successful.’ (Outside expert A February 4 2016)

In contrast, one of the two non-university-parented companies founded in 2011 had been awarded a patent by 2014; the other had three patents awarded by 2018.

Other elements of UNC’s entrepreneurial support system also encourage early company formation. The fragmented nature of UNC’s programming means smaller pots of money are spread across campus departments and initiatives. This results in a model with small amounts of ‘award’ funding going to numerous companies as opposed to much larger amounts of translational funding paid out to a smaller group of companies (Staff Member B 18 February 2016; Outside expert A 4 February 2016). Of the two entrepreneurs discussed in the previous paragraph, the first stated that funding from UNC ‘essentially paid [them] to start the company,’ (UNC Entrepreneur F, 22 July 2014). The second won a student competition, which included a small pot of money (UNC Entrepreneur G, 23 July 2014). Given the uncertainties inherent in technology development and the related payoff structure, these companies, which are based on less-developed technologies, may struggle to raise external funding compared to companies with technologies that have gone through additional proof-of-concept rounds (Lacetera 2009). Even for those founding teams that do have patented technology, UNC’s OTD currently aims to spin out companies in just a few months (UNC Staff Member C, 22 June 2016). While this eases the bureaucratic burden on the founding team, it also leaves them with little time to secure outside funding that would allow the firm to move off-campus. Through these practices, UNC is increasingly making visible as commercial activity technologies that would have remained in development and spun out later. Yet by spinning out early, these companies may have little choice but to locate within university-sanctioned spaces.
5. Implications and conclusion

In this paper, we have examined how deepening university support for entrepreneurial development has influenced university-affiliated entrepreneurial decision-making, including concentrating entrepreneurial activity within a small-scale innovative microgeography with a greater number of firms based on less-developed technology. Our institutional focus is on UNC, a pioneer in public education that nonetheless delayed committing formal support to entrepreneurship. UNC, therefore, provides a contemporary case for studying how changing attitudes and strategies within prominent academic institutions, driven by a diverse set of stakeholders, influence entrepreneurial firm formation, strategy and location. By offering a robust entrepreneurial curriculum and support network alongside affordable and sanctioned workspace to academic-affiliated entrepreneurial firms, UNC has contributed to higher growth rates in the firm formation and has encouraged nascent entrepreneurs to co-locate initially dispersed and less-visible entrepreneurial activities within increasingly centralised physical space. With this integrating step, UNC decision-makers have effectively signalled their explicit support for entrepreneurial development while simultaneously positioning UNC to extend influence over decisions related to firm formation and technology commercialisation.

This case has broader implications for how we conceptualise the contribution of universities to local and regional entrepreneurship. The growing commitment by prominent and public universities to entrepreneurial development is not without valid criticism. Slaughter and Leslie (1997) raised important questions about the normative and structural changes that result when universities actively encourage faculty and staff to launch new ventures on the basis of academic science and research. In particular, they note the chilling impact this can have on non-commercialised research and teaching activities, not only in terms of shifting priorities and diminished resource availability but also declining institutional status and influence. Furthermore, as universities become enamoured with entrepreneurship, it can alter the composition and career leanings of university personnel in ways that privilege commercialisation of science and technology over other academic goals (Owen-Smith and Powell 2001; Azoulay, Liu, and Stuart 2017). Others have added further critical voice, some placing entrepreneurial activities within a larger transformation they call academic capitalism, noting especially the conflicts of interest that can arise when academic institutions adopt corporate roles, reward structures and profit-making goals (Slaughter and Rhoades 2004). Their main concern is the potential loss of social and public value when universities engage directly in corporate and capitalist space. UNC’s own delay in supporting entrepreneurship reflects some of these very concerns (Donegan 2019).

But blanket criticism of academic entrepreneurship fails to recognise the variation in how universities manage and structure that role (Wright et al. 2009; Siegel and Wright 2015; Rothaermel, Agung, and Jiang 2007; Bradley, Hayter, and Link 2013). Furthermore, academic institutions coexist and interact with other institutions to shape entrepreneurial opportunities and decisions – with academic institutions playing pivotal roles in priority setting and technological choice. For example, Owen-Smith and Powell (2006) have noted that when academic institutions act as major institutional drivers in pioneering bioscience regions, they have helped to push entrepreneurial activity towards advancing broader social objectives, rather than simply pursuing profit motivations. In Cambridge, Massachusetts, early bioscience firms focused more intensively on treatments for orphan diseases, despite lower
anticipated profit returns. They did so with strong encouragement and support from their home academic institutions and affiliated academic networks. This stands in strong contrast to early bioscience firms in the San Francisco Bay Area which disproportionately focused on human therapeutics with larger market potential and motivated by higher returns – a distinct result shaped by stronger regional influence of venture capitalists. Lester and Piore (2004) reinforce this finding, noting the important role that academic institutions play in protecting public conversational space through which broader societal needs get promoted and privileged, even with corporate funding in the mix. In this regard, universities are not simply regional anchors of entrepreneurship. They are well-established and well-respected institutions that shape and reshape a region’s political economy (Luger and Goldstein 1997).

Still, even if academic institutions attempt to strengthen their sphere of influence by anchoring entrepreneurial activities in place, it is important to recognise both the presence of other institutional supports within the region and the role universities play in the success of regional non-academic firms. Innovative microgeographies such as those engendered by academic institutions are rarely closed innovation systems. Rather, most are embedded within larger regional ecosystems. Institutions that develop their own internal systems to nurture academic firms also provide entry points for connecting these emerging firms to larger sets of regional resources and supports. But an inward-looking system raises questions about sustained institutional influence, especially among academic institutions that are seeking to use physical proximity to gain influence over technology choice and business strategy. As academic entrepreneurs traverse the larger ecosystem, their priorities potentially shift as they engage with new or alternative institutional actors.

This creates a predicament for academic institutions. Walling off microgeographies has the potential to increase immediate influence over entrepreneurship (Gieryn 2002). Given UNC’s latecomer status to commercialisation, institutionalising the university’s commitment to and programming for entrepreneurship via entrepreneurial spaces can thus be considered a ‘good’ outcome from the university’s perspective and the perspective of UNC-parented firms. Yet there are drawbacks. While a dynamic industrial cluster, buttressed by strong academic firms, may ‘float many boats,’ competition within clusters for resources is intense – with both social networks and geographic proximity influential in determining which entrepreneurs (and thus firms) gain access to critical resources (Whittington, Owen-Smith, and Powell 2009). Scholars of knowledge spillovers have noted that benefits decay over short (2–5 miles) distances (Arzaghi and Vernon Henderson 2008; Kerr and Kominers 2015; Rosenthal and Strange 2003, 2008); other work emphasises even smaller scales, suggesting even rearrangements of buildings can alter the casual interactions that benefit scientific knowledge (Kabo et al. 2014). Given the dominance of university knowledge generation in the life sciences industry (Pisano 2006), geographic or network splintering between academic from non-academic firms could potentially endanger the success of non-academic firms – and, perhaps, longer-term regional success. Moreover, given that close proximity is particularly important for less privileged actors (Chown and Liu 2015), it is worth asking if separating ‘star’ university scientists from broader scientific inquiry in the region could dampen innovation among those entrepreneurs with the least access to resources. In other words, the institutional model of mirroring a regional entrepreneurial ecosystem on a smaller scale, while improving the entrepreneurial experience and increasing the number of firms within the microgeography, may have unintended consequences not just for the academic firms but for the region, too.
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ORCID

Mary Donegan http://orcid.org/0000-0001-9569-5164
Nichola Lowe http://orcid.org/0000-0002-1632-0493

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