Too much of a good thing? Linking Foreign Direct Investment and innovation in urban innovation ecosystems

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Abstract

Foreign direct investment (FDI) can play an important role in regional innovation ecosystems. Although FDI flows unevenly to various regions of a country, the theoretical debate on innovation ecosystems has considered FDI and geographic space as almost mutually exclusive drivers. Using a unique city and technology-level dataset in the US, this study combines both FDI spillover and innovation ecosystem theories and investigates the conditions under which FDI has a positive relation with innovation in a city-level ecosystem. We found that moderate levels of FDI are positively related with local innovation. Using a novel enabling technology index of urban innovation ecosystems, we further show that FDI spillovers are contingent upon the level of absorptive capacity of the region (i.e., the enabling technologies that are already developed within the ecosystem). This study's disaggregated approach enables us to gain more precise insights into the determinants of cross-city differences in innovation.

1. Introduction

Foreign direct investment (FDI) has long been recognized as a key external source of advanced knowledge and technology for recipient countries (e.g., Blomstrom, 1986; Caves, 1974; Buckley et al., 2007). Given that 68 percent of global research and development (R&D) funds are spent outside the US, FDI can occasionally bring foreign marketing, management, and workforce best practices to innovation ecosystems in the US (Battelle, 2013). Foreign companies account for about 19 percent of total corporate R&D spending in the US (Fikri & Saha, 2015), and as of 2016 the cumulative value of FDI in high-tech industries amounted to more than $1.6 trillion (SelectUSA, 2017). FDI may thus be a significant contributor to the competitiveness of the US high-technology sector.

Much of the extant literature on innovation ecosystems has concentrated on the influence of domestic actors. Nelson (1993) focuses on national contexts that influence innovation. Feldman and Kogler (2008) highlight the role of universities in ecosystems as a multifaceted creative force in the economy. Rasmussen (2008) describes government initiatives that can facilitate 'bottom-up' institutional innovation by providing resources for direct use in commercialization projects. Bloom, van Reenen, and Williams (2019) describe the role of government tax credits and R&D relationships with private firms. However, we understand much less how foreign actors, and in particular their direct investment in a local ecosystem, can influence innovation in regional ecosystems.

In the FDI literature, the country is often used as the unit of analysis for the purpose of measuring technology spillovers. This literature is difficult to interpret and marry to the ecosystems literature, as agglomeration effects (e.g., benefits from colocation in innovation ecosystems) typically occur within geographies smaller than countries. Such aggregated country- or industry-level analysis is restricted in the extent to which it can disentangle the dynamic interaction between FDI and innovation effects, because FDI flows unevenly to the various regions of a country. This suggests that there is considerable scope for more micro-level research examining the nature of interaction between foreign affiliates in host economies at a subnational level in different sectors, and the precise mechanisms by which FDI spillovers occur in different geographies.

To this end, we investigate two main empirical questions. First, this paper presents novel results to explain cross–US city variation in innovation outputs. We test under which conditions FDI inflow into a city improves or degrades a city's innovation output. Second, by exploiting major city variation, we test how the level of enabling technologies in an innovation ecosystem moderates the relationship between FDI and innovation in a city.

This paper makes two important contributions. First, we contribute to the innovation ecosystem literature by exploring the possible effect of FDI spillovers on innovation ecosystems. By doing so, we bridge the literature on the spillovers of FDI and innovation ecosystems in explaining urban innovation. As discussed earlier, the majority of existing studies do not consider the possible effect of FDI on urban innovation ecosystems.

Second, our analysis is a multilevel model involving technology and city levels. Geographic space provides a unit of analysis that captures interactions between actors and supply of necessary resources (e.g., FDI). Location is an important factor in FDI dynamics, but much of the research about the location of FDI is confined to the country level (Moon, 2016, p.99). Few studies in the FDI literature have discussed agglomerations of cities. The use of countries as the unit of analysis is problematic in measuring agglomeration economies, given the diversity of location-specific factors at the subnational level that might affect FDI spillover effects. With more disaggregated data, we ask about the effects of FDI inflows on particular cities receiving the investment. Further, innovative solutions are increasingly relying on the integration of different knowledge sources that cross industries (Bresnahan et al., 2001; Owen-Smith & Powell, 2004), so industry-level variables may not adequately explain innovation. We need to look at a link between individual technologies and innovation.

The remainder of this paper is organized as follows. We first review the literature on innovation ecosystems and FDI externalities in terms of urban innovation. This is followed by research methodology, data, and measurements on variables. We then present our empirical preliminary results. We conclude with policy implications and also discuss research limitations.

2. Innovation ecosystems

Innovation often occurs within an entrepreneurial ecosystem that typically involves a set of agents, institutions, activities or processes, and surrounding culture (Feldman, Siegel, & Wright, 2019, p.817). The concepts of 'entrepreneurship' and 'innovation' have been closely related (Autio et al., 2014). The concept of an "innovation ecosystem" is the latest in a list of similar concepts—including "innovation districts," "innovation clusters," and "national innovation systems"—that reference geographically located innovation at a national, regional, or local level (Heaton, Siegel, & Teece, 2019).

Understanding the factors that influence the vitality of innovation ecosystems is a main goal of a large body of the literature (e.g., Zucker et al., 1998; Shane, 2004). The effects of decisions by governments, firms, and universities that impact the vitality of an innovation ecosystem are of considerable interest to many constituencies (Heaton, Siegel, & Teece, 2019, p.921). While some have emphasized the importance of entrepreneurs' social networks (Davidsson & Honig, 2003; Greve & Salaff, 2003), macro-conditions also impact the development of entrepreneurship in the literature on national systems of entrepreneurship (Acs et al., 2014). Regional scientists such as Saxenian (1994) have also written about network relations in innovative regions like Silicon Valley.

We argue that FDI as a source of external knowledge is contingent on the host city's technological profile and ability to take advantage of spillovers. Innovative solutions rely on the integration of different knowledge sources that cross industries (Bresnahan et al., 2001; Owen-Smith & Powell, 2004). For example, innovations in multiple application sectors occur as a consequence of innovation in an enabling technology (Teece, 2018). We also believe that simple theories that emphasize just industry- or citywide factors are insufficient. We hypothesize that a connection between FDI and regional innovation is empirically stronger at the city–technology level than on either dimension individually.

3. FDI at the city level

FDI flows unevenly to the various regions of a country. According to the Brookings Institution (Saha et al., 2014), nearly three-quarters of jobs in the nation's largest metro areas are in foreign-owned enterprises (FOEs). In eighty-one different metro areas, FOEs employed a larger share of the private-sector workforce in 2011 than they did in 1991. Large metro areas (e.g., Atlanta, Georgia; Houston, Texas; Los Angeles, California; and New York, New York) saw the number of jobs in FOEs in their areas increase by over 10,000 workers. Metro areas specializing in technology, such as Phoenix, Arizona, also witnessed sizeable increases (Saha et al., 2014).

Although innovation ecosystems can be defined in various spatial units, ranging from street level to continents, some recent studies suggest the city level as an appropriate level to explain regional differences in innovation (e.g., entrepreneurship as an urban event; Bosma, Schutjens, & Stam 2009; Fritsch & Wyrwich, 2014). Cities have often been at the forefront of innovation, and innovative activity is highly concentrated in cities. The role of urban ecosystems in the generation of knowledge has also been well documented (Bettencourt et al., 2007). More than 90 percent of the total number of patents (from 1990–1999) was granted within metropolitan areas (USPTO, 2000). Altogether, there is considerable scope for more micro-level research examining the nature of interaction among foreign affiliates in host economies at a subnational level in different sectors, and the precise mechanisms by which FDI spillovers occur in different urban geographies.

Location is an important factor of FDI dynamics also, but much research about the location of FDI is confined to the country level (Moon, 2016, p.99). This is surprising, as the interactions between actors and the supply of necessary resources (e.g., FDI) often occurs at a subnational level. Our analysis is a multilevel model involving technology and city levels. Few studies have discussed agglomerations of cities in the host and neighboring countries in the FDI literature. With the new longitudinal panel data, we aim to answers these questions.

Studies have added agglomeration economies to FDI models at the level of countries (Wheeler & Moody, 1992; Braunerhjelm & Svensson, 1996). The use of countries as the unit of analysis for the purpose of measuring agglomeration economies makes it difficult to interpret the findings, however, because agglomeration effects refer to processes occurring within geographies smaller than countries. With more disaggregated data, one could ask about the effects of FDI inflows on particular regions receiving the investment.

4. FDI externalities in urban innovation ecosystems

The spatial 'external economies' concept advanced by Marshall (1890) has been discussed as a key determinant of regional growth and new investment. Studies on the location choice of multinational enterprises emphasize the importance of agglomeration economies and industrial clusters. Foreign entities invest in locations where related firms are colocated to enjoy supporting facilities, shared service centers, and specialized factor inputs (Dunning, 2009).

Innovation ecosystems are often thought to emerge from the agglomeration of local firms, potentially attracting FDI only at some later development stage. However, FDI can initiate development. Studies have shown that large investment can stimulate the agglomeration of small firms (e.g., Morgan, 1997; Moon, 2016). For example, the Sinos River Valley shoe cluster, contributing 80 percent of Brazil's shoe exports, was developed largely because foreign traders had set up branch offices (Schmitz, 1995).

The foundational research on FDIs in the US showed that FDI is associated with increasing private R&D intensity (Caves, 1974; Coe & Helpman, 1995). Teece (1977) argued, theoretically, that if the investing foreign firms introduced new products or processes to the domestic market, the investee domestic firms may benefit from the accelerated diffusion of new technology. Through knowledge spillovers from foreign entrants to local firms, or through heightened incentives to innovate to compete with foreign entrants, FDI could therefore lead to increased innovation by local firms (see Bloom et al., 2016, for similar reasoning). De Propris and Driffield (2005) found that positive externalities from FDI are greater in ecosystems than in non-ecosystems.

Some, however, cast doubt on these positive FDI externalities and argue that the presence of FDI can negatively affect innovation or 'crowding-out effect' (Meyer & Sinani, 2009; Spencer, 2008). Firms in ecosystems can suffer from the intensified competition tied to FDI. Increased competition may reduce the availability of resources of local firms for innovation projects and raise costs for highly skilled labor. FDIs may force domestic firms to produce less and therefore raise their costs, eventually reducing their R&D inputs and outputs (Konings, 2001). FDIs may risk other negative effects, such as loss of critical assets to foreign investor firms (Luo & Tung, 2007). In much research, this evidence is sketchy and has been performed mostly at the industry level.

The innovation ecosystem literature has also recognized these congestion costs as a cluster grows. Studies suggest that what may serve as an agglomerating influence in triggering innovative activity to spatially cluster in the early and growth stages of the industry life cycle may later turn into a congestion effect, leading to greater dispersion in innovative activity (Feldman & Audretsch, 1996). Long-term relationships in an ecosystem may lock participants of social networks into established ways of doing things, with negative effects on innovation.

Locating in an innovation ecosystem has a positive influence on a firm up to a certain point, and the positive effects can turn negative later when the embedded relationships become too closely tied (Boschma, 2005, p.67).

These findings suggest that the effect of FDI in ecosystems is curvilinear rather than linear. Some urban economists argue that there is an optimal density, given the offsetting effects of increased density on innovation. Carlino et al. (2007) find that a mid-sized city of about 750,000 people is optimal, suggesting relatively weak agglomeration effects. We expect that FDIs will have a positive effect on innovation up to a certain point (i.e., before the urban location is too crowded with foreign firms), but after that level, the negative effects associated with increased competition will exceed the benefits associated with FDI spillovers. We propose the following hypothesis to capture FDI spillover effects in urban ecosystems:

Hypothesis 1: The relationship between FDI and innovation performance in a city is curvilinear (inverted-U shape).

5. FDIs and enabling technologies in urban innovation ecosystems

FDI spillovers involve a process in which host ecosystems absorb capabilities from foreign firms. Therefore, FDI spillover effects may depend on the characteristics of ecosystems as the recipients of spillovers.

Existing studies have focused on industry structure as a determinant of localized technology spillovers. The concept that spillovers arise from industry specialization in a location originates in the work of Marshall (1890), Arrow (1962), and Romer (1986). The specialization viewpoint is that spillovers are more likely to occur between similar firms, meaning that regions where firms are specialized in a particular industry enjoy increasing returns and thus should produce more innovations.

However, there is little consensus on the impact of industry structure on technology spillovers. The influence of industry structure on spillovers often varies by industry. Examining differences across sectors, Henderson et al. (1995) find that urban diversity is important for attracting innovative sectors, but a history of similar past specialization matters more to retaining mature industries. Combes (2000) finds similar results between 1984 and 1993 that service sectors and more innovative manufacturing sectors in France benefit from diversity.

Variations in the technology profile of an urban ecosystem lead to a varying extent of technology spillovers in innovation ecosystems. Foreign firms bring different technologies and management skills to a host country. The technology profile of an ecosystem differs in many dimensions. Aggregating it at the industry level, as was done in prior research, may cause one to miss important issues regarding how FDI spillovers take place. For example, enabling technologies often support the industries of the future and can influence technology spillovers.

General purpose technologies (GPTs), introduced by Bresnahan and Trajtenberg (1995), characteristically (1) are pervasive (i.e., in wide use); (2) are capable of ongoing technical improvement; and (3) enable complementary innovations in application sectors. Enabling technologies share with GPTs the characteristic of being applicable across domains and are capable of further improvement, but their breadth of application is not necessarily high enough to have a measurable impact on the economic growth of the entire economy.

The term "enabling technology" has become commonly used in the vernacular of everyday business to refer generally to technologies characterized by broad applicability.[1] Teece (2018,

[1] The paragraphs explaining the definitions of enabling technologies are drawn heavily from a working paper by Gambardella, Novelli, Heaton, and Teece (2018).

p.1369) differentiates enabling technology from GPTs and calls an enabling technology a 'junior GPT,' meeting Bresnahan & Trajtenberg's (1995) criteria 2 (i.e., continuous improvement) and 3 (i.e., innovation spawning, but not necessarily having measurable economywide impacts).

Enabling technologies can have great effects on innovation across industries. The European Commission has identified six 'key enabling technologies' that are non-software research fields (micro and nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing) underpinning innovation in products across many industries (Commission of the European Communities, 2009).

Possessing enabling technologies reflects in part the capability to internalize knowledge acquired from others and modify it to fit specific applications (i.e. the city's absorptive capacity). Working from the firm-level analysis of absorptive capacity (Cohen & Levinthal, 1989), Dahlman and Nelson (1995) define national absorptive capacity as "the ability to learn and implement technologies and associated practices of already developed countries." This reflects the capability of a country to exploit existing resources and technological opportunities to create competitive advantage. Although this work is at the level of nations, we expect similar absorptive capacity effects to apply at the level of cities.

According to the absorptive capacity perspective, a firm's capability to draw upon the knowledge stock from another firm depends largely on the firm's existing knowledge stock, so a certain level of knowledge overlap is necessary (Cohen & Levinthal, 1990; Rosenkopf & Almeida, 2003; Tallman et al., 2004). When the knowledge gap between the local and foreign firms is too large, the domestic firm does not have resources to internalize knowledge brought by foreign firms, so spillovers are not likely to occur. Foreign firms are likely to take over the market and thus force local firms into narrow areas that are insignificant for foreign firms (Zhang et al., 2010).

Cities differ in terms of capability to generate enabling technologies. According to Brookings, Pittsburgh has twelve times the national average of academic publications in artificial intelligence, but it has only 66 percent of the national average employment in software (Andes & Katz, 2016). Stockholm, a global competitor of Pittsburgh's in automation, does not have Pittsburgh's academic strength in artificial intelligence, but it receives ten times the FDI that Pittsburgh does—the largest category of which is software and communication technology firms (Andes & Katz, 2016, p.3). Therefore, we conjecture the following:

Hypothesis 2: An innovation ecosystem with a high level of enabling technology generation will positively moderate the relationship between FDI and innovation in the ecosystem.

6. Data and methods

We test these hypotheses on a sample of cities for which reliable indicators for FDI and innovation are available. We obtained access to a unique Brookings dataset and use it for indicators for FDI. There are several novel aspects of the Brookings's data. First, Brookings built a metropolitan/regional dataset derived from a national database of every foreign-owned establishment (FOEs). This allows researchers to construct estimates of jobs in FOEs for any geography down to the metropolitan or county level. Second, its national scope makes it possible to compare estimates across regions in the US. FDI varies by region within the US (see Figure 1). Third, the dataset contains longitudinal data spanning from 1991 to 2011, which allows historical trend analyses. Last, information about the industry of each investment down to the four-digit North American Industry Classification System (NAICS) code level helps identify what type of FDI is coming to each region and measure the contribution of FDI to top industry ecosystems (Saha et al., 2014).

Independent Variables

Foreign Employment Total (FET): The primary independent variable is the total number of foreign employees in a metropolitan area. FET represents the investment of FOEs in the United States and therefore serves as a useful operationalization of FDI (Saha et al., 2014). FET is calculated as the sum of employees whose salary is paid by a foreign-owned establishment but who live in the domestic metropolitan area. This includes both domestic and international employees. FET is calculated in the thousands.

Enabling technology index (ETI): The independent variable used to measure hypothesis 2 is the average ETI score for a metropolitan area. Following Rathje and Katila (2019, p.22–24), ETI operationalizes and quantifies how enabling a patented technology is. ETI is an index of the three factors of an enabling technology: pervasiveness, ability for continuous improvement, and ability to support complementary innovations. After calculating these three measures for each patented technology, we combine the measures to create the averaged ETI score for a given metropolitan area.

Dependent variable

Number of patents. The main outcome variable is invention measured by the number of patents applied for in a metropolitan area, lagged by one year (Katila, 2000; Branstetter, 2006). The United States Patent and Trademark Office (USPTO) reports the number of utility patents awarded to residents of each state, metropolitan area, and county in the US.

We test our hypotheses regarding FDI on a city's innovative performance while controlling for unobservable factors that may simultaneously affect a city's performance and likelihood of receiving FDI. The Breusch–Pagan Lagrange multiplier test suggests that unobservable individual effects exist, and thus a panel data design was used to test the hypotheses. The results of the Hausman test revealed that the unobserved factors and the explanatory variables are correlated, which suggests that random-effects models are inappropriate. As a result, we used a fixed-effects model. With city-fixed effects, our analysis compares each city with itself. This means we compare the amounts of FDI a specific city receives to its innovative output, as well as the industries for which the city is more likely to innovate in. Second, economic and geographical trends over time may affect both citywide innovation and FDI. To overcome this, we include year-fixed effects in all regressions.

A key objective of this study is to examine the relationship of FDI with innovation. A possible reverse causal relationship is that when the innovation level of a given city is high, many investments (relatedly, greater foreign investments) will choose to invest in the city. Therefore, the amount of investment in a city may be determined partially by the innovation level of the city. To rule out this possible reverse causal relationship, we conducted the following endogeneity check. We regressed the change in total employment in the city from year t-1 to year t on innovation in the city in year t-1. We also regressed the change in foreign employment in the city from year t-1 to year t on the innovation in the city in year t-1. If any one of the predictors had been significant, it would have provided some evidence of the endogeneity concern. Given that none of these predictors was significant, we concluded that this reverse causal relationship is unlikely to exist in our data.

7. Results

Table 1 provides descriptive statistics and correlations. All correlations are statistically insignificant, with the expected correlation between the FET and FET squared terms. Other variables used for controls (as city and year-fixed effects) are not included in this table.

Table 1: Mean, Standard Deviation, and Correlation

Variable	Mean	S.D.	1	2	3
1. FET	5066.111	22006.48			
2. FET-squared	5.1E+08	7.48E+09	0.864887		
3. Average City ETI	-0.13169	0.395734	0.039062	0.018572	
4. FET x ETI	-327.011	1908.202	-0.25081	-0.13753	0.221541

Table 2 provides our main results. Hypothesis 1 predicts that FDI has an inverted-U relationship with citywide innovation. We find strong and significant support for Hypothesis 1. Model 2 in the table shows the main effect and squared term of foreign employment totals, our proxy for FDI. We find positive and significant evidence of effects of FET on the number of patents the following year, while finding negative and significant support for the squared FET term. This indicates an inverted-U relationship.

Hypothesis 2 indicates that the greater the ETI for a city, the stronger the effect FDI will have on citywide innovation. We again find support in the direction of the hypothesis. Model 4 in the table illustrates the interaction term between average ETI per city and FET. We find that the coefficient for the interaction term is positive and significant, indicating that the stronger the ETI score, the stronger the effect of FET on patenting.

Interestingly, we find no relationship between the average ETI score and the number of patents the following year. We find no evidence that cities with greater enabling technology scores produce more patents the following year. This result supports the empirical observation made by economists that enabling technologies often fail to deliver benefits for a long time after introduction, and it takes time for advances in enabling technologies to ignite a sustained growth.

Table 2. Panel Regression predicting Number of Patents (1-year lag)

	(1)	(2)	(3)	(4)
Foreign Employment (Thousands)	3.54e-4***	7.51e-4***	7.53e-4***	7.46e-4***
	(2.57e-4, 4.52e-4)	(6.00e-4, 9.01e-4)	(6.02e-4, 9.03e-4)	(5.96e-4, 8.96e-4)
Foreign Emlpoyment Squared		-1.06e-10***	-1.06e-10***	-1.06e-10***
		(-1.36e-10,-0.75e-10)	(-1.37e-10,-0.75e-10)	(-1.36e-10,-0.75e-10)
Average Enabling Technology Index			-0.72	-1.33
			(-2.04,0.60)	(-2.68,0.03)
Foreign Employment X Average Enabling Tech Index				6.80e-4***
				(3.45e-4, 1.02e-3)
Dummies Included:				
Location (City)	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	19,510	19,510	19,510	19,510
R2	0.003	0.005	0.005	0.006

Note: *p<0.05; **p<0.01; ***p<0.001;

8. Conclusion

Although there is a substantial body of literature considering FDI spillovers and innovation ecosystems, there is not enough effort directed at understanding the links between FDIs, enabling technologies, and urban innovation ecosystems. One major goal of this paper, therefore, was to formulate a model that tests directly the potential effects of FDIs on innovation ecosystems and the moderating role of the ecosystem's enabling technologies as they relate to innovation. Using a unique city- and technology-level data set, we tested hypotheses about major US cities. By doing so, we provided new empirical insights into the determinants of cross-city differences in innovation. We found that FDI has an inverted-U relationship to citywide innovation. We also found that the greater the ETI for a city, the stronger the effect FDI will have on citywide innovation.

This study makes both theoretical and empirical contributions. First, our focus on the effects of FDI is significantly different from prior innovation ecosystem literature, which has neglected the contribution of FDI and addressed largely the contribution of domestic elements such as institutional factors and network effects in innovation. Our empirical results show the existence of FDI spillovers on urban innovation ecosystems in the United States. This supports the view that FDI has an important role as an external source of technology for improving local innovation. This is consistent with broader findings on positive externalities in the literature (e.g., Bloom et al., 2016). Our results contribute to this literature and further show that the level of enabling technologies is an important factor in allowing FDI externalities to have an impact.

Second, our analysis is a multilevel model involving technology and city levels, which may help us better understand how innovation at the city level is linked to that at the technology level. In doing so, we provided a richer and more complete perspective of FDI spillovers and innovation. Although innovation is inherently a multilevel phenomenon, few studies have treated it directly as such. While contemporary literature on innovation ecosystems and FDI spillovers stresses multilevel analysis (e.g., Archibugi & Michie, 1997; Meyer & Sinani, 2009), such examples remain scarce.

Our results show that FDI can be a tool for strengthening innovation in ecosystems, and thus effective FDI policy should not treat FDI attraction as an end in itself but as a process of infusing new technology into US innovation systems. The policy of subsidizing FDIs is often designed to address regional disparities such as unemployment, rather than underlying causes such as low levels of technological competency (Morgan, 1997). Policymakers often foster ecosystem development through FDIs, but FDI-generated ecosystems can be fragile and short term because foreign investments can relocate if economic conditions change (De Propris & Driffield, 2005). To maximize the benefits of FDI, policies should be focused on developing absorptive competencies within the ecosystem.

Our paper has a number of limitations that offer significant opportunities for future research on this important issue. Although we established that FDI spillovers are an important mechanism underlying innovation, we shed little light on the actual mechanisms by which knowledge is transmitted across firms and individuals in an innovation ecosystem. Patent data does not reflect the complex processes of technological accumulation, whereby tacit knowledge is built up and complex transactions involve (Feldman et al., 2002). Thus, future research should consider the mechanisms by which knowledge spills over and the degree to which these processes are geographically localized.

We examined the heterogeneous nature of urban environments in terms of enabling technologies and focused on how this difference may affect the relationship between FDIs and innovation. Future research can investigate other aspects of urban environments. Some scholars link amenities with innovation. Florida (2013) observed a migration trend where startups move from suburban locations, like Silicon Valley or Boston´s outskirts along Route 128, to denser and more walkable outlets with a vibrant street culture, like downtown San Francisco or Lower Manhattan.

To the best of our knowledge, this is the first study that examined how the heterogeneous nature of urban environments in terms of absorptive capacity affects innovation in ecosystems. Our focus on the diversity of urban environments deviates significantly from the existing literature, which has focused mainly on the presence of FDI at an industry or a country level. Also, we advance the innovation ecosystem literature by drawing upon the FDI literature and by testing the moderating role of a city's absorptive capacity. We believe that our study can contribute to a better understanding on how FDI spillovers take place and provide insights into mechanisms that facilitate knowledge spillovers in ecosystems.

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