Multinational location strategy:

connectivity, agglomeration and heterogeneity

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Where business comes to life

Basile R., Castellani D., Zanfei (2008) “Location choices of multinational firms in Europe: The role of EU cohesion policy”, *Journal of International Economics*, 74, 328-340,

Ribaudo D., Castellani D., Zanfei A. (2023) “Getting there and around. The role of transportation infrastructures in MNEs’ location choices at the city-level”.

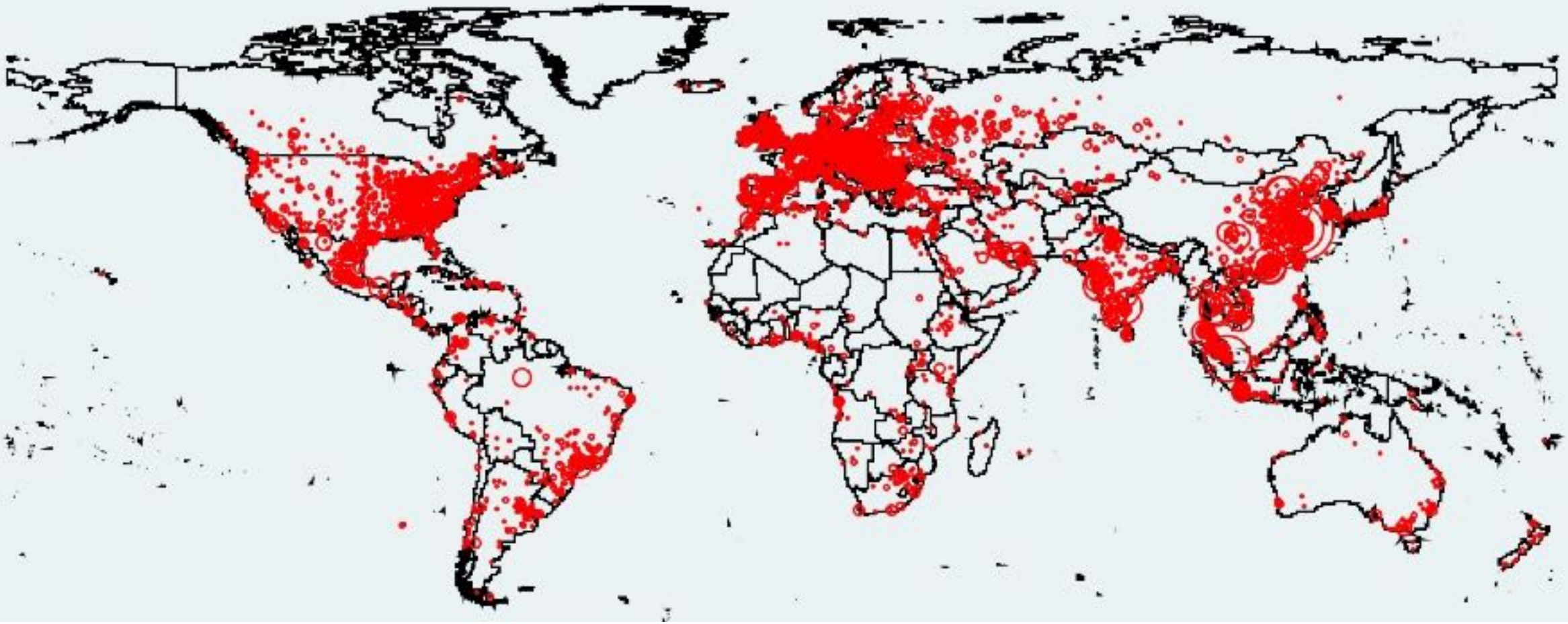
Benfratello, L., Castellani D., D’Ambrosio A., (2023) Migration and the location of MNE activities. Evidence from Italian provinces.

Castellani D. and Lavoratori K. (2020) The Lab and the Plant: Offshore R&D and co-location with production activities, Journal of International Business Studies, 51, 1, 121-137,

Castellani D., Lavoratori K., Perri A., Scalera V. (2019) “Connectivity and the Location of MNE activities across the value chain. Evidence from US Metropolitan Areas”, Global Strategy Journal, 12,1, 82-107

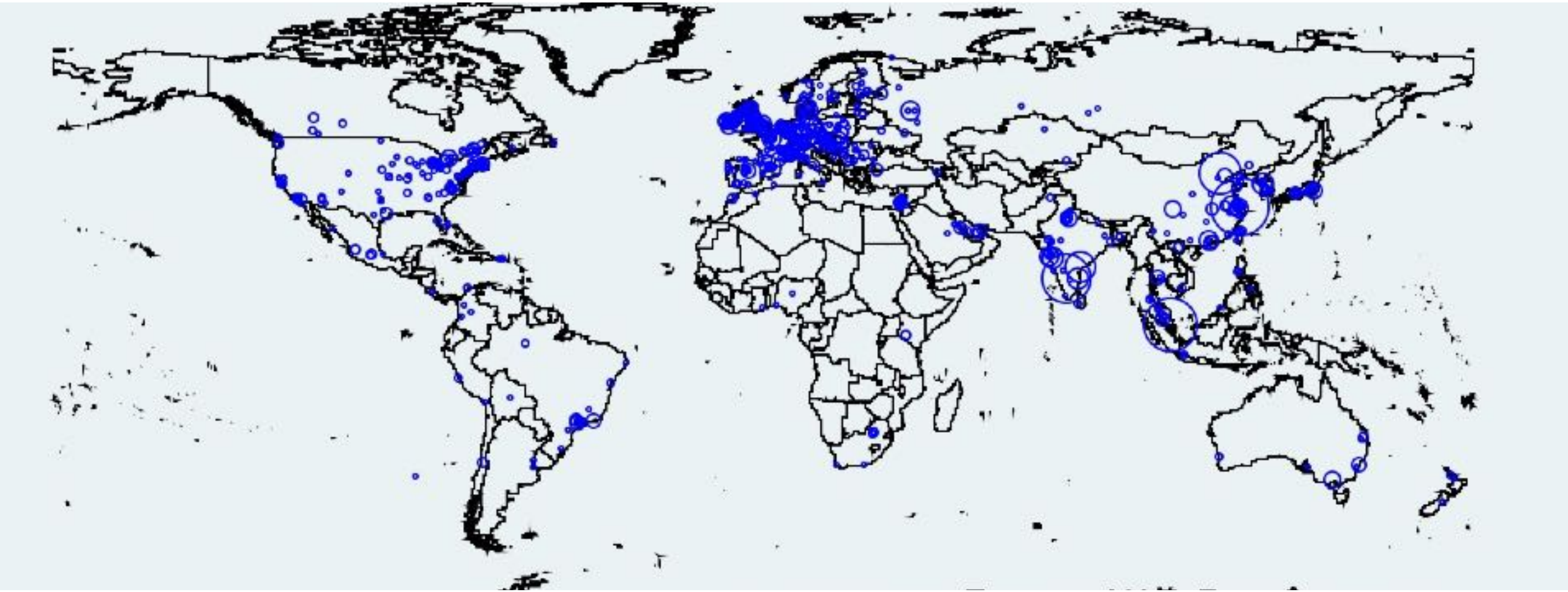
Belderbos, R., Castellani D., Du, H., Lee G.H., (2023) Internal versus External Agglomeration Advantages in Investment Location Choice: The Role of International Connectivity of Global cities

Research questions



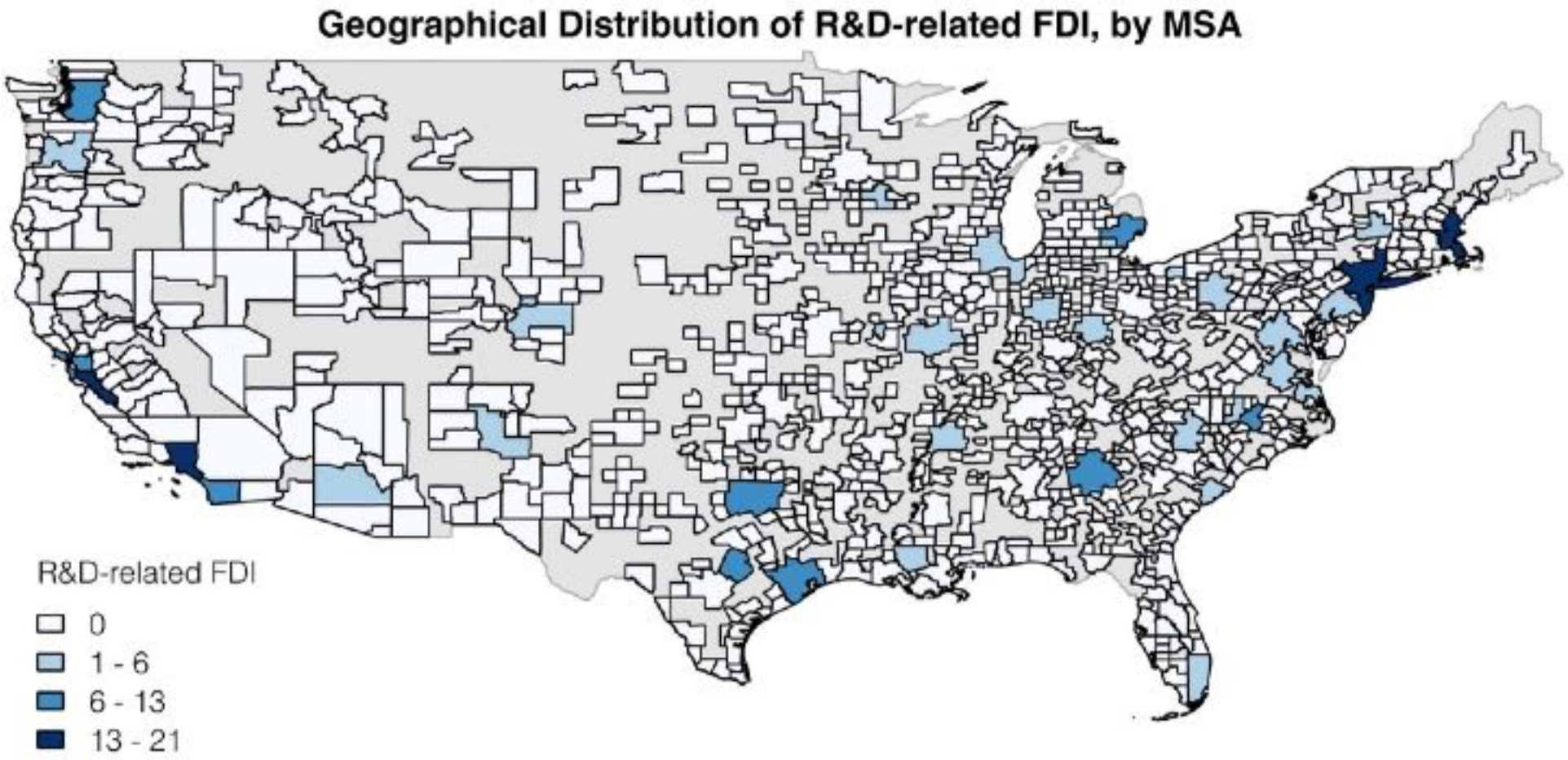
Based on greenfield investment projects from fDi Markets 2003-2015,
6532 cities received at least one FDI in manufacturing activity

Research questions



Based on greenfield investment projects from fDi Markets 2003-2015
707 cities received at least one R&D FDI (blue)

Research questions



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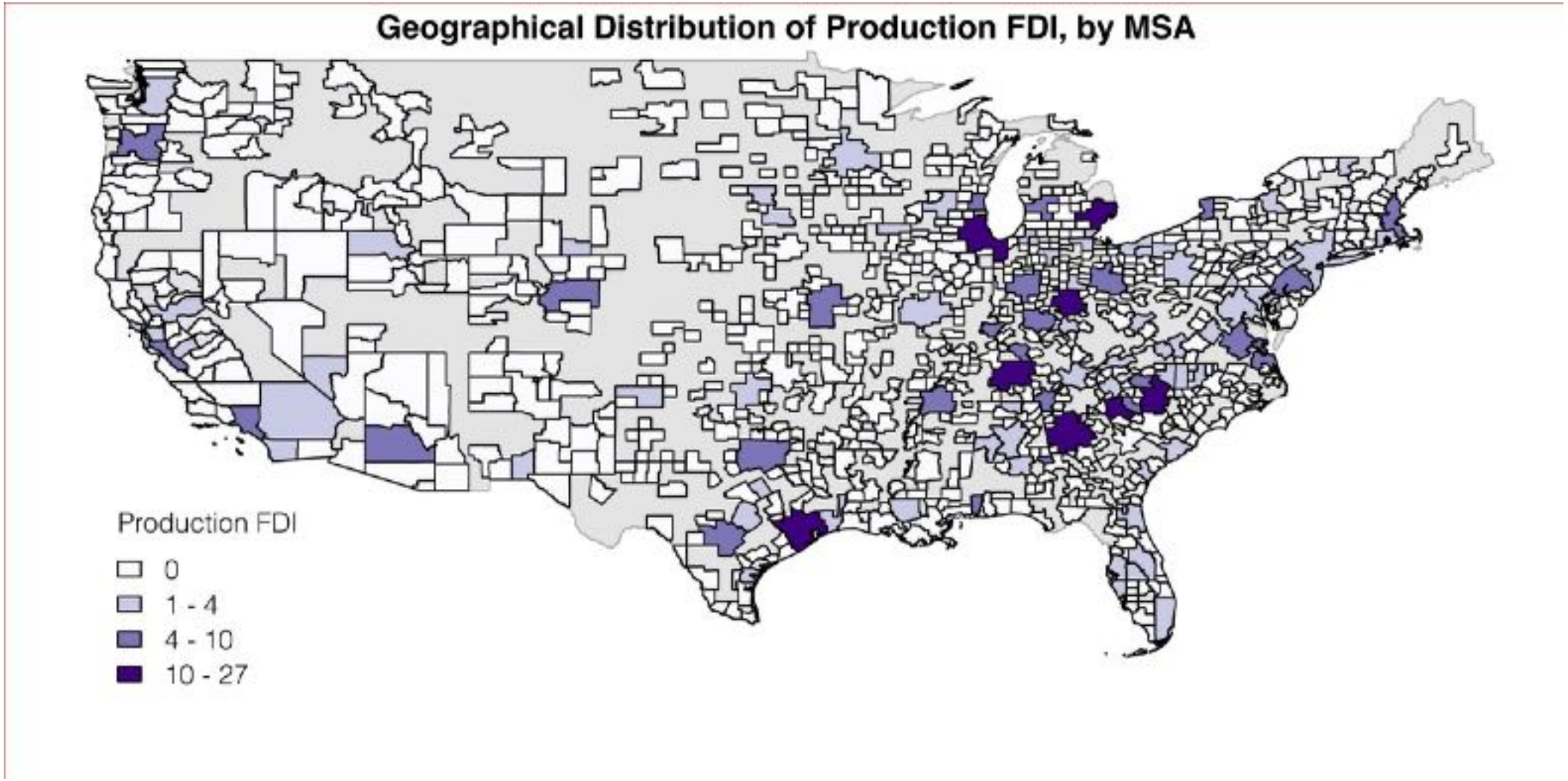

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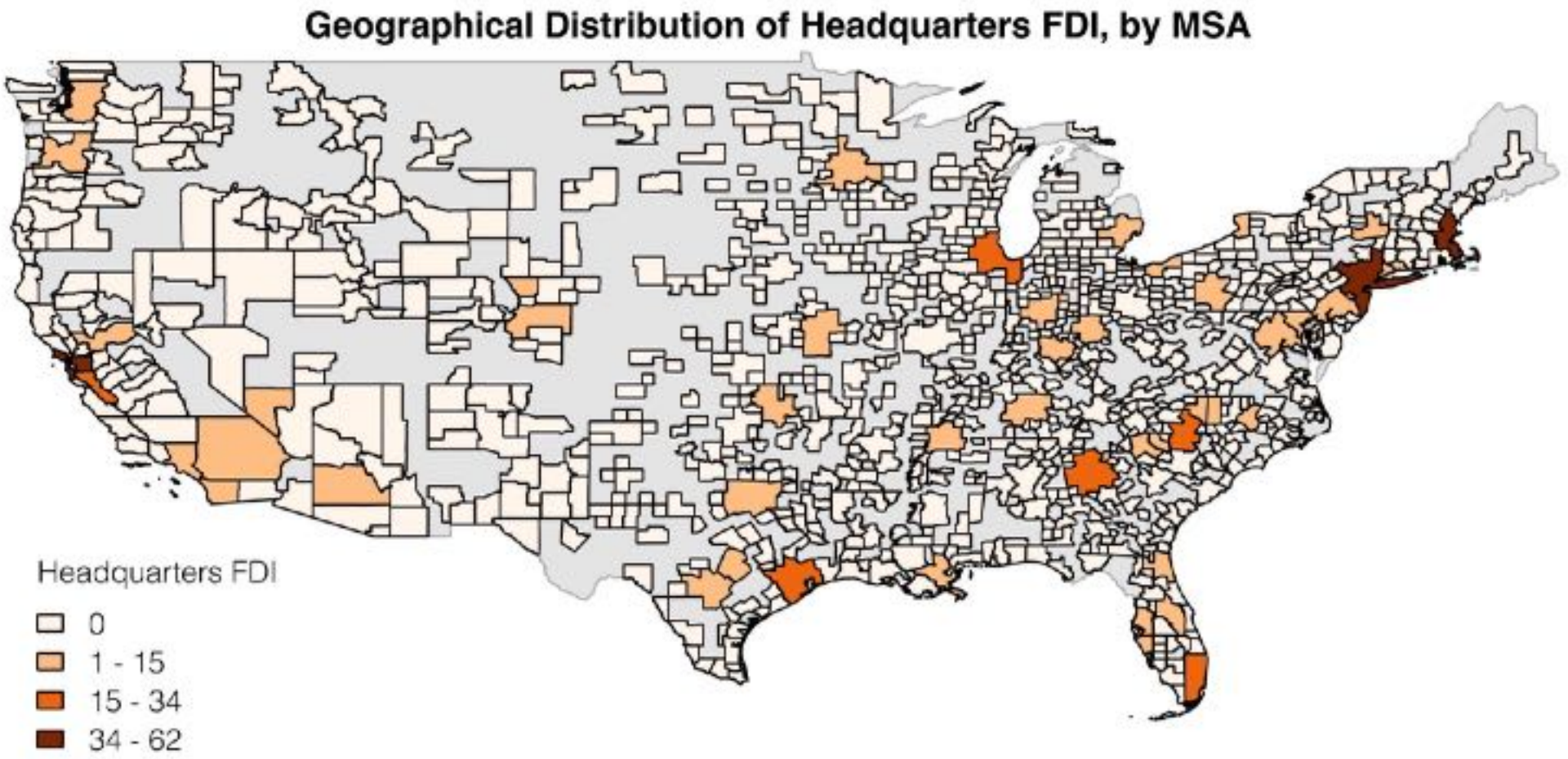
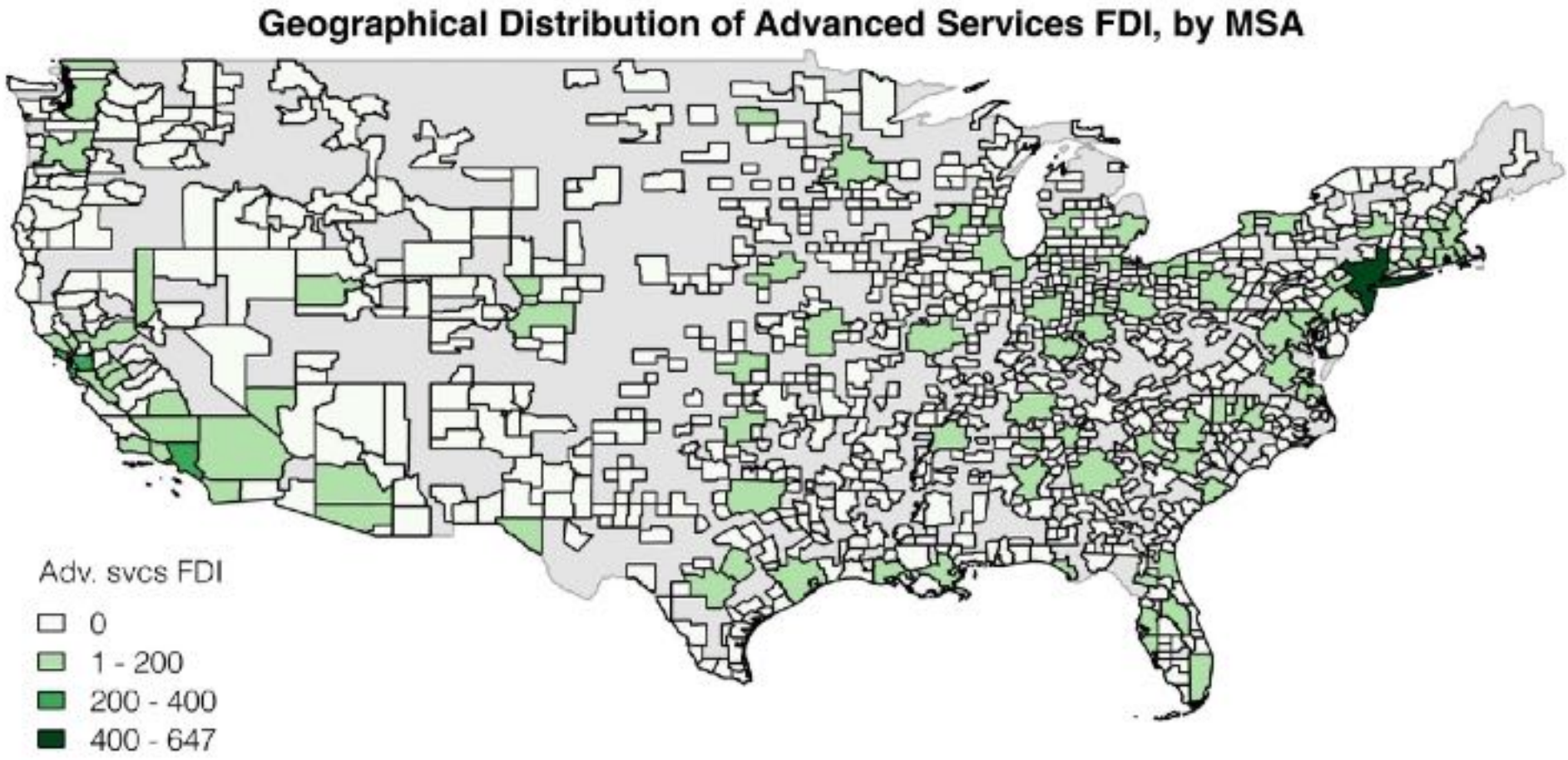


Research questions



Research questions

- What are the factors affecting the location choice for MNCs activities?
- Do they differ across value chain activities?
- What is the appropriate geographical granularity for these decisions?

Building on recent research this presentation will focus on

- (global and local) connectivity
- agglomeration economies

Connectivity and the location of MNEs

Henley Business School
UNIVERSITY OF READING

Where business comes to life

Global connectivity and the location of MNE activity

- International connectivity especially impacts MNE activity, because these firms are required to **orchestrate a geographically fragmented network of cross-border activities**, which need to be efficiently coordinated and connected across space

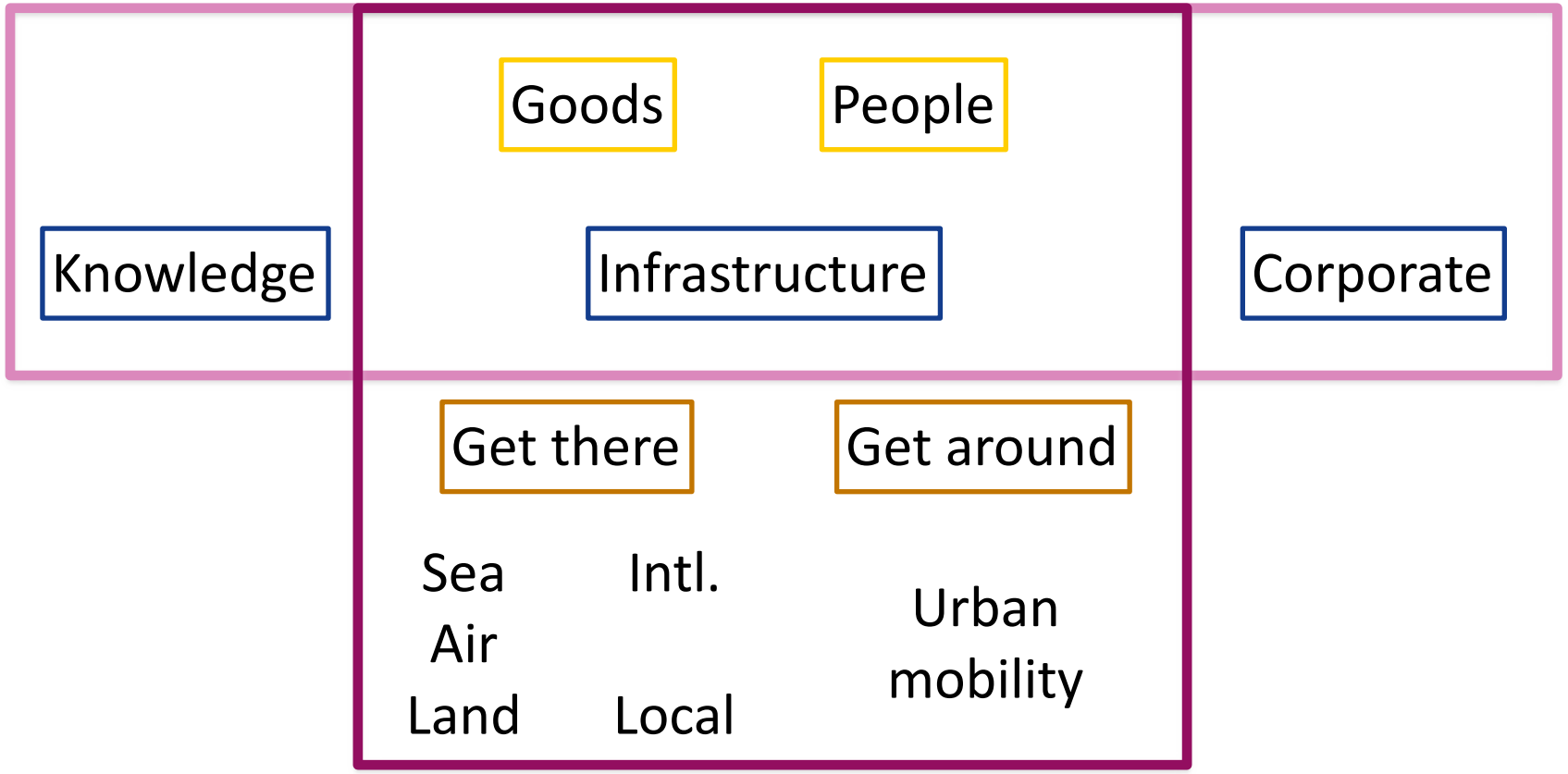
- To analyze the role of international connectivity in the location choices of MNE activities, scholars originally focused on **global cities and their features** (Goerzen et al., 2013

Connectivity

- Connectivity can be defined as the ease and intensity with which **people**, **goods**, **capital**, and **knowledge** flow across space (Bevearstock, 1999; Belderbos et al. 2017)
  - the **knowledge-centred** approach
    - a place cannot rely only on its own local knowledge base but also needs to encourage external knowledge inflows
    - dense local knowledge circulation and strong international connections to outside knowledge networks
  - **infrastructure** approach
    - focuses on the set of enabling systems and technologies that underpin border-crossing networks
  - the **corporate organisation** approach
    - relations between places are created primarily by firms pursuing transnational location strategies
    - connectedness through the networks of corporate service firms as a key trait of global cities

Connectivity

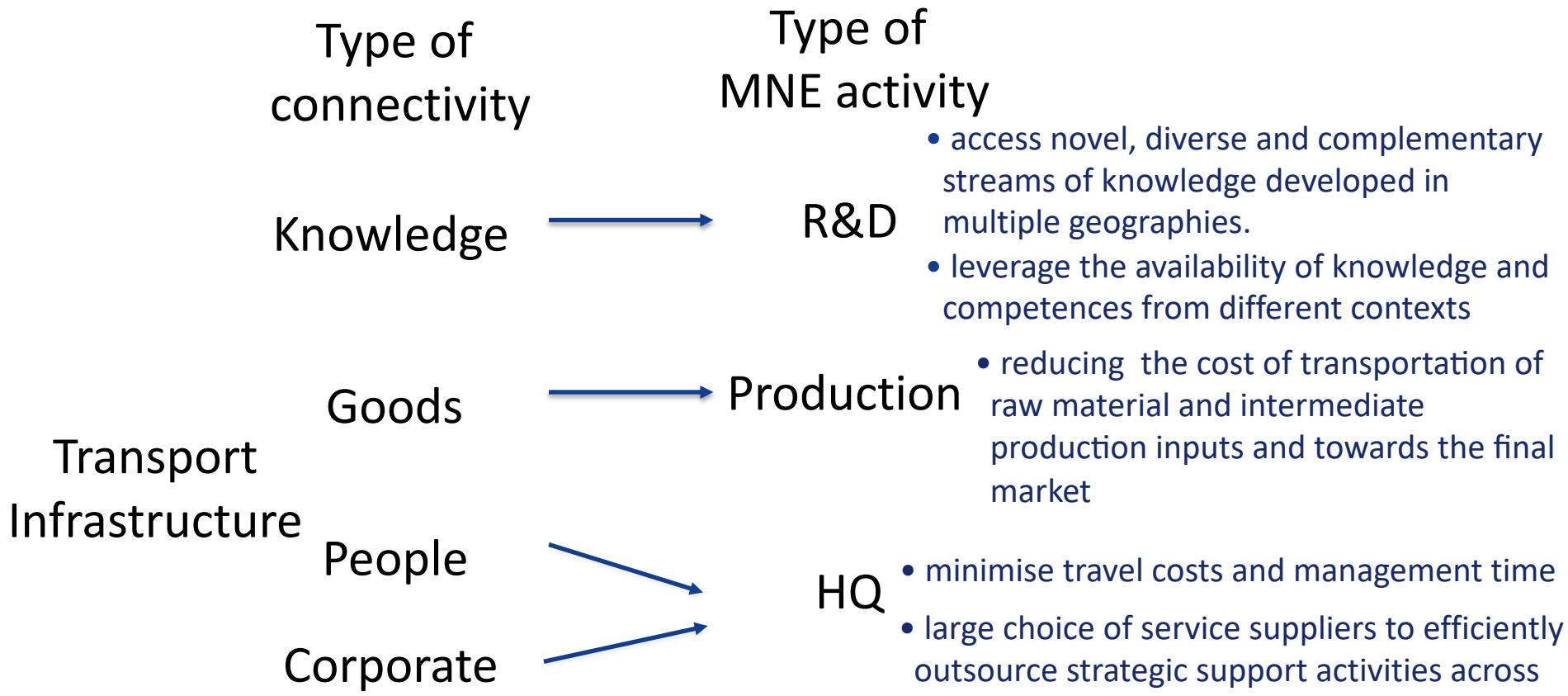
Castellani D., Lavoratori K., Perri A., Scalera V. (2019) "Connectivity and the Location of MNE activities across the value chain. Evidence from US Metropolitan Areas"



Ribaudo D., Castellani D., Zanfei A. (2019) "Getting there and around. The role of transportation infrastructures in MNEs' location choices at the city-level".

International connectivity and the location of MNEs

Castellani, Lavoratori, Perri and Scalera (2019)



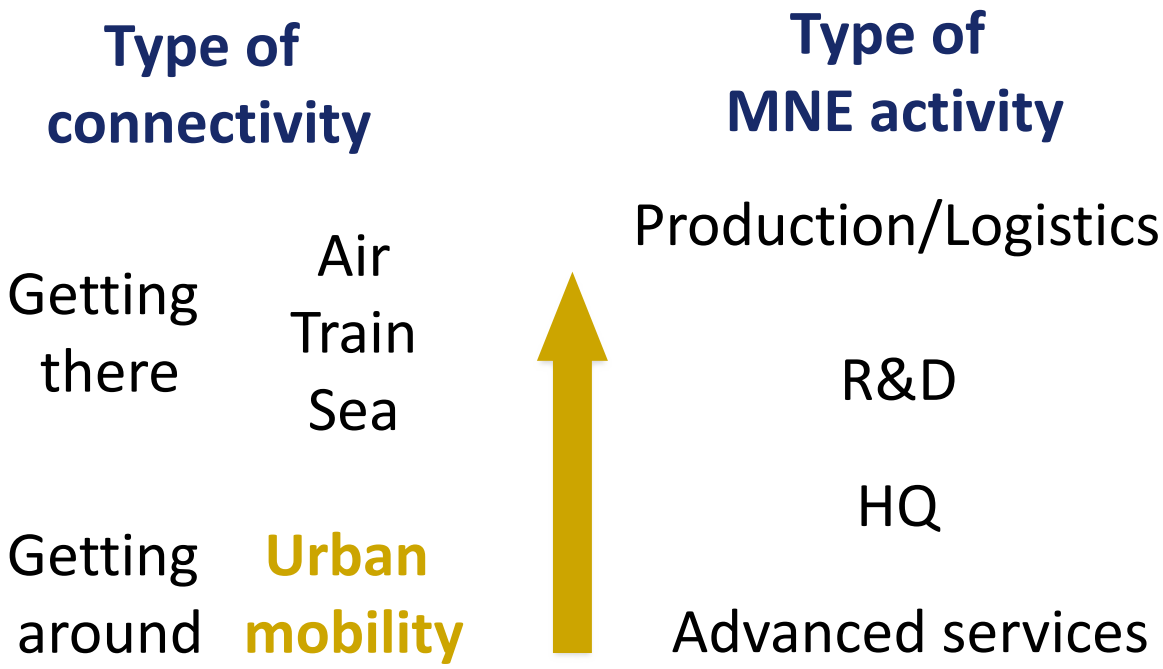
Transport infrastructure and the location of MNEs

Ribaudo, Castellani, and Zanfei (2023)

- Why (and how) does urban mobility matter for MNEs location decisions?
  - reduced **opportunity cost** for workers
    - commuting times reduce job satisfaction and require salary compensation
  - better **match** between firms and workers
    - lower commuting times allow firms to hire workers residing in (and workers to choose firms located in) a larger catchment area
  - **workers and firms differ** in the importance they attach to an effective urban mobility system
    - less important for younger and more educated workers, for more qualified jobs and in high-tech and innovative firms

Transport infrastructure and the location of MNEs

Ribaudo, Castellani, and Zanfei (2023)



Business Activity/Occupation	Age	ISCED
Production and logistics	50.35	2.52
R&D	47.78	4.08
Headquarters	51.34	3.94
Advanced Producer Services	47.09	3.84

Share of Home-workers by Occupation (ISCO-08) - LFS* 2019

Business Activity/Occupation	Age	ISCED
Low Knowledge Intensive	50.35	2.52
High Knowledge Intensive	48.02	3.95
Production and logistics	50.35	2.52
Metal, Machinery, and related trades work	48.71	2.74
Precision, handicraft, printing and related	52.11	2.55
Other craft and related trades workers	52.35	2.34
Stationary-plant and related operators	50.68	2.51
Machinery operators and assemblers	50.02	2.38
R&D	47.78	4.08
Professionals - Physical, Mathematical	45.55	4.56
Professionals - Life Science and Health	49.41	4.69
Physical and Engineering Science	48.13	3.55
Life Science and Health Associate Professionals	47.55	3.91
Headquarters	51.34	3.94
Corporate Managers	51.34	3.94
Advanced Producer Services	47.09	3.84
Professionals	46.77	4.45
Other Associate Professionals	47.26	3.53

Data

- Cross-border greenfield investments from FT's ***fDi Markets*** (2003-2014)
  - For each project we know
    - **Name** of the investing company and its parent
    - **City** where the investment take place and city of parent (with geographical coordinates)
    - Main **business activity** involved (e.g. production, R&D, sales & marketing, HQ, logistics, business services, …)
    - **Industry**
  - We use the information on the destination city
    - for **70 cities** with data on Urban mobility (Ribaudo et al., 2019)
    - to geo-reference each project within US Core Based Statistical Area (CBSA) and we focus our analysis on **382 US Metropolitan Statistical Areas (MSA)** (Castellani et al., 2019)
- **Urban Mobility Tools UT-DAT (World Bank)**
  - which contains information on city's mobility characteristics

International connectivity and the location of MNEs
Results: conditional logit

	R&D	HQs	Operations	Sales
Inventor Connectivity				
N. of intl. connected patents	1.0191***	-0.1544	-0.0832	0.0761
Producer Service Connectivity				
GaWC index ranking	-0.0012	0.2852***	0.0256	0.2241***
Infrastructural (People) Connectivity				
Share of International passengers	0.0166	1.0180**	0.4501**	0.1859
Share of Intl Direct (non-stop) Routes	-1.0313	1.1306	-0.7836	0.4496
Share of Business Passengers	-0.9054	1.1106**	-0.5396	-0.4653
Infrastructural (Goods) Connectivity				
Exports	0.0755	-0.0095	0.2568***	-0.0176
N. major ports	-0.1292*	0.0347	-0.0012	0.0065
N. of obs	52,883	111,154	136,634	363,402
N. of MNEs	213	507	510	1423
Pseudo-R^2	0.3206	0.3598	0.1779	0.4222
Log-Likelihood	-900.5731	-1783.127	-2814.762	-5261.698

International connectivity and the location of MNEs
Results: conditional logit

	R&D	HQs	Operations	Sales
Technology and Human Capital				
N. patents (same tech class)	0.5821***	0.7539***	0.4961***	0.8636***
N. patents (other tech class)	-0.9213***	0.066	-0.4161**	-0.3543**
Tech. Diversification	-1.3785*	0.2171	-0.614	-0.3853
Domestic migration	0.9932*	1.2253***	0.7282***	0.0059
Agglomeration economies				
N. firms	1.2399	3.1314**	1.5167	2.4487**
N. firms (sq)	-0.042	-0.1524**	-0.1085**	-0.1151***
N. previous inv. in MSA	0.0014*	0.0027***	0.0014**	0.0023***
Share R&D inv.	2.2677***	-0.2712	-1.7028***	-1.3534**
Share HQ inv.	2.4606**	2.0786***	0.9774**	1.4128***
Share operations. inv.	0.5769	1.4969**	1.0117***	0.9011***
Share Sales inv.	0.1966	0.9534	-0.0817	0.8453**
Firm-MSA experience	0.6112***	1.0904***	0.8401***	-0.4840*
Other controls				
Population	-1.5264	-1.7825**	1.0002**	-1.0682**
GDP	0.8662	1.5127***	1.1952***	0.6452
Wages	-0.074	-0.9961*	-1.5209***	0.7601*
Geographical distance	-0.5150**	-1.0548***	-0.8795***	-0.5300***
MSA area km^2	-0.3319	0.1418	-0.5146***	0.0662
MSA Latitude	-0.0313	-0.0303	-0.0054	-0.0556***
MSA Longitude	-0.0118*	0.0195***	-0.0001	-0.0016
Share of GDP in Arts & Entert.	0.093	4.0873*	-2.2086	3.2327**
Km railroad	0.4040*	0.1474	0.5062***	-0.0645
N. of obs	52,883	111,154	136,634	363,402

Measuring transport infrastructure

- **Getting around**
  - Average Time to Work
  - Number of Public Urban Transport Vehicles (underground, bus, light railways)

- **Getting there**
  - Number of passengers at national and international airports
  - Number regional and commuter trains
  - Distance to the airport
  - Presence of a port

Transport infrastructure and the location of MNEs

Results: conditional logit

	Manufacturing	Logistics	R&D	HQs	Advanced Producer Services
Getting Around					
Average time of journey to work	-0.0205***	-0.0143***	-0.0149***	0.000143	-0.00201
Public Urban Transport Vehicles	0.0496***	0.0988***	0.0624***	0.0343	0.0353***
Getting There					
Log Tot. Number of Air Passengers	0.111*	0.265***	-0.0587	0.378***	0.256***
Distance to Airport(KM)	-0.0419***	-0.0194***	-0.0213***	-0.0367***	-0.00959***
National Flights	0.0350	0.123***	0.0315	0.161***	0.109***
International Flights	-0.162***	0.111***	-0.00610	0.209***	0.127***
Presence of a Port (0,1)	0.318***	-0.0901	0.0462	-0.527***	-0.0900***
Observations	73,050	34,944	72,204	73,998	681,456
Log. Likelihood	-4312.78	-2825.55	-4789.95	-4564.74	-47816.19

Agglomeration economies and the location of MNEs

External agglomeration economies

Collocating with other firms

- Marshallian and Jacobian externalities
  - Reduce firms' operating costs of search for labour and input providers and knowledge spillovers
- Congestion costs and competition effects may counteract
- Heterogeneity
  - Weaker firms benefit more from clustering
  - Benefits and costs weigh differently for different activities
- Same home-country and co-ethnic agglomerations
  - legitimizing effects
  - existing buyer-supplier relationships that are replicated abroad, a
  - information flows that reduce uncertainty
    - migrants have similar effects (Benfratello, Castellani and D'Ambrosio, 2023)

Internal agglomeration economies

- Geographic collocation of different value chain activities owned by the same parent company
  - Economies of scale and scope in internal labor market
  - Access to intermediate inputs
  - Knowledge sharing
  - Easiest coordination
    - it avoids coordination of complex and dispersed organizational structures
      - Facilitate intra-firm flow of (tacit) knowledge and information between different units)
      - Reduce communication costs
- The propensity to collocate differ across pairs of activities
  - collocation of R&D and production have attracted most of the research

Agglomeration economies and the location of MNEs activities

External agglomeration economies

- derived from co-location **with other firms**

disperse R&D activities

Internal agglomeration economies

- **derived from proximity (co-location) of different activities of the same firm**

concentrate R&D activities

Internal agglomeration economies

Do R&D collocate with production activities?

- R&D and production may be attracted by rather different external factors (including external agglomeration economies), thus leading to dispersion
- There are benefits of collocation in terms of exchange of tacit knowledge
- Evidence is mixed
- The need/advantage from collocation can be very heterogeneous across firms and sectors
  - **firms' ability to coordinate geographically dispersed activities**
  - tacit vs. codified and science-based knowledge
  - degree of modularity
  - basic vs. applied

Methdological challenges

Conditional logit

- Firm i chooses to locate in the location j which yields the highest expected profit, conditional on observable variables:

$$\pi_{ij} = V_{ij} + \varepsilon_{ij}$$

- where V_{ij} denotes profit that firm i derives from locating in j. The probability of locating in j can thus be expressed as:

- Assuming an extreme value distribution for ε_{ij}, yields the conditional logit model. $P_{ij} \equiv \Pr(y_i = j) = \Pr(\pi_{ij} \geq \pi_{i\ell}) = \Pr(\varepsilon_{i\ell} - \varepsilon_{ij} \leq V_{ij} - V_{i\ell}) \forall \ell \neq j$
- If error terms ε_{ij} are correlated across alternatives, CL is biased.

Mixed logit

$$\pi_{ij} = \underbrace{\beta_i'}_{\substack{random \\ parameter}} x_{ij} + \varepsilon_{ij} \qquad \pi_{ij} = \beta' x_{ij} + \underbrace{\mu_i' z_{ij} + \varepsilon_{ij}}_{error\ component}$$

- error component interpretation
  - it allows to model the degree of substitution among locations in a very flexible way
    - For example, if the cost of land increases in NYC, it is more likely that a firm relocates in London, than in …
- random parameter interpretation
  - Not all firms assign the same importance to some location determinants
    - E.g. some firms may value high wages (i.e. high skilled workers, while others don't)

Random parameters

$$\pi_{ij} = \beta_i x_{ij} + \epsilon_{ij}$$

- Normally, we estimate the mean of parameter β, assuming that it is the same across all observations
- One way to allow different β is to have interaction terms or sub-sample analysis.
- With random parameter models we estimate the mean and the variance of β
- We can have various cases
  1. statistically **significant** mean / statistically **in**significant variance
  2. statistically **in**significant mean / statistically **in**significant variance
  3. statistically **in**significant mean / statistically **significant** variance
  4. statistically **significant** mean / statistically **significant** variance
- In cases 3 and 4 we have evidence of heterogeneous responses across firms (to location determinants)
- Note that in case 3 by looking at the mean only we would infer that our variable of interest is not important, while the statistically significant variance suggests that for some observations that variable is important

Random parameters

- If we find evidence of heterogenous responses, we can explore the sources of such heterogeneity

A. explain the variance

- refine the model specification by adding variables and/interactions
- e.g. Chung and Alcacer (2002) study MNE location decisions across states and find that firms heterogeneously value states' R&D activity. Adding several industry dummies, interacted with state R&D activity, leads the variance to become insignificant.

B. predict firm-specific effects

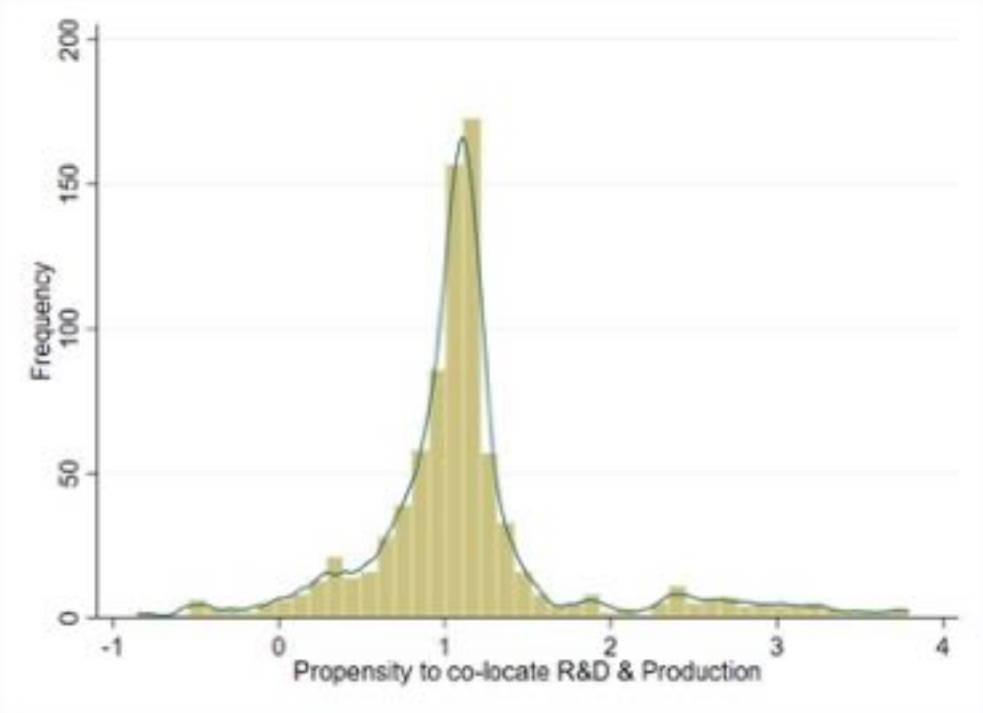
- assuming a distribution for firm-specific effects allows to predict a vector of such firm-specific coefficients.
- this vector can be used as the dependent variable in a second stage (see Alcacer et al., 2018; Castellani and Lavoratori, 2020; Hornstein and Greene, 2012)

$$\hat{\beta}_i = \theta_0 + \theta_1 Z_i + u_i$$

Predicting firm-specific effects

Castellani and Lavoratori (2020)

	Mod. 1			
	Mean		Std. Dev.	
	(1)		(2)	
Intra-firm co-location city level				
Prior firm Production	1.111	[0.0000]	1.8733	[0.0000]
	(0.1774)		(0.2348)	



- Castellani and Lavoratori (2020) find that the propensity to co-locate R&D with production is positive on average positive, but highly heterogenous across firms
- They predict the vector of firm-specific coefficients and regress it on a large number of firm characteristics
- The advantage of this method is that it allows to simultaneously account for a large set of moderating factors, which would not be feasible with neither sub-sample, nor with interactions

Explaining firm-specific effects

Castellani and Lavoratori (2020)

Table 3 Uncovering the sources of heterogeneity in the propensity to co-locate production and R&D, second-stage OLS regression.

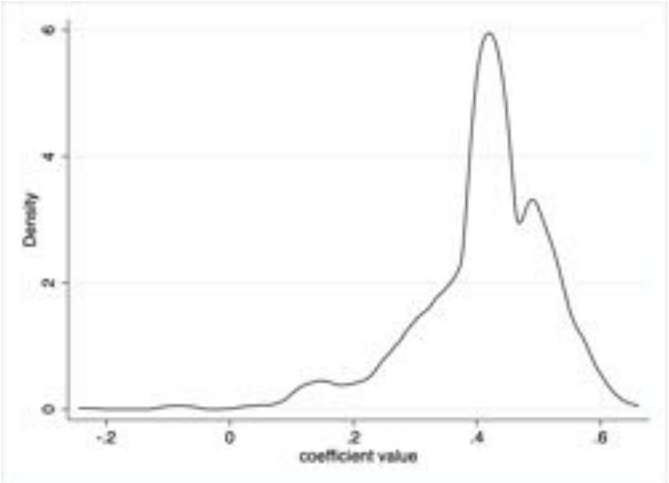
OLS	Propensity to co-locate R&D and production										
	Total sample							Orbis subsample			
	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod. 5	Mod. 6	Mod. 7[§]	Mod. 8	Mod. 9	Mod. 10[§]	Mod. 11[§]
Firm's characteristics											
Geographical dispersion	− 1.6479			− 1.9405	− 2.0697	− 2.0829	− 3.3036	− 2.9916	− 3.4966	− 3.7025	− 4.0443
	(0.8794)			(1.1789)	(1.1742)	(1.1715)	(1.0086)	(1.6513)	(1.9200)	(1.4069)	(1.6067)
	[0.0613]			[0.1001]	[0.0783]	[0.0758]	[0.0011]	[0.0709]	[0.0695]	[0.0089]	[0.0124]
International experience		− 0.0119		0.0052	0.0031	0.0022	− 0.0356	0.0098	− 0.0106	− 0.0352	− 0.0363
		(0.0094)		(0.0129)	(0.0125)	(0.0124)	(0.0081)	(0.0201)	(0.0225)	(0.0123)	(0.0135)
		[0.2045]		[0.6856]	[0.8067]	[0.8572]	[0.0000]	[0.6271]	[0.6391]	[0.0045]	[0.0075]
Share of intangible assets								− 0.352	− 0.3421	− 0.1768	− 0.1763
								(0.2072)	(0.2143)	(0.1153)	(0.1216)
								[0.0902]	[0.1115]	[0.1262]	[0.1481]
Firm age									0.0415		0.0481
									(0.0475)		(0.0283)
									[0.3829]		[0.0902]
Number of patents									0.0205		− 0.0107
									(0.0166)		(0.0092)
									[0.2169]		[0.2460]
Large firm									0.1112		0.0245
									(0.0945)		(0.0525)
									[0.2401]		[0.6408]
Share of foreign subsidiaries									− 0.1678		0.051
									(0.1619)		(0.0764)
									[0.3008]		[0.5052]

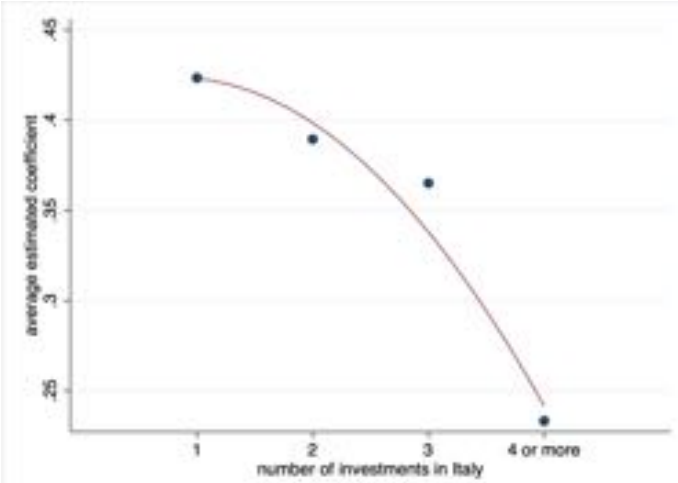
Explaining firm-specific effects

Benfratello, Castellani and d'Ambrosio (2023)

	Model 5 Mixed Logit	
	Mean	**SD**
	(1)	(2)
Log immigrants	0·313*	−0·342***
	(0·187)	(0·075)
Log emigrants	−0·207	−0·004
	(0·231)	(0·115)
Residuals (immigrants)	−0·082	0·024
	(0·114)	(0·167)
Residuals (emigrants)	0·296**	−0·091
	(0·135)	(0·227)

Figure 2: **Distribution of the simulated $\hat{\delta}_f^{\text{Immi}}$ coefficients**





	Model 5 Mixed Logit		Model 6 Mixed Logit	
	Mean	**SD**	**Mean**	**SD**
	(1)	(2)	(3)	(4)
Log immigrants × RD	−0·052		0·042	
	(0·247)		(0·233)	
Log immigrants × Manufacturing	−0·487**		−0·383**	
	(0·197)		(0·181)	
Log immigrants × Market Access	0·630***		0·525***	
	(0·192)		(0·183)	
Log immigrants × Business Services	0·659***		0·623***	
	(0·220)		(0·207)	
Log immigrants × Logistics	−0·137		−0·033	
	(0·240)		(0·221)	
Log immigrants × Construction	−0·206		−0·029	
	(0·243)		(0·231)	
Log emigrants × RD	−0·234		−0·265	
	(0·266)		(0·262)	
Log emigrants × Manufacturing	−0·078		−0·105	
	(0·215)		(0·211)	
Log emigrants × Market access	0·083		0·089	
	(0·220)		(0·216)	
Log emigrants × Business services	0·142		0·093	
	(0·244)		(0·239)	
Log emigrants × Logistics	0·076		0·037	
	(0·262)		(0·260)	
Log emigrants × Construction	0·023		0·018	
	(0·273)		(0·273)	
Log immigrants × More than one investment in Italy			−0·745***	
			(0·127)	
Log emigrants × More than one investment in Italy			0·160	
			(0·137)	
Observations	111,692		111,692	
AIC	3,986.083		3,948.955	
BIC	4,534.623		4,516.741	
LR test of joint significance of the SD	46.467		10.971	
Degrees of freedom	20		20	
Test p-value	0.001		0.947	

Figure 3: **Average estimated coefficient $\hat{\delta}_f^{\text{Immi}}$ by number of investments in Italy**

Table 10: Sources of heterogeneity in the immigrant effect $\hat{\delta}_f^{\text{Immi}}$

Dep. var: $\hat{\delta}_f^{\text{Immi}}$	**Model 1** (1)	**Model 2** (2)	**Model 3** (3)	**Model 4** (4)	**Model 5** (5)
Jobs/mln US$ invested	−0·001***	−0·001**	−0·001**	−0·001**	−0·001
	(0·000)	(0·001)	(0·000)	(0·000)	(0·001)
Type of sector (ref: Services)					
Final goods	−0·032**	−0·033*	−0·033**	−0·036**	0·008
	(0·015)	(0·019)	(0·017)	(0·018)	(0·031)
Intermediate goods	−0·035***	−0·036***	−0·037***	−0·039***	−0·020
	(0·008)	(0·010)	(0·009)	(0·010)	(0·016)
Other goods	−0·029***	−0·029**	−0·029**	−0·031**	0·012
	(0·011)	(0·013)	(0·012)	(0·013)	(0·021)
Dummy: more than one investment in Italy	−0·040***	−0·042***	−0·041***	−0·042***	−0·043**
	(0·010)	(0·012)	(0·011)	(0·012)	(0·020)
Log total capital investment worldwide	−0·014***	−0·015***	−0·015***	−0·015***	−0·006
	(0·002)	(0·003)	(0·002)	(0·003)	(0·004)
Italy share of capital investment worldwide	−0·055***	−0·060***	−0·057***	−0·060***	−0·014
	(0·011)	(0·014)	(0·012)	(0·013)	(0·022)
Area of origin (ref: EU)					
South-East Asia	0·019	0·015	0·022	0·020	0·025
	(0·013)	(0·015)	(0·014)	(0·015)	(0·025)
Non-EU Europe	0·003	0·005	0·002	0·003	0·003
	(0·015)	(0·018)	(0·016)	(0·017)	(0·029)
North America	0·003	0·001	0·002	0·002	0·001
	(0·008)	(0·010)	(0·009)	(0·009)	(0·015)
Rest of the world	0·017	0·015	0·019	0·015	0·006
	(0·020)	(0·024)	(0·022)	(0·023)	(0·039)
Constant	0·458***	0·584***	0·501***	0·513***	0·354***
	(0·014)	(0·016)	(0·015)	(0·015)	(0·026)
Observations	895	898	895	895	895
Test of the joint significance of the regressors	132·687	97·405	122·822	117·517	15·571
Degrees of freedom	11	11	11	11	11
Test p-value	0·000	0·000	0·000	0·000	0·158

Internal versus External Agglomeration Advantages in MNEs Location Choice:

The Role of International Connectivity

Belderbos R., Castellani D., Du H., Lee G.H

Research questions

- Connectivity
    - better connected cities are more attractive

Are agglomeration economies less important if the city is better connected?

- Agglomeration economies
    - cities with activities of other MNE activities are more attractive (external)
    - cities where my firm has invested in the past are more attractive (internal)

Are external agglomeration and internal agglomeration substitute in the same location

The paper in a nutshell

- Advantages of internal and external agglomeration are reduced in importance due to the international connectivity of a location
  - international connectivity weakens the role of **internal agglomeration more** than the role of external agglomeration
  - the moderating effect is **stronger for service-based** than for production-based activities
- Internal and external agglomeration benefits **weaken each other** in the same location

➢ We provide empirical evidence based on cross-border investment data at the city level across six value chain activities

Hypotheses

- International connectivity, temporary proximity and internal agglomeration
  - Temporary proximity
    - mobility of employee and manager for periodic coordination and exchange of knowledge and information
    - builds on organizational proximity (e.g. communities of practice within the MNC)
    - is easier in cities that well connected
    - can act as a coordinating device that reduces spatial transaction costs

H1a: The international connectivity of a location negatively moderates the influence of internal agglomeration economies on the probability that the location is chosen for investment by an MNC

- International connectivity and external agglomeration
  - allows knowledge exchanges between firms at greater distance
  - allows access to intermediate inputs, and specialized labor at greater distance

H1b: The international connectivity of a location negatively moderates the influence of external agglomeration economies on the probability that the location is chosen for investment by an MNC

Hypotheses

- Temporary proximity is a relatively more effective coordination mechanism in *service-related* activities
  - which are largely immaterial, embodied in specialised professionals and inherently more mobile.
  - this reduces the need for permanent physical proximity,
    - as services can be supplied from a distance and occasional face-to-face meetings can be efficient means of coordination and complement long-distance knowledge sharing

- *Production–related* activities rely more on local material assets
  - This reduces the potential for international connectivity to provide the benefits from permanent geographical proximity

H3: The negative moderating effect of international connectivity is stronger for service-related value chain investments than for production-related value chain investments

Hypotheses

- External agglomeration are associated with local knowledge exchange
  - Such greater local knowledge exchange renders the firm a stronger source of outgoing knowledge spillovers to rival firms in the local agglomeration
- Firms benefitting from internal agglomeration advantages are likely to put more emphasis on preserving their knowledge generated and shared internally.
  - They have relatively less to gain from knowledge spillovers related to external agglomeration, and the internal orientation may also render the firm less open to benefit from agglomeration externalities
- When locations offer significant external agglomeration benefits, firms are better off not seeking to increase internal agglomeration in the same location

H3: Internal and external agglomeration are substitute (and they weaken each other's influence on the probability that a location is chosen for investment by a MNC)

Data

Cross-border investments

- fDi markets database on cross-border greenfield investments, 2003-2016
- Six types of value chain activities in 40 industry sectors
  - **Headquarters**: HQ, Shared Services Centre
  - **Logistics**: Logistics, Distribution & Transportation, ICT & Internet infrastructure
  - **Manufacturing** Manufacturing, Recycling
  - **R&D**: Research & Development, Design, Development & Testing, Technical Support Centre
  - **Sales**: Customer Contact Centre, Maintenance & Servicing, Retail, Sales, Marketing & Support
  - **Services**: Business Services, Education & Training
- Investments during 2008-2016
  - Window of five years of prior investments to construct agglomeration measures

Value chain activity	Number of investments	Percentage
Production-related:	*4,395*	*10.30*
Manufacturing	1,741	4.08
R&D	2,654	6.22
Service-related:	*38,241*	*89.70*
Sales	22,733	53.32
Services	10,947	25.68
HQ	2,866	6.72
Logistics	1,695	3.98
Total	42,636	100

Data

Global Cities

- 75 worldwide global cities provided by Mastercard "Worldwide Centres of Commerce Index" (2008)
  - Ranked on 5 dimensions: human capital, information exchange, political and legal stability, livability, economic stability

- **42,636** cross-border investments in **71** global cities by **19,275** firms from **97** home countries
  - Account for **42.2%** of worldwide FDI projects observed in the FDI market database in the period, 2008-2016

HQ

City	Freq.
LONDON	344
SINGAPORE	306
DUBAI	178
DUBLIN	154
HONG KONG	150
PARIS	138
SHANGHAI	119
AMSTERDAM	91
SYDNEY	70
NEW YORK	69

Logistics

City	Freq.
SINGAPORE	162
DUBAI	110
SHANGHAI	91
HONG KONG	90
LONDON	84
SYDNEY	64
MOSCOW	48
PARIS	45
AMSTERDAM	44
BARCELONA	41

Manufacturing

City	Freq.
SHANGHAI	308
SINGAPORE	206
BANGALORE	102
DUBAI	84
BEIJING	82
STPETERSBURG	66
SAO PAULO	61
SHENZHEN	56
BANGKOK	42
JAKARTA	34

R&D

City	Freq.
SINGAPORE	325
SHANGHAI	300
BANGALORE	282
BEIJING	131
DUBLIN	114
LONDON	73
PARIS	58
MUMBAI	56
DUBAI	52
MONTREAL	49

Sales

City	Freq.
LONDON	1953
SINGAPORE	1456
DUBAI	1135
HONG KONG	1043
SHANGHAI	985
PARIS	956
NEW YORK	917
BEIJING	622
SYDNEY	586
TOKYO	582

Services

City	Freq.
LONDON	955
SINGAPORE	803
HONG KONG	664
DUBAI	628
SHANGHAI	484
NEW YORK	455
BEIJING	344
PARIS	335
SYDNEY	298
SAO PAULO	217

Variables and Model

Dependent variable

- Binary variable indicating in which global city the cross-border investment is made

Key explanatory variables

- Internal agglomeration
  - The number of focal firm's prior investments in the 5 value chain activities other than the focal value chain activity of investment in the global city
    - Prior investments weighted by a colocation advantage parameter: different pairs of value chain activities have different degrees of collocation benefits
  - Same value chain collocation/expansion: the number of prior investment in the same value chain activity as the focal investment
- External agglomeration
  - The number of prior investments in the same value chain activity as the focal investments made by all firms in the same industry in the global city
- International Connectivity
  - A composite measure averaging the indexed scores of three dimensions of connectivity: cities' producer services connectivity, international airport passenger traffic flows and international knowledge connectivity

Variables and Model

Control variables

- Distance measures
  - Language distance between home and host countries
  - Geographical distance between home and host cities
  - Cultural distance based on four Hofstede cultural dimensions
  - City-specific: GDP, GDP growth, population density, wage level, patent intensity, the number of world top 500 universities, net migration rate
- Country-specific: Corporate tax rate

Empirical model: Conditional (and Mixed – random coefficient) Logit Models

Results

	Model 1	Model 2	Model 3	Model 4	Model 5	Production-related investments	Service-related investments
City-level variable							
Internal agglomeration		1.232	1.231	1.564	1.605		
		(0.000)	(0.000)	(0.000)	(0.000)		
External agglomeration		0.792	0.783	0.833	0.840		
		(0.000)	(0.000)	(0.000)	(0.000)		
Connectivity			0.0748	0.110	0.101		
			(0.002)	(0.000)	(0.000)		
Observation	2841933	2841933	2841933	2841933	2841933		
Number of projects	42636	42636	42636	42636	42636		
Number of firms	19275	19275	19275	19275	19275		

p-values in parentheses
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Results

	Model 1	Model 2	Model 3	Model 4	Model 5	Production-related investments	Service-related investments
City-level variable							
Internal agglomeration		1.232	1.231	1.564	1.605		
		(0.000)	(0.000)	(0.000)	(0.000)		
External agglomeration		0.792	0.783	0.833	0.840		
		(0.000)	(0.000)	(0.000)	(0.000)		
Connectivity			0.0748	0.110	0.101		
			(0.002)	(0.000)	(0.000)		
Connectivity *internal agglomeration				**-1.337**	**-0.803**		
				(0.000)	**(0.000)**		
Connectivity *external agglomeration				**-0.127**	**-0.125**		
				(0.000)	**(0.000)**		
Observation	2841933	2841933	2841933	2841933	2841933		
Number of projects	42636	42636	42636	42636	42636		
Number of firms	19275	19275	19275	19275	19275		

p-values in parentheses
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Results

	Model 1	Model 2	Model 3	Model 4	Model 5	Production-related investments	Service-related investments
City-level variable							
Internal agglomeration		1.232	1.231	1.564	1.605	1.054	1.491
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
External agglomeration		0.792	0.783	0.833	0.840	0.874	0.794
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Connectivity			0.0748	0.110	0.101	0.0281	0.143
			(0.002)	(0.000)	(0.000)	(0.736)	(0.000)
Connectivity *internal agglomeration				-1.337	-0.803	0.135	-0.975
				(0.000)	(0.000)	(0.665)	(0.000)
Connectivity *external agglomeration				-0.127	-0.125	0.00427	-0.127
				(0.000)	(0.000)	(0.921)	(0.000)
Observation	2841933	2841933	2841933	2841933	2841933	289152	2552781
Number of projects	42636	42636	42636	42636	42636	4395	38241
Number of firms	19275	19275	19275	19275	19275	2371	17993

p-values in parentheses
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Results

	Model 1	Model 2	Model 3	Model 4	Model 5	Production-related investments	Service-related investments
City-level variable							
Internal agglomeration		1.232	1.231	1.564	1.605	1.054	1.491
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
External agglomeration		0.792	0.783	0.833	0.840	0.874	0.794
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Connectivity			0.0748	0.110	0.101	0.0281	0.143
			(0.002)	(0.000)	(0.000)	(0.736)	(0.000)
Connectivity *internal agglomeration				-1.337	-0.803	0.135	-0.975
				(0.000)	(0.000)	(0.665)	(0.000)
Connectivity *external agglomeration				-0.127	-0.125	0.00427	-0.127
				(0.000)	(0.000)	(0.921)	(0.000)
Internal * external agglomeration					-0.532	-0.666	-0.592
					(0.000)	(0.000)	(0.000)
Observation	2841933	2841933	2841933	2841933	2841933	289152	2552781
Number of projects	42636	42636	42636	42636	42636	4395	38241
Number of firms	19275	19275	19275	19275	19275	2371	17993

p-values in parentheses
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Range of elasticities - by connectivity

a. Effects of Agglomeration at different levels of international connectivity

International connectivity:	Elasticity w.r.t. Internal agglomeration	Elasticity w.r.t. External agglomeration	Int./Ext.
Mean - 2SD	2.147*** (0.000)	0.916*** (0.000)	2.344*** (0.000)
Mean	1.582*** (0.000)	0.828*** (0.000)	1.911*** (0.000)
Mean + 2SD	1.015*** (0.000)	0.739*** (0.000)	1.373*** (0.000)

- Elasticities for both internal and external agglomeration decrease as connectivity increases from low to high level
- At all levels of agglomeration, magnitude of decrease is higher for internal agglomeration than external agglomeration

Range of elasticities - by agglomeration

b. Internal (external) Agglomeration at different levels of external (internal) agglomeration

Ext. agglomeration level:	Elasticity w.r.t. Internal agglomeration
Mean - 2SD	3.076*** (0.000)
Mean	1.582*** (0.000)
Mean + 2SD	0.098 (0.640)

Int. agglomeration level:	Elasticity w.r.t. External agglomeration
Mean - 2SD	0.874*** (0.000)
Mean	0.828*** (0.000)
Mean + 2SD	0.781*** (0.000)

- Elasticity of internal (external) agglomeration decreases as the level of external (internal) agglomeration increases -> Trade-offs in MNC's VC investment decision with regard to agglomeration factors

- Effect of internal agglomeration turns insignificant at high level of external agglomeration

Summary

- Agglomeration economies and international connectivity are characteristics that make cities attractive for MNC deciding to locate abroad
- Nevertheless, our results suggest that it would misleading to think that more of all would be beneficial (too much of a good thing)
- Agglomeration economies are more beneficial in poorly connected cities than in highly connected ones
  - This is particularly true for internal agglomeration economies deriving from collocation of different activities of the same firm. International connectivity allow for temporary proximity that can substitute for collocation
- External and internal agglomeration are substitutes
  - Cities can choose whether to foster the creation of clusters by targeting several firms, or focus on encouraging further embeddedness of MNC that has previously located (nurturing existing investors vs. attracting new ones)

Concluding remarks

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Concluding remarks

- connectivity is emerging as a key driver of the location of MNE activities
    - well connected locations can attract MNE activities, even lacking agglomeration externalities benefits
- heterogeneity in connectivity and value chain activities
- the role of intra-city connections
    - IB and (economic/transport) geography complementary views
- geographical granularity of location
    - Zoom-in / Zoom-out
- connectivity and digitalisation