Choose the Neighbor Before the House: Agglomeration Externalities in UK Science Parks

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Definition: Science Park

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- ▶ Different from incubators - well-established firms are welcome

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- ▶ Findings: Positive externalities between firms within the same relatively narrow industry
- ▶ Potential policy implications: Choose firms with similar activities - build specialized science parks

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  1) Low-tech manufacturing industries, such as textiles, ceramics, and cutlery, are geographically concentrated rather than high-tech industries (Devereux et al., 2004)

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- ▶ Policy intervention: science parks

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- ▷ Is it that straightforward?

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- ▶ Total of 3,800 people employed in science parks in 1985; 16,587 in 1992; 76,603 in 2008
- ▷ Nearly entire existing literature case-study based - quantitative research embryonic

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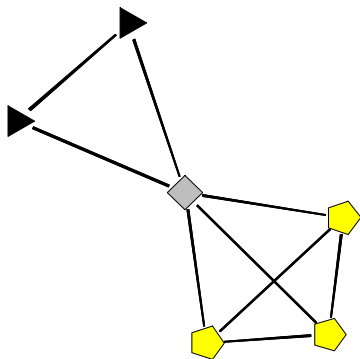
Identification

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- ▶ **Identification of peer effects:** Exploit network heterogeneity
- ▶ **Peer vs correlated effects:** Network fixed effects, selection rule & handwaiving...

Identification of Peer Effects: intuition

- Identification of peer effects through heterogeneity across firms in their relative position in network

Identification of Peer Effects: intuition

$$g = \begin{pmatrix} 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 \end{pmatrix}$$

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- ▶ Example:
- ▷ Black triangles: $d_i(g) = 2$
- ▷ Yellow pentagons: $d_i(g) = 3$
- ▷ Grey square: $d_i(g) = 5$

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- ▶ Why **Bonacich centrality**?

- ▶ Calvó-Armengol et al. (2009) show why

Empirical Approach — Identification

▶ Empirical specification (Spatial Error Model)

$$y_i^* = \sum_{m=1}^{M} \beta^m x_i^m + e_i \tag{2}$$

$$e_i = \mu \sum_{j=1}^{n} g_{ij} + b \sum_{j=1}^{n} g_{ij} e_j + u_i \tag{3}$$

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▶ In matrix notation

$$Y = X\beta + e \qquad (4)$$

$$e = \mu g \mathbf{1} + bge + u \qquad (5)$$

Empirical Approach — Identification (Bramoullé et al., 2009)

- Apply spatial Cochrane-Orcutt transformation:

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- **Structural justification** for spatial error specification!

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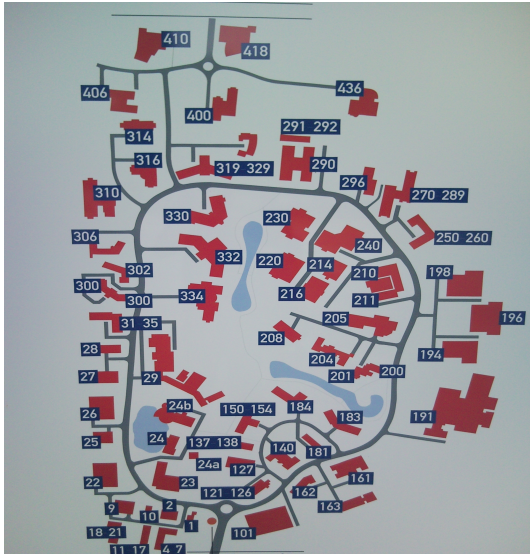   - ► Fully owned and managed by St John's College, Cambridge
    - ► 3,500 sq sq ft in lettable space
- ► Not specialized in a certain area of business activity.

Science Parks - CSP Map

Firm-level financial information and IP

- ▶ Main characteristics of data base used:
  - ▶ Covers population of UK firms over the period 2000-2007
  - ▶ Firm-specific characteristics (FAME & ICC) and information on IP (PATSTAT)
  - ▶ Result of matching FAME database and firm-level IP datasets

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  - ► Result of matching FAME database and firm-level IP datasets
- ► Serious Problem of item-nonresponse - data not missing at random (e.g. 3% of firms report employment data)

Identification of tenants

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- ▶ Identified 412 tenants
- ▶ Regression sample 275 tenants

Tenant Firms - Entry & Exit from/to CSP & SJC

Year	# Tenants	# Entry	# Exit
(1)	(2)	(3)	(4)
2000	127	24	3
2001	170	46	27
2002	182	39	15
2003	199	32	23
2004	221	45	31
2005	230	40	28
2006	239	37	19
2007	266	46	23
# Firms	412	309	169

Tenant Firms - Degree Summary Statistics

Year	Network Density		Mean	Degree Std.Dev.	Firms
		SIC **3**-digit			
2000	0.153		15.17	8.42	99
2007	0.157		28.90	16.63	184
		SIC **2**-digit			
2000	0.325		32.85	17.88	101
2007	0.313		57.73	28.70	184
		SIC **1**-digit			
2000	0.610		65.28	30.79	107
2007	0.678		128.94	54.13	190

Peer effect estimates

Dependent variable: ln No. Patent Applications			
	(1)	(2)	(3)
SIC 3-digit			
ln **Degree** (μ)	0.066***	0.092***	0.078***
	(0.016)	(0.026)	(0.026)
Peer effects (b)	0.163**	0.149**	0.162**
	(0.064)	(0.067)	(0.067)
SIC 2-digit			
ln **Degree** (μ)	0.049***	0.060**	0.055*
	(0.017)	(0.030)	(0.030)
Peer effects (b)	0.062	-0.041	-0.059
	(0.097)	(0.108)	(0.109)
SIC 1-digit			
ln **Degree** (μ)	0.040***	0.007	-0.008
	(0.014)	(0.024)	(0.024)
Peer effects (b)	0.197*	0.125	0.143
	(0.107)	(0.116)	(0.114)
Year dummies	YES	YES	YES
Sector fixed effects	NO	YES	YES
Contextual effects	YES	YES	YES

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- ▶ Positive knowledge spillovers between firms within the same industries at the 3-digit SIC level (much less so at 2-digit level and none at 1-digit level)
- ▷ Evidence for presence of unobserved localized spillovers
- ▷ Let science parks specialize?