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Innovation in Services and University Collaboration

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Background

Services account for 75% of the UK economy (NESTA, 2006).

But the innovation performance is rather disappointing:

24% of firms in the services innovate vs 36% in the manufacturing (CIS4).

Here I focus on the relationship between universities and firms on the one hand and their impact on their propensity to innovate.

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Collaboration with HE Establishments

A weakness of the British innovation system is the relationship between Higher Education Establishments (HEEs) and firms.

For instance, BIS' calculations based on the CIS5 (2004-06) report that only 29% of the respondents collaborate with HEEs while only 20% claim to source information from them.

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Classical papers in the area have focused on the direct impact of R&D spillovers from HEEs on firms' performance (productivity, innovation performance etc.):

Jaffe, 1989; Jaffe et al., 1993; Almeida and Kogut, 1994; Anselin et al., 1997; Acs et al., 1999; Karlsson and Andersson, 2005, Woodward et al., 2006

Evidence supports the notion that HEEs R&D activities generates spillovers for firms in the local area.

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Research suggests that collaboration with firms are an important device for the creation of spillovers from R&D activities of HEEs (Jaffe et al, 1993; Breschi and Lissoni, 2003, 2006).

Unknown is the size of the additional R&D spillovers generated by collaboration of firms with HEEs.

It can be argued that these spillovers matter more than the number of firms directly collaborating with HEEs.

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Aims

To test the extent to which HEE investment in R&D has a positive impact on the propensity to invest in R&D of firms that collaborate with HEEs;

To compute the R&D spillovers generated by the firms collaborating with HEE;

To assess their impact of the production of innovation in Services;

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Approach

Unlike previously papers, I do not directly estimate the impact of HEE investment in R&D on firms' innovation production function.

I am interested in the spillovers it generates through the investment in R&D of service firms that collaborate with HEE.

Assumption: HEE R&D activity is complementary to the R&D investment of collaborating firms.

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I focus on inter-industry spillovers generated at postcode level where the weights are the distance between postcodes:

Collaborating firms may have strong links with local firms and this may favour the spreading of spillovers in the area.

Assumption: I do not consider spillovers due to flows of intermediate goods and services through the value chain.

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Stages

Model the relationship among HEE investment in R&D at regional level and the R&D expenditure of service firms that collaborate with HEE.

Compute spatial R&D spillovers (at postcode level) generated by the R&D of collaborating firms.

Quantify the impact of these R&D spillovers on the service firms' probability of producing innovation.

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Econometric methodology

Selection model to assess the impact of HEE R&D investment on collaborating firms' R&D intensity.

Probit equation to model firms' propensity to innovate.

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Methodology

Decision to invest in R&D and the R&D intensity:

$$RD_i^* = f(x_i, RD_{HEE,t-1,r}) + \varepsilon_r + \varepsilon_s + \varepsilon_{isr}$$

$$RD_i / EMP_i = f(x_i, RD_{HEE,t-1,r}) + \varepsilon_r + \varepsilon_s + \varepsilon_{isr}$$

Controls include:

firms' characteristics (science graduates, collaborating or not, age, size)

sources of information

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Innovation production functions:

$$INN_i^* = f(x_i, SPILL_{pc,t-1}) + \varepsilon_{pc} + \varepsilon_s + \varepsilon_{is,pc}$$

Spillovers are computed by the predicted value of R&D intensity from the first stage.

Controls include:

science and non-science graduates, whether the firms collaborates, part of a group, age, size, training expenditure and sources of knowledge;

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The Data

1258 firms from the Service sectors (Catering, Motor Trade, Property, Retail, Finance, Wholesale).

Community Innovation Survey (4 and 5):

Innovation activities:
- Product, process and wider innovators
- Innovation related expenditures
- Collaboration and Information Sources
- Skilled workforce

ARD2

Density of firms by 4 digit-SIC and postcode

Higher Education R&D (HERD, 2001):

HEE investment in R&D at regional level in 2001;

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Descriptive Statistics

Variables	Obs	Mean	Std. Dev.
Product Innovators	1258	0.24	0.42
Process Innovators	1258	0.13	0.34
Wider Innovators	1258	0.39	0.49
Employment	1241	391.58	1546.13
HEE R&D	1258	562.09	396.06
Internal R&D	705	134.49	861.71
Information sources			
Group	1258	0.69	0.46
Suppliers	1258	0.73	0.44
Customers	1258	0.75	0.43
Competitors	1258	0.71	0.46
University	1258	0.38	0.49
Collaboration			
Group	1258	0.07	0.25
Suppliers	1258	0.09	0.29
Customers	1258	0.09	0.28
Competitors	1258	0.06	0.24
University	1258	0.05	0.23
Age	1258	17.09	10.05
Science	1022	9.94	21.43

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First Stage

	Invest in R&D	*R&D Intensity*
Proportion of Scientists over the workforce	*0.051* *0.7*	***0.3*** ***3.9***
HEE R&D	***0.00015*** ***1.70***	***0.0029*** ***13.5***
Information Source: Group	***-0.14*** ***-1.98***	*0.40* *1.68*
Information Source: Suppliers	***-0.22*** ***-1.81***	*0.51* *1.34*
Information Source: Customers	***-0.17*** ***-1.88***	*-0.17* *-0.68*
Information Source: Competitors	*0.14* *1.46*	*-0.30* *-1.21*
Age	*-0.007* *-0.66*	***1.10*** ***3.1***
Size	*-0.1* *-0.54*	***-0.08*** ***-3.3***
Barriers to Innovation	***-0.09*** ***-2.70***	

SE clustered around sectors and regions
Includes Sector and Region Dummies

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Second stage

	Product Innovators	*Process Innovators*	*Wider Innovators*
Geographical density of firms (by SIC4)	**-0.000080**	**-0.000007**	**-0.000008**
	-5.43	**-0.35**	**-0.49**
Employment	**0.000068**	**0.000086**	**0.000090**
	1.66	**2.42**	**1.70**
R&D Spillovers from coll. firms	0.37	-0.66	0.13
	0.72	-1.25	0.26
HEE R&D	0.000609	0.000137	-0.000047
	0.93	0.32	-0.08
R&D	**0.000835**	0.000089	**0.000191**
	1.84	1.11	**1.86**
Info sources: group	**0.44**	**1.00**	0.41
	1.91	**3.96**	1.36
Info sources: supplier	0.42	0.08	0.15
	1.55	0.23	0.63
Info sources: customers	0.27	0.00	0.42
	0.80	0.01	1.64
Info sources: competitors	0.08	0.27	0.31
	0.28	0.76	1.28

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Info sources: University	**-0.71**	**-0.64**	**-0.94**
	-4.01	**-4.46**	**-6.48**
Collaboration: group	-0.50	-0.30	0.30
	-1.26	-1.08	1.01
Collaboration: suppliers	**1.01**	**0.94**	**0.47**
	4.18	**4.49**	**2.08**
Collaboration: customers	**0.75**	0.08	0.20
	2.46	0.21	0.51
Collaboration: competitors	**-0.61**	-0.06	**-0.51**
	-2.55	-0.18	**-1.87**
Age	**-0.01**	0.00	-0.01
	-1.86	-0.57	-1.54
Proportion of scientists	**0.01**	**0.01**	**0.01**
	4.42	**2.36**	**4.33**

SE clustered around zip and industries.
Includes sector, region and postcode dummies.

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Some additional tests

- KIBS: results do not differ qualitatively
- Analysis on manufacturing shows that spillovers from collaborating universities are important for product innovators.

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Conclusions

HEE investment in R&D does have a positive impact on collaborating firms' propensity to invest in R&D but it is complementary to the R&D intensity;

However, spatial R&D spillovers do not seem to have any significant impact on non-collaborating firms' propensity to innovate.

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