My precious!

The location and diffusion of scientific research: evidence from the Synchrotron Diamond Light Source

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Overview

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- Analyze impact of GBP380 million basic scientific research facility on geographic distribution of research

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- Direct impact on clustering of research that uses facility
- Indirect impact on location of related research

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$\Rightarrow$ Importance of agglomeration externalities produced by indivisible scientific research facilities for science and innovation

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- Main challenge in identifying **causal** link from Diamond to geographical distribution is potential **endogeneity of Diamond's location**:
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  "*[Didcot] is a thriving hub of scientific research [...]. Diamond is surrounded by a number of scientific research facilities making the site a centre of excellence in terms of tools and expertise and therefore the ideal location*."
- If related research increasingly clustered in existing centers regardless of Diamond (government anticipated this) then wrongly attribute affect to Diamond

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- *Assumption:* conditional on observable as well as unobservable location-specific characteristics, in the absence of Diamond, **changes** in pattern would have been same around Diamond and Daresbury

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- Does it matter where infrastructure is sited **within** the UK?

The Diamond Synchrotron

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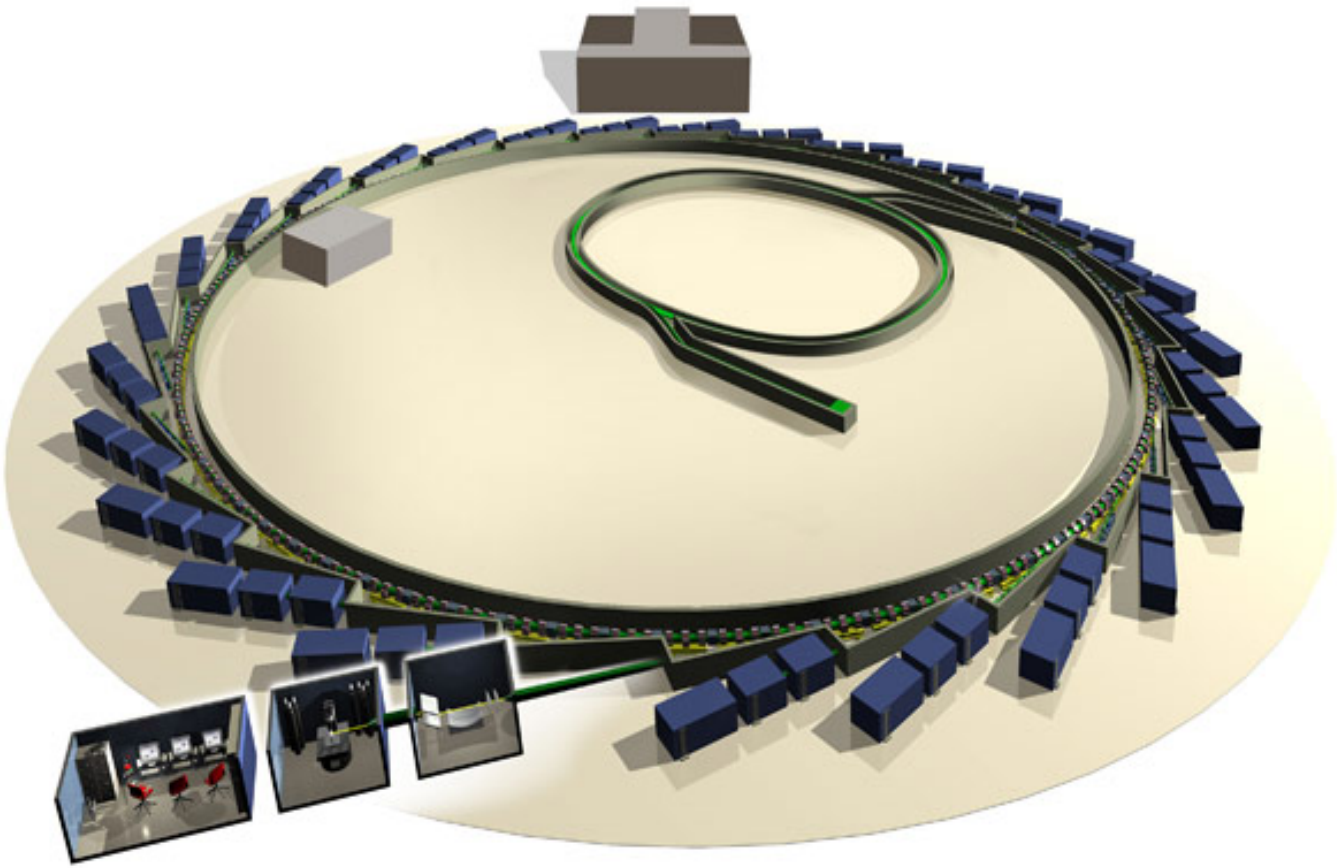
- What is Diamond used for?



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- Novel research in **hard sciences**

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- Government went with Harwell in March 2000

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$$c_{at} = \alpha_a + \sum_t D_t + \sum_R D^r_{DI} + \sum_R D^r_{DI} \times I(t \geq 2007) + \\ + \beta_1 X_{at} + \beta_2 X_{at} \times I(t \geq 2007) + \epsilon_{at} \quad (1)$$

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- α_a: area FE (if included, $\sum_R D^r_{DI}$ drops out)

Use 'runner-up' location:

$$c_{at} = \alpha_a + \sum_t D_t + \sum_R D^r_{DI} + \sum_R D^r_{DI} \times I(t \geq 2007) + \\ + \sum_R D^r_{DA} + \sum_R D^r_{DA} \times I(t \geq 2007) + \\ + \beta_1 X_{at} + \beta_2 X_a t \times I(t \geq 2007) + \epsilon_{at} \quad (2)$$

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- ▷ Analysis at Local Administrative District level (379 LADs)

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  - Focus on GB affiliations: 1,282 authors affiliated to 194 institutions

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- Focus on authors with at least 1 UK affiliation

Summary statistics for Academic publications
Diamond academic journal articles

	Mean	Median	Std. Dev.	Min.	Max.
Descriptive Statistics of Authors & Affiliations (UK only)					
# authors per article	5.69	5	2.99	1	20
# affiliations per article	2.19	2	1.23	1	7
# affiliations per author	1.13	1	0.38	1	3
Geographical Distribution of Authors' Affiliations					
$<$ 2007 (*Before* Establishment of Diamond)					
Distance (km) to Diamond	180.1	120.6	148.4	0	539.3
Distance (km) to Daresbury	206.2	219.4	76.7	0	340.0
$\geq$ 2007 (*After* Establishment of Diamond)					
Distance (km) to Diamond	152.4	116.5	153.1	0	623.4
Distance (km) to Daresbury	196.9	216.5	81.6	0	425.6

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Distance (km) to Diamond	170.5	120.6	136.9	0	554.3
Distance (km) to Daresbury	192.0	209.7	85.7	0	347.3
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Distance (km) to Diamond	164.4	118.4	155.1	0	624.3
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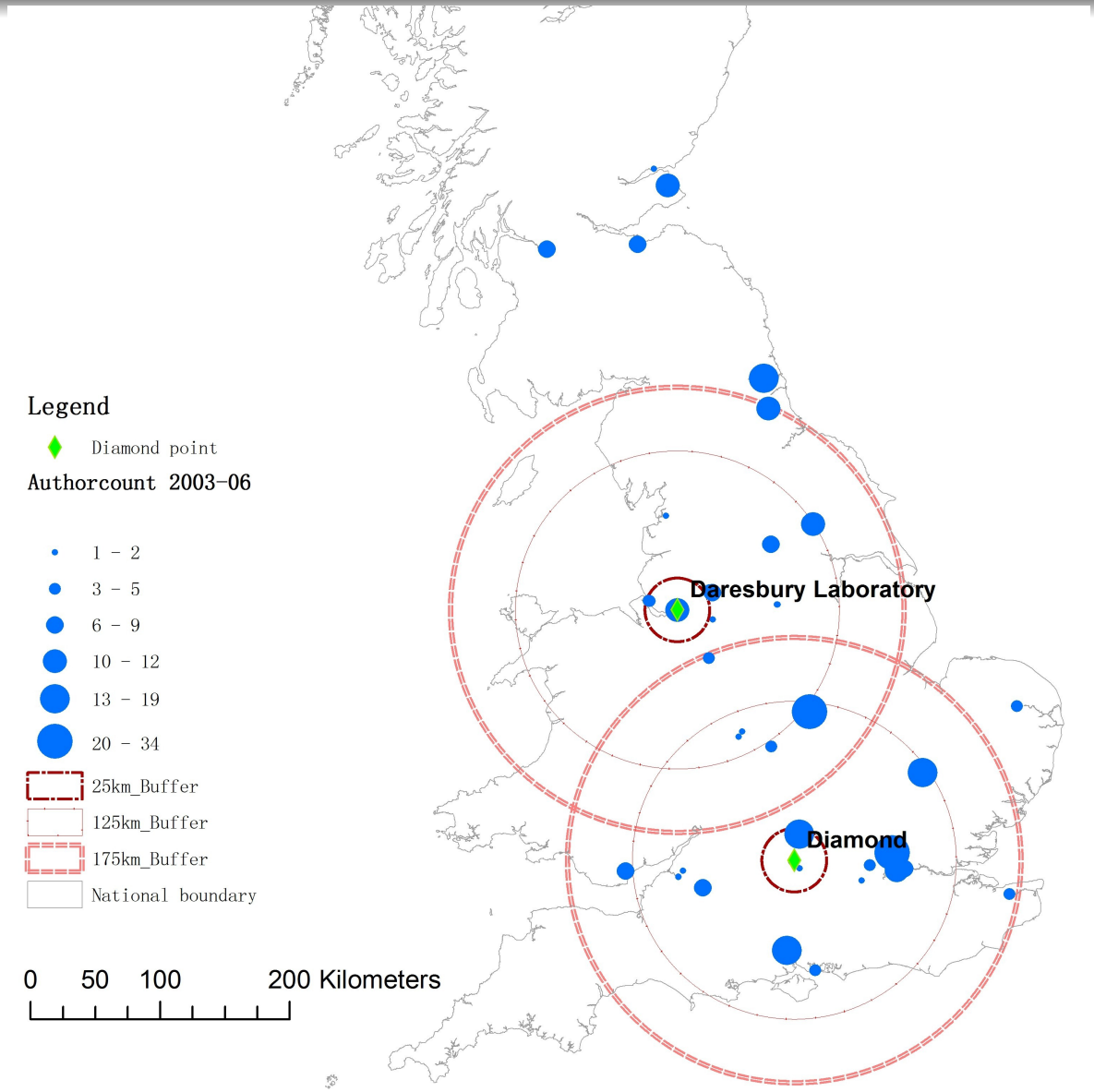
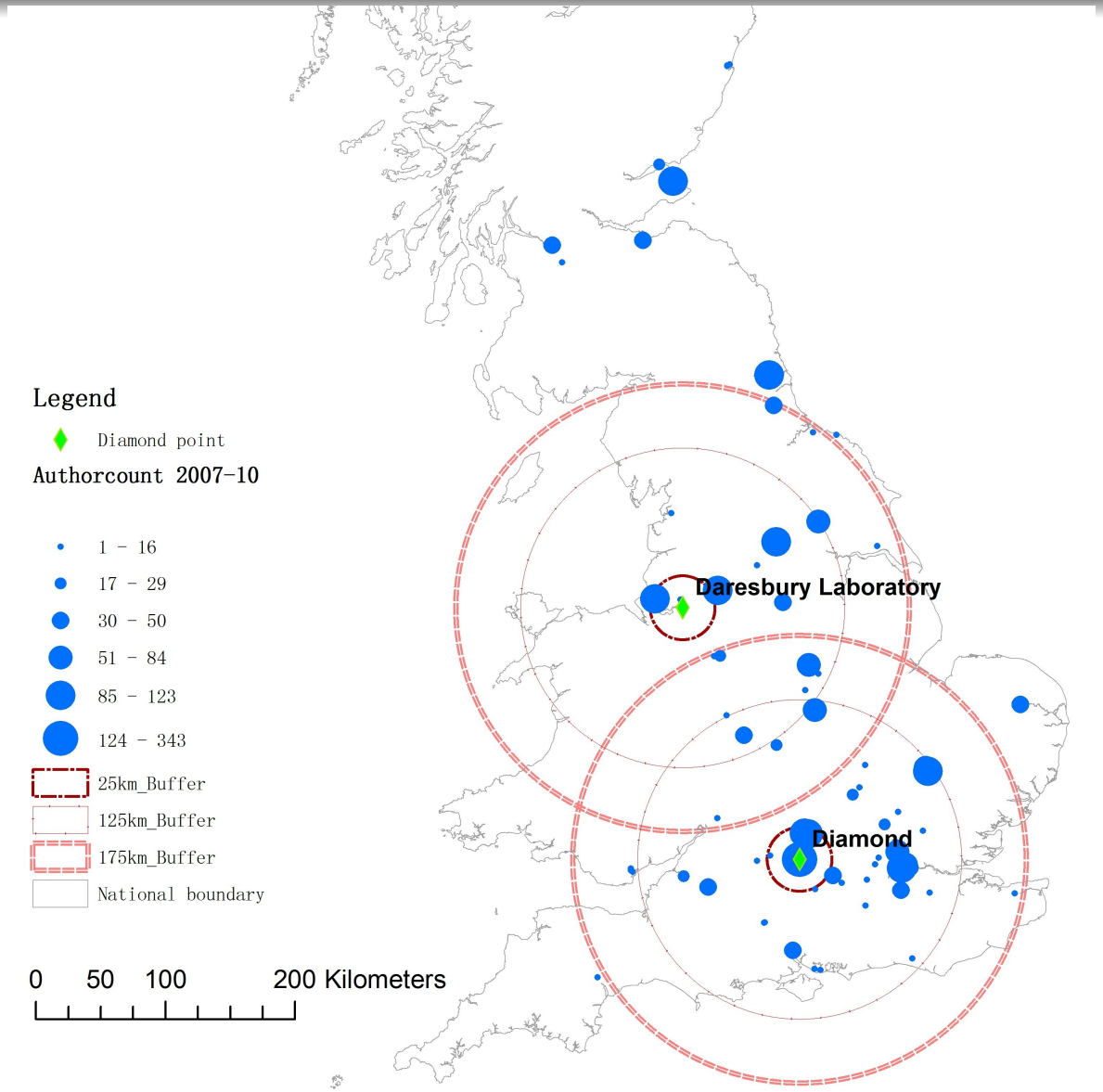
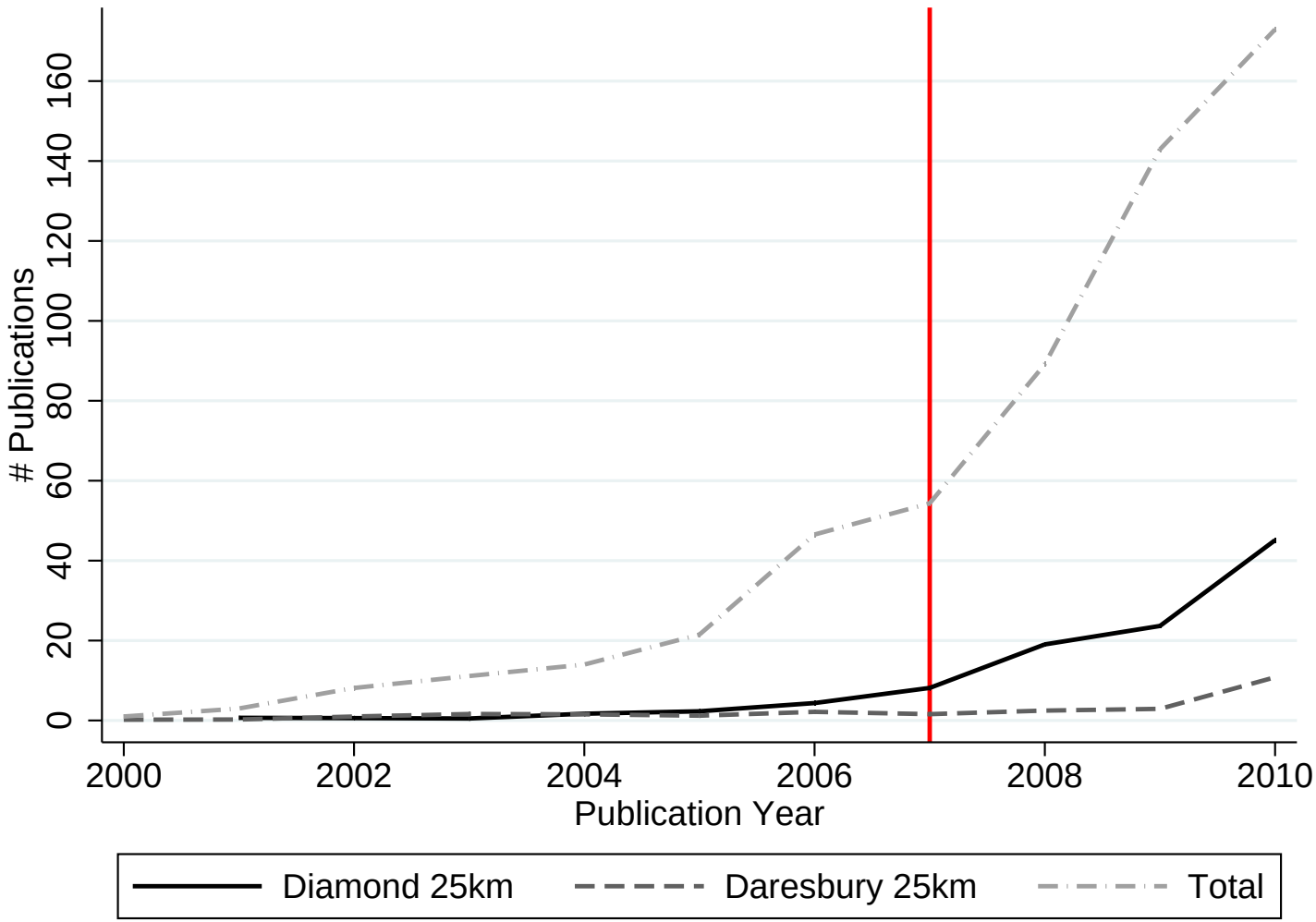
Academic Publications: **Pre**-Diamond 2003-2006



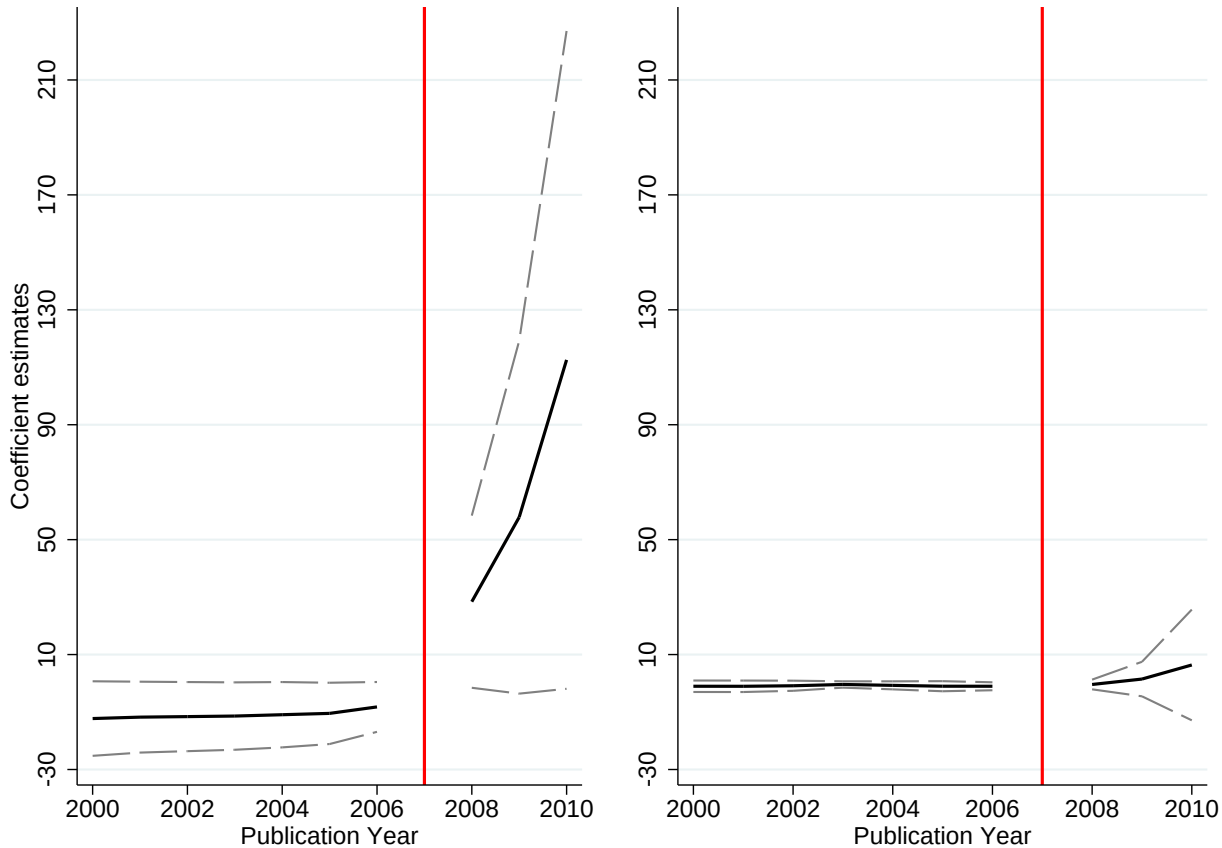
Academic Publications: **Post**-Diamond 2007-2010



Academic Publications: # Articles – Distance to **Diamond** vs **Daresbury**



Academic Publications: annual estimates for **Diamond** vs **Daresbury**



Notes: Annual coefficient estimates β_{Ct} from the regressions $p_{at} = \alpha_a + \sum_t D_t + \beta_{Dt} D_C^{25} \times D_t + \epsilon_{at}$ (with $C = [DI, DA]$) for Diamond and Daresbury (within 25km) where $t = 2000, 2001, ..., 2010$, 2007 is the omitted category.

Academic Articles: OLS (379 LAD – 2000-2010)

		[I]	[II]	[III]	[IV]
Diamond	25km	6.649*	0.529*	0.493	
		(3.474)	(0.308)	(0.305)	
	125km	0.047	0.015	-0.001	
		(0.109)	(0.026)	(0.021)	
	175km	-0.228***	-0.031*	-0.003	
		(0.069)	(0.049)	(0.016)	
Diamond $\times$ $I(t \geq 2007)$	25km		16.834*	16.135*	16.250*
			(8.983)	(8.883)	(8.881)
	125km		0.087	-0.317*	-0.340**
			(0.238)	(0.166)	(0.159)
	175km		-0.528***	-0.045	-0.116
			(0.150)	(0.131)	(0.126)
Time dummies		YES	YES	YES	YES
Controls		NO	NO	YES	YES
Fixed Effects		NO	NO	NO	YES
Daresbury		NO	NO	NO	NO
Obs		4,121	4,121	4,121	4,121

Controls: % NVQ4 and above; % NVQ4 and above $\times$ $I(t \geq 2007)$; Labor force; Labor force $\times$ $I(t \geq 2007)$.

Academic Articles: OLS (379 LAD – 2000-2010)

		[I]	[II]	[III]	[IV]
Diamond	25km	6.649*	0.529*	0.493	
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Academic Articles: OLS (379 LAD – 2000-2010)

		[I]	[II]	[III]	[IV]
Diamond × $I(t \geq 2007)$	25km	16.788*	16.277*	17.071*	16.482*
		(8.985)	(8.886)	(8.987)	(8.887)
	125km	0.044	-0.309	0.327	-0.093
		(0.307)	(0.233)	(0.245)	(0.179)
	175km	-0.572**	-0.087	-0.289*	0.130
		(0.245)	(0.219)	(0.159)	(0.176)
Daresbury × $I(t \geq 2007)$	25km	1.060	0.811	1.343	1.052
		(1.113)	(1.029)	(1.098)	(1.018)
	125km	-0.107	-0.002	0.117	0.187
		(0.316)	(0.248)	(0.250)	(0.196)
	175km	-0.347*	-0.016	-0.357**	0.140
		(0.329)	(0.254)	(0.151)	(0.178)
Time dummies		YES	YES	YES	YES
Fixed Effects		YES	YES	YES	YES
Controls		NO	YES	NO	YES
Newcastle		NO	NO	YES	YES
Obs		4,121	4,121	4,121	4,121

Controls: % NVQ4 and above; % NVQ4 and above × $I(t \geq 2007)$; Labor force; Labor force × $I(t \geq 2007)$.

Academic Articles: OLS (379 LAD – 2000-2010)

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Diamond $\times$ $I(t \geq 2007)$	25km	16.788*	16.277*	17.071*	16.482*
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Robustness – variations of the basic model

- Channels:
  - Research input: author counts by LA and year
  - Research input: 'unique' institution counts by LA and year
- Vary size of distance rings (30km, 100km, 150km)
- Vary number of distance rings (25km, 125km; 25km, 75km, 125km, 175km)
- Daresbury shut-down effect
- Diamond construction effect
- Limit sample to LAs that report a positive author/article count in at least 1 sample year
- Alternative ways of constructing related articles sample (field/journal restrictions)
- Count data model

Conclusion

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- Not driven by increased proximity to existing clusters (unless unique to Diamond)
- Work in progress...