Does light touch cluster policy work? Evaluating the Tech City programme

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All the outputs have been granted final clearance by the staff of the SDS-UKDA.

Telling stories with data

- **Today we're going to do three things**

1. Look at tech clusters and policies for them [conceptual framework, literature review]
2. Explore a London tech cluster's origin story [qualitative methods, descriptives]
3. Look at a cluster programme and assess its impacts [quantitative methods, causal inference]

- I'll draw on three papers of mine: Nathan and Vandore (2014 EPA), Nathan et al (2019 JOEG), Nathan (2019 CEP DP) [refs]

Telling stories with data

- **By the end of the talk you should have …**

1. Some key **concepts from urban economics and economic geography** for thinking about urban clusters
2. Key **facts** about the East London tech cluster; its origins; the effects of cluster policy
3. An **overview of qualitative and quantitative methods** you can use to explore urban clusters and cluster policies

- I'll use three of my own papers: Nathan and Vandore (2014 EPA), Nathan et al (2019 JOEG), Nathan (2019 CEP DP) [refs]

Background

- **Background:** London tech ecosystem is a world player
- From the 2019 Tech Nation report:
  - Over 50,000 London **tech firms** in 2018
  - Over 260,000 **workers in tech** in 2018
  - **VC dealflow**: £384m in 2013, £1.8bn in 2018
  - **Sector strengths**: fintech, retail tech, AI …
  - **Unicorns**: DeepMind; Transferwise; Deliveroo …
  - https://technation.io/report2019/

- So far, resilient to a) 2008 crash b) Brexit …
- **Question: how did all this come about?**

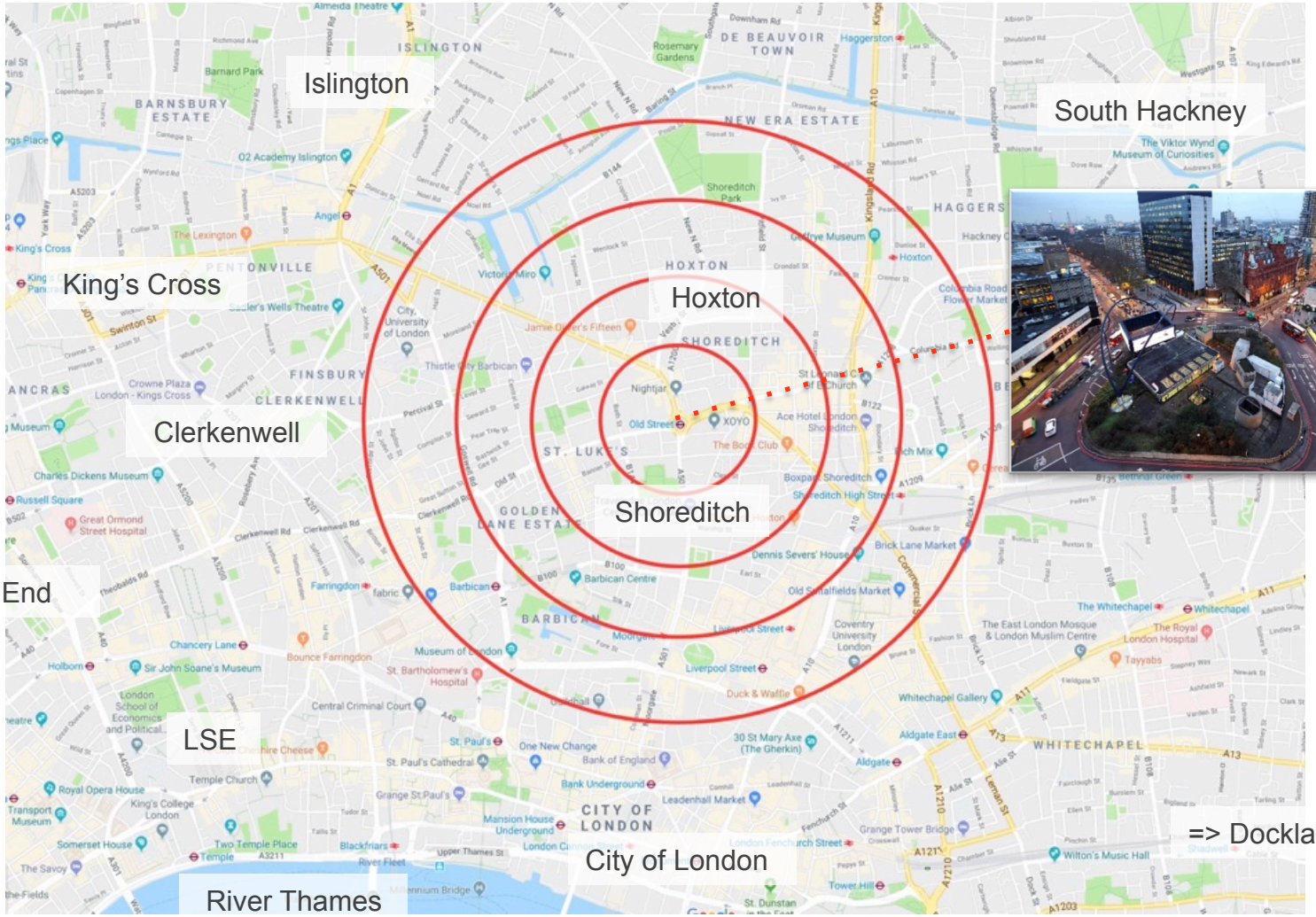
Background

- **East London is an important part of the London tech story**. A cluster in Shoreditch dominated by 'digital content' activity (media, design, marketing, web etc.) which grew 'organically' for years: then, a big policy intervention in 2010.

- **I want to know**: what effects did the policy have, and how?

- **Why bother?** Four reasons:
  - Lots of cities have clusters like this! NYC, Berlin, Paris, Stockholm …
  - Cluster policy is popular, but many experts don't like it. Who's right?
  - Surprisingly few robust impact evaluations of cluster policies
  - Tech City programme is distinctive – any lessons to learn?

The cluster



Red lines = 250m rings from Old St roundabout. In 2010 there were c. 2,800 tech firms in the area covered by the outermost circle, 1km from the roundabout.

A success story?


Shoreditch office rents to rise as Tech City grows

Why London is the tech city of the future

Source: Google Trends. Searches for “Tech City” + London

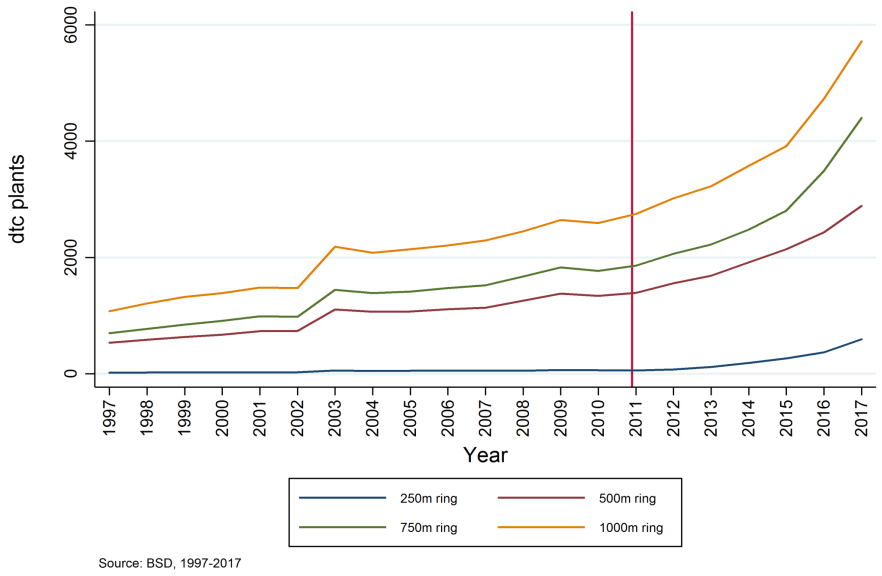
*Tech City, the heart of London’s tech sector, has become the biggest cluster in Europe over the last three years, **growing out of east London to span the entire capital**.*

(London Mayor Boris Johnson, March 2014)

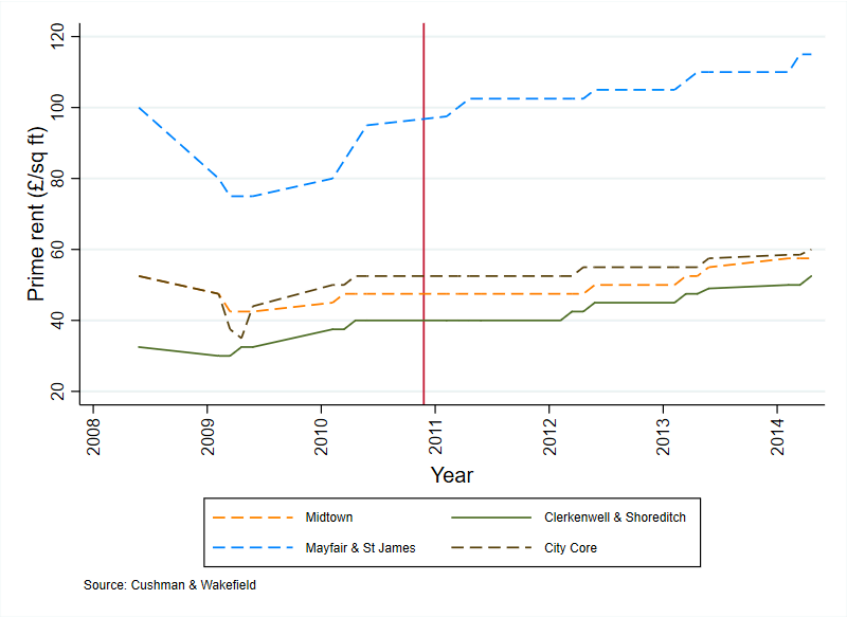
Detail

Cluster trends

Tech firm counts, 1997-2017



Prime rents, 2008-2014



The cluster has been dominated by 'digital content' (media, design, web etc.) with little 'core tech' (hardware, software etc.)

The Shoreditch rent gap with nearby Midtown (Clerkenwell + Holborn) and the City Core (West End) has also narrowed

What – if anything – has the policy changed?

Framework

Clusters: basics

- Basic idea: **colocation + collaboration by firms in cities** fosters innovation, growth (Marshall 1918; Chatterji et al 2014)
- **Same industry** (Marshall) vs. **cross-industry** (Jacobs)
- Old idea, revived by Michael Porter in the 1990s (Porter 1996)
- More recently, some **important extensions**:
  - Clusters **evolve through 'branching'** of industry (Boschma and Frenken 2011)
  - **ICT allows globalised workflows** for small firms (Bathelt 2005, Varian 2011)
  - Clusters as **hubs in larger production systems** (Sturgeon 2008 et al)

Urban tech clusters

- Urban tech clusters are distinctive, typically characterised by:
  - Tight cluster shapes
  - Cheap inner urban locations (at least, in the early days)
  - Mix of face to face and remote workflows
  - Lots of networking (because lots of small firms and startups)
  - Good amenities (bars, cafes and ‘soft infrastructure’)
  - Functional links to other industries (often media/content)

  - Competition for land uses (resi vs industrial vs commercial)
  - Importance of real estate industry + media in pushing cluster brands
- See Martins (2015) for a case study of Shoreditch spaces

Cluster policy

- **Clusters usually arise ‘organically’. But obvious market failures where policy could help** (Helmers 2017)
  - poor location choices by firms
  - lack of information about the cluster
  - costs of co-ordinating firm decisions
  - costs of networking
  - lack of affordable workspace, etc.
- Porter (1996, 2000) argues that clusters can be developed by mapping strengths; better firm-firm links; better infrastructure; building up local markets. … **Positive feedback loops**

Cluster policy: critique

- Porter's notion of 'clusters' is **vague**; hard to use this to make policy (Martin and Sunley 2003)
- Clusters involve **both positive and negative feedback loops** (Duranton 2011, Nathan and Overman 2013):
  - Agglomeration effects: sharing, matching, learning (+)
  - Competition effects: staff, space, market (- firms; + cluster?)
  - Crowding effects: cost of being there goes up (-)
- **Useful framework for analysing cluster change!**
- BUT not obvious what best policy choices are; lots of tradeoffs

Tech City: Origins

Map

A very brief history of the area

- Boundary of Islington, Hackney and the City of London
- Rich industrial history: furniture, textiles, jewellery, printing and design
- Post-WW2 decline, severe de-industrialisation in 1980s …
- … empty buildings gradually filled by business services; creative industries; loft-dwellers …
- … in the 1990s, a ‘new media’ scene and a vibrant night time economy developed …

- So, **today’s cluster has ‘branched’ from previous versions**

Tech community origins

- Between 2008 and 2012, we interviewed lots of local firms …

- **Branching**: ‘new media’, design industries moving east from Soho and Clerkenwell
- **Dotcoms** and **post-2001 crash** survivors (some, millionaires)
- **Haddock mailing list** [http://www.haddock.org]
- Early UK **blogging** scene [‘weblogs’, livejournal etc.]
- **Jobs at the BBC**, especially on the first BBC website

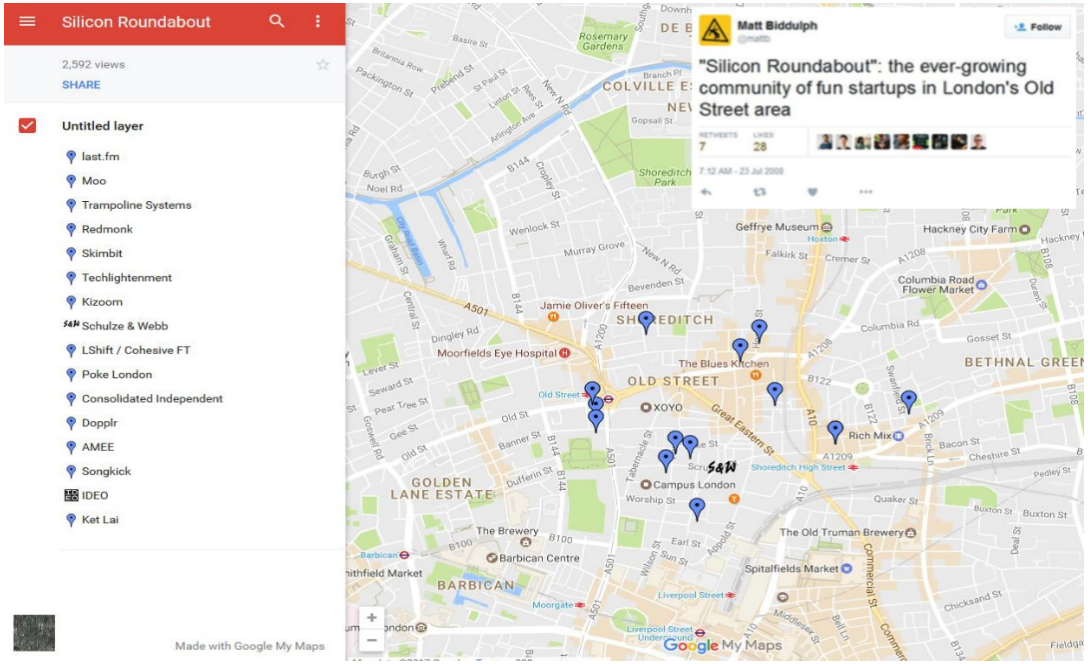
What people told us

We live locally. All the firms live locally. *We knew we wanted to be here, it made sense … we knew the area well, knew it was very vibrant, very close to home, lots of cheap space, lots of flexible space …* ***we were subletting from someone, then from someone else. Then the first person we sublet from sublet from us, then someone else came, then we took the whole space … then we moved out. [F11]***

We looked at lots of places, and there were a couple of companies in this area already, and we moved here because the other companies were here. *And you know… the first weekend we were here we went out and got some sandwiches and sat in the park …* ***and I ran into some friends who worked at [redacted]. And that was, you know we talked about some possible ways we could work together*** *… [F3]*

Source: Nathan and Vandore (2014 EPA), Nathan et al (2019 JOEG)

Silicon Roundabout



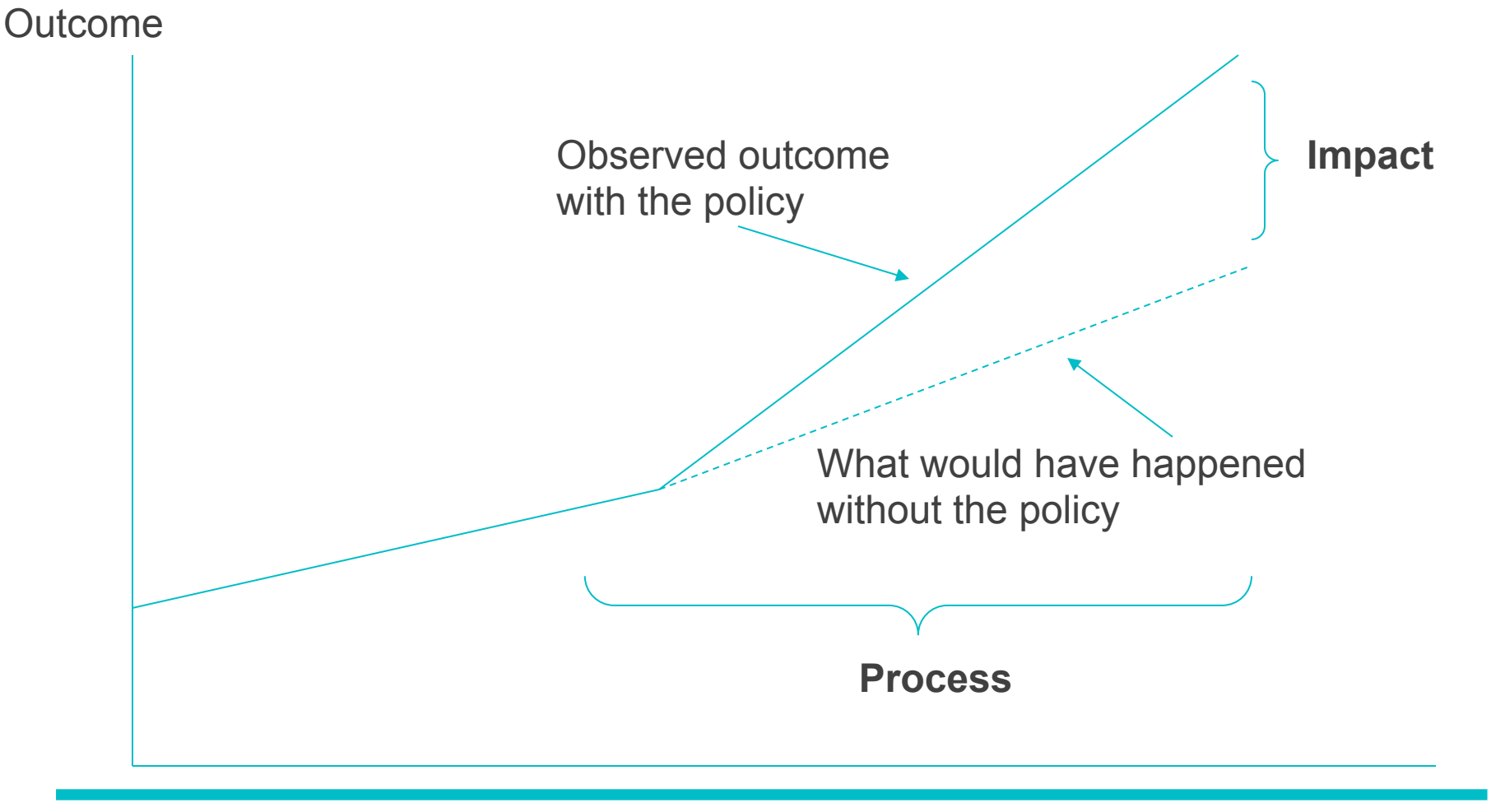
Source: http://twitter.com/mattb, accessed 25 November 2015; http://bit.ly/siliconroundabout, accessed 17 March 2017; Wired (2010)

The policy

- **Surprise announcement** by David Cameron, Nov 2010:
  - No explicit boundaries, but focused on Old St area
  - Place-branding, marketing for the area
  - Attracting FDI to the area
  - Business support for selected local firms
  - Public-private networking; lobbying central Government
  - Tax breaks for early stage finance [national programme]
  - Delivery body = Tech City Investment Organisation [now Tech Nation]
- *"Tech City … has become the biggest cluster in Europe over the last three years, growing out of east London to span the entire capital."* (Boris Johnson, London Mayor, 2014)

Tech City: policy impacts

What do we want to know?



Adapted from OECD 2004, ch. 10

what works centre for local economic growth

Research design

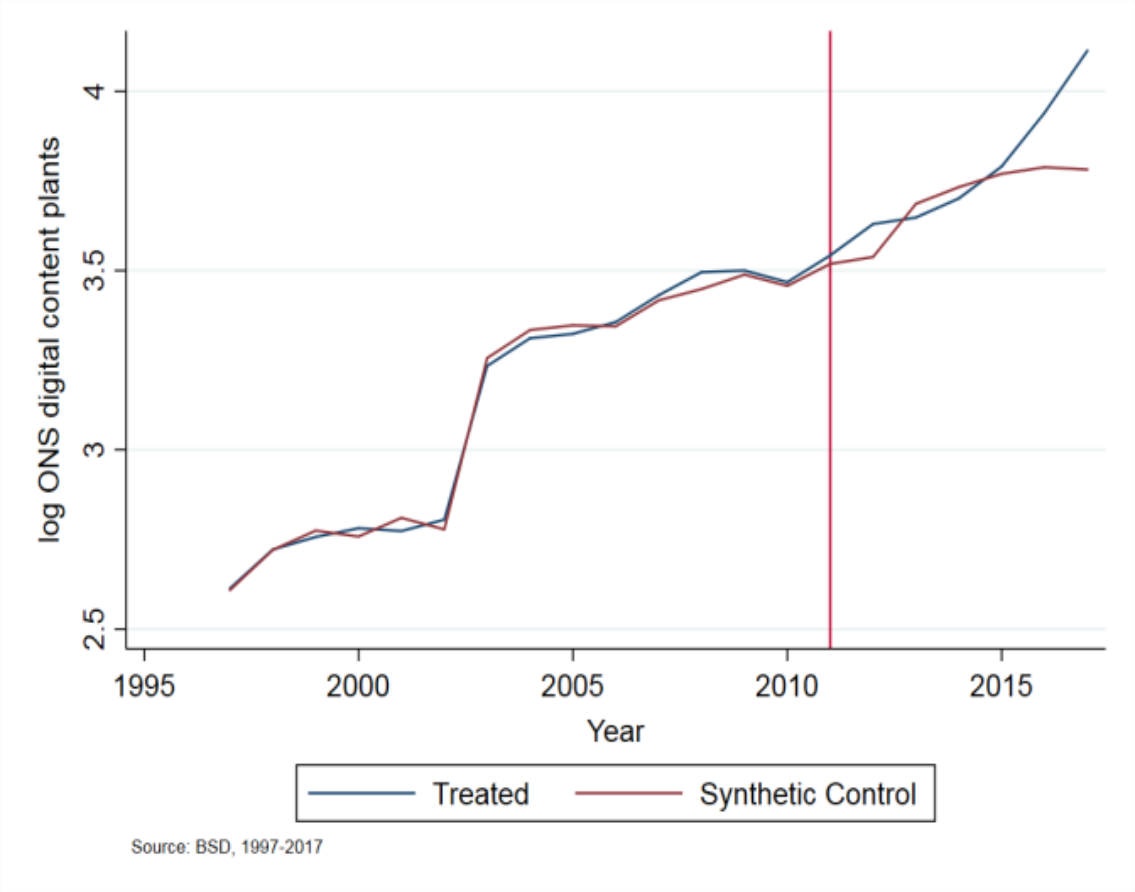
- **Setup**: look at cluster size, density, firm performance. Compare 'digital tech' and 'digital content' firms [build] [desc]

- **Option 1**: compare changes in Tech City area with changes in similar London neighbourhoods ('difference in differences'). I use propensity score matching to find control areas
- *Problems: control areas aren't like for like* [matching], *control areas don't follow parallel trends pre-policy* [balancing]

- **Option 2**: compare Tech City to a weighted average of similar neighbourhoods ('synthetic control') (Abadie et al 2010)
- *How does the synthetic control work … ?*

Synthetic control predictors

Synthetic control: example



Blue = change in **actual Tech City area**

Red = change in **synthetic Tech City**

Synthetic Tech City is built from a weighted average of 213 rest-of-London LSOAs selected through nearest-neighbour matching.

Vertical line = policy rollout

Estimation

- Generalised DID: for neighbourhood *i*, year *t*, I estimate:

$$Y_{it} = I_i + T_t + aTC_{it} + \mathbf{X}\boldsymbol{b}_{it-n} + e_{it} \quad (1)$$

- Synthetic control: ATT for Tech City is given by:

$$a_1 = Y_{1t} - \sum_{i \geq 2} \mathbf{W}_i Y_{it} \quad (2)$$

- **W** = *i*x1 vector for matched control neighbourhoods (w_2, … w_{i+1}), where $0 \leq w \leq 1$. **W*** minimises prior prediction error:

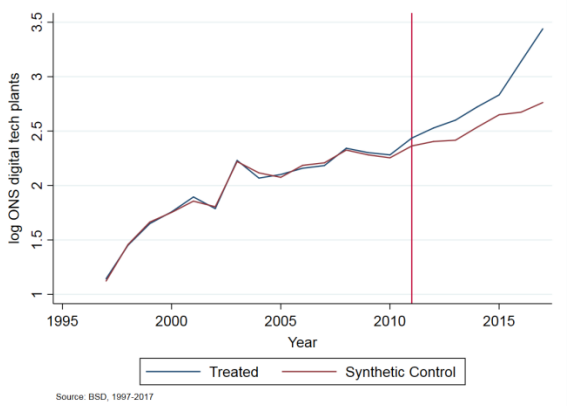
$$\mathbf{W}^* = Min(\mathbf{X}_1 - \mathbf{X}_0\mathbf{W})`\mathbf{V}(\mathbf{X}_1 - \mathbf{X}_0\mathbf{W}) \quad (3)$$

- Various specification tests for **V** and **X** …
- Inference via fit-based placebo tests

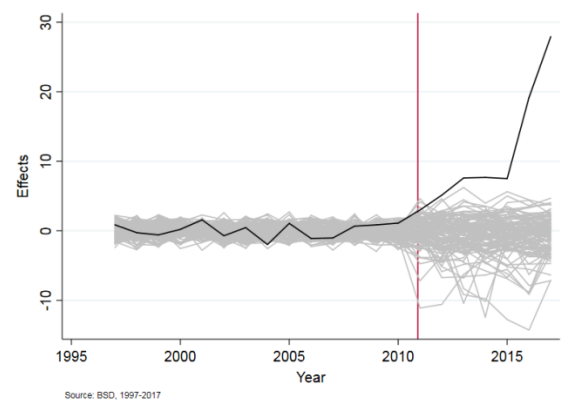
Results table

Results: # tech firms

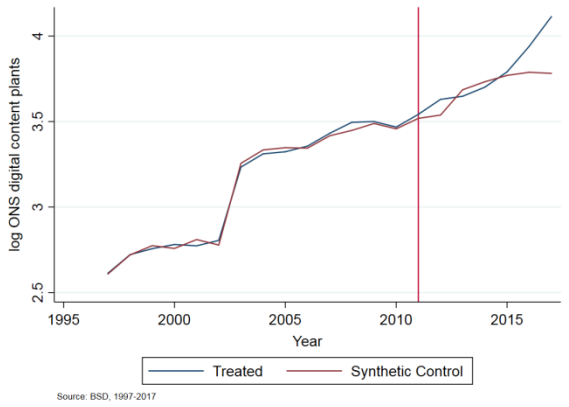
Log digitech firms



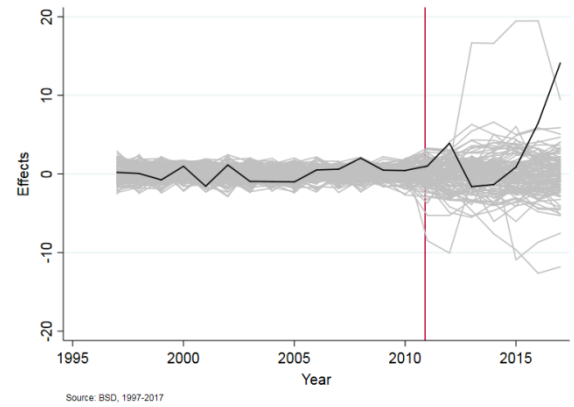
Placebo test, log digitech firms



Log content firms



Placebo test, log content firms

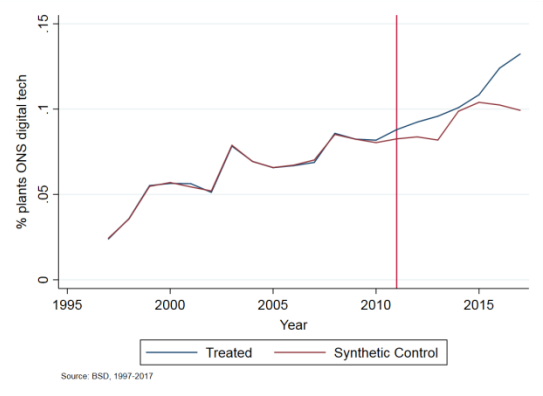


The left column shows outcomes for Tech City LSOAs (blue) vs. synthetic Tech City (red), the no-policy counterfactual scenario. The right column shows precision-weighted effect sizes for Tech City (black) versus 213 placebo units in the donor pool (grey). Effect sizes are weighted by pre-treatment RMSPE.

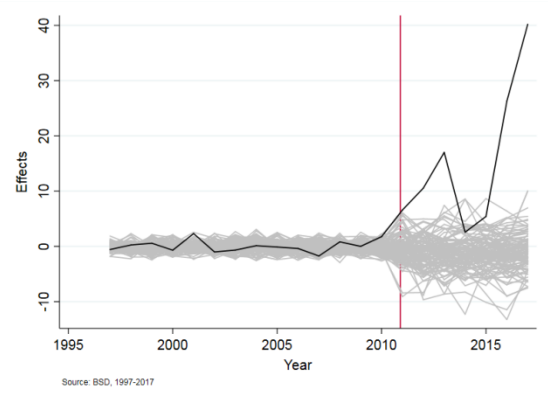
Results table

Results: % tech firms

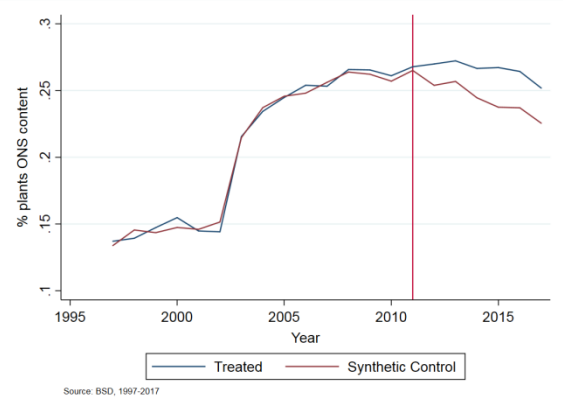
% digitech firms



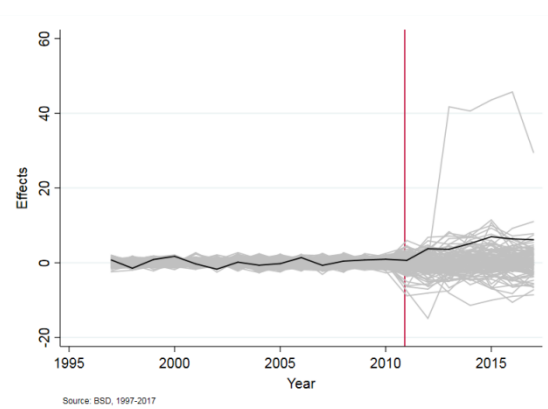
Placebo test, % digitech firms



% content firms



Placebo test, % content firms



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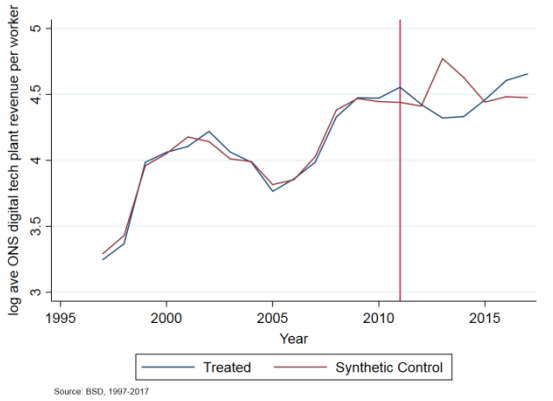
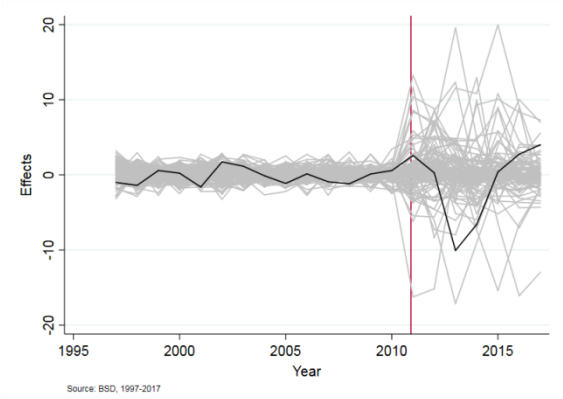
Results table

Results: tech firm revenue/worker

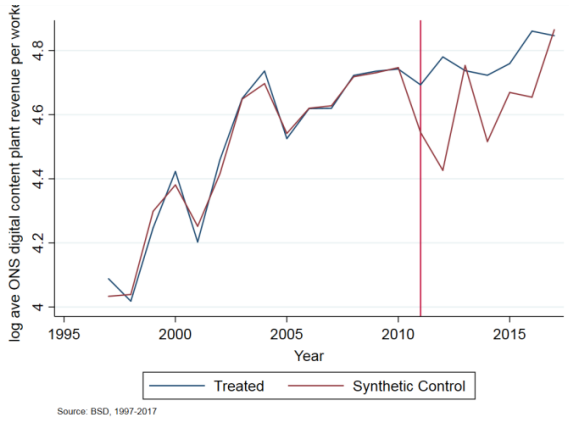
Log digitech firm performance



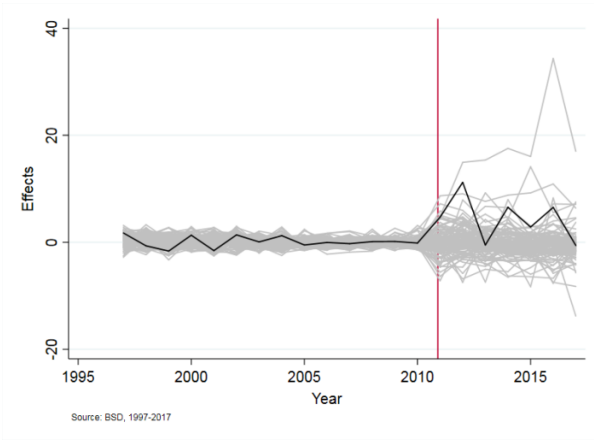
Placebo test, log digitech



Log content firm performance



Placebo test, log content



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Extensions

- **Timing:** outcomes start changing *before* policy starts. What does the policy add? In 7/10 cases, effect sizes/year are *smaller* after policy starts. Implies little added value [detail]

- **Dispersion channel:** big rises in digital tech activity in inner ring (<250m from roundabout); digital content plants and jobs move to outermost ring (750-1000m) [detail]. In and out-movers mainly within rest of London

- **Competition channel:** cluster growth driven by new entry; falling share of leavers; little role of foreign-owned firms [detail]. No policy effect on high-growth firm activity [detail]

Discussion

- What did the Tech City policy do and how?
  - **Bigger and denser cluster.** Driven by new entrants > in-movers. Some evidence of within-cluster crowding => dispersion
  - **Mixed performance effects**. Competition > agglomeration for newer tech firms. Rising churn. No evidence policy => high-growth activity
  - **Little added value** – policy largely 'rode the wave'. Results consistent with weaker marginal value of cluster location

- **Did it work? Yes**, if you just care about size. **No,** if you also care about cluster performance and composition (which you should)
- **Could it work elsewhere?** Unlikely for smaller places. Maybe for other big cities where clusters are already growing
- **Other lessons?** Future policy in those cities needs *more careful design*, especially in setting objectives => policy actions

Recap

- **You should now have …**

1. Key **facts** about the East London tech cluster; its origins; the effects of cluster policy

2. Some key **concepts from urban economics and economic geography** for thinking about urban clusters

3. An **overview of qualitative and quantitative methods** you can use to explore urban clusters and cluster policies

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References

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Thanks!

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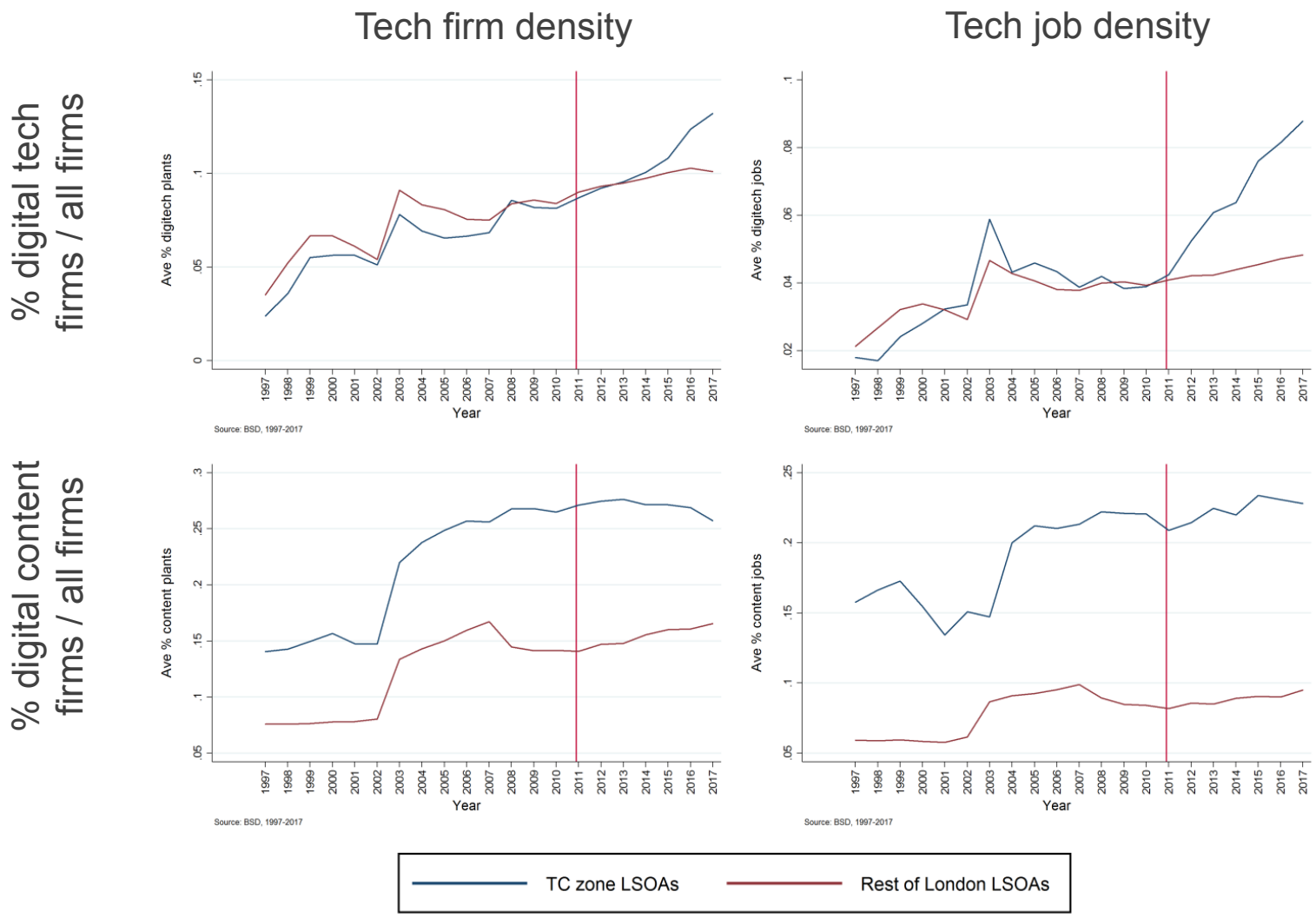
Extras

The cluster is unlike the rest of London



TC vs rest of London: pre-treatment

Variable	TC lsoa	ROGL lsoa
ONS digital tech plant count	15.854	4.297
ONS content plant count	57.503	9.620
ONS digitech & content plant count	72.406	13.616
GI tech plant count	103.826	26.952
% plants ONS digital tech	0.063	0.071
% plants ONS digital content	0.208	0.118
% plants ONS digital tech & content	0.267	0.184
% plants GI tech	0.359	0.361
LSOA total employment	4199.506	796.347
ONS digital tech employment	172.100	21.944
ONS content plant employment	928.866	76.554
ONS digitech & content plant employment	1070.226	96.179
GI tech plant employment	1941.463	291.417
% employment ONS digital tech	0.036	0.036
% employment ONS digital content	0.185	0.077
% employment ONS digital tech & content	0.218	0.109
% employment GI tech	0.357	0.329
LSOA total revenue per worker	1.35e+05	17763.513
Total ONS digital tech revenue	1816.104	429.743
Total ONS content plant revenue	8931.765	1440.213
Total ONS digitech & content plant revenue	10654.802	1838.854
GI tech plant revenue	1.01e+05	8019.650
LSOA mean plant revenue per worker	274.280	110.875
mean ONS digital tech revenue per worker	86.051	83.444
mean ONS content revenue per worker	145.584	101.966
mean ONS digitech & content revenue per worker	142.313	92.411
Mean GI tech revenue per worker	409.367	104.468
Observations	*350*	*67144*

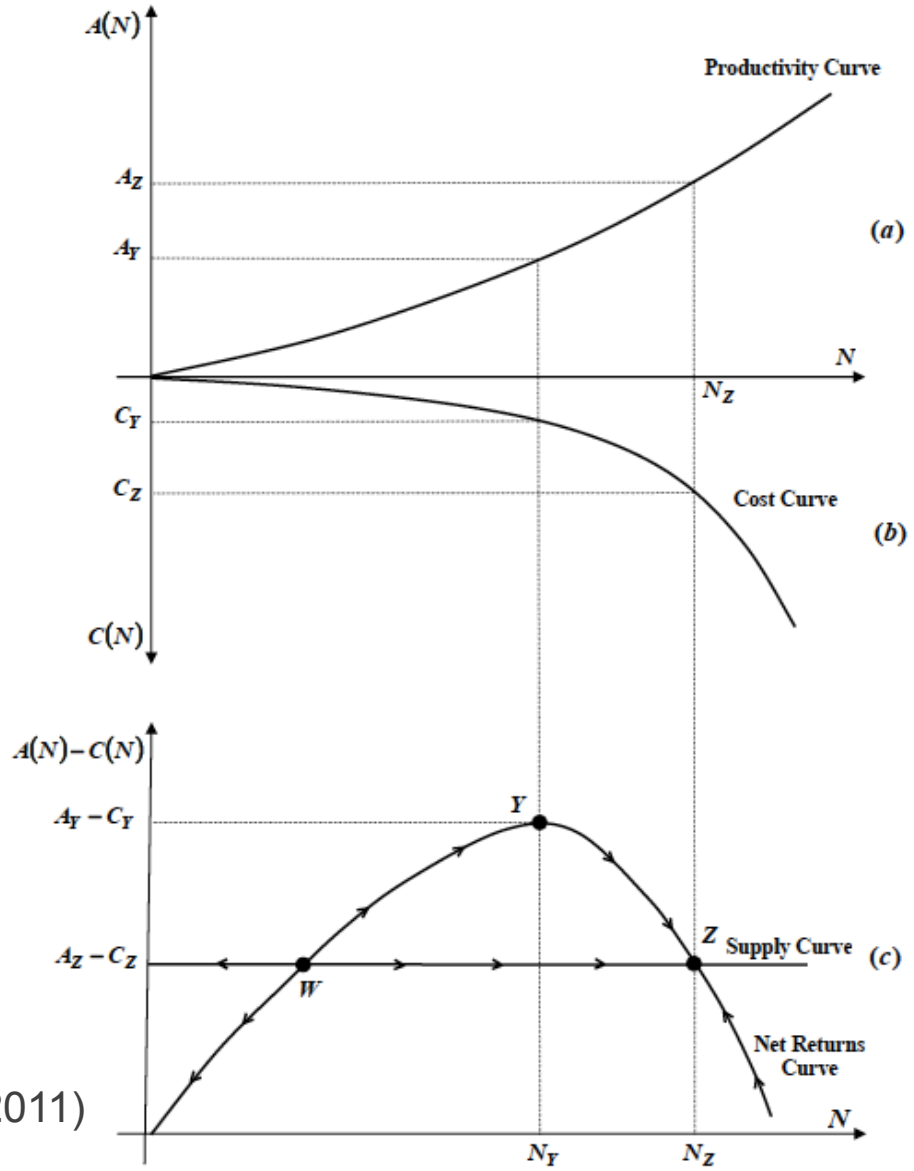
Source: BSD.

TC vs rest of London: pre-treatment (2)

Variable	TC lsoa	ROGL lsoa
Herfindahl Index	0.148	0.150
LSOA total cafes and restaurants	7.734	2.511
LSOA total bars pubs and clubs	3.340	0.989
LSOA total coworking spaces	1.740	0.646
LSOA total galleries and museums	0.180	0.048
LSOA total libraries	0.323	0.085
LSOA total hotels	0.000	0.000
LSOA total other accommodation	0.080	0.057
LSOA total arts and arts support activities	11.349	2.573
LSOA total supporting arts orgs	0.271	0.068
LSOA total HEIs	0.557	0.143
LSOA count of TFL stations	0.120	0.098
LA share of non-UK born	0.310	0.256
LA share of residents aged 18-29	0.231	0.197
Observations	*350*	*67144*

Source: BSD.

Framework



Source: Duranton (2011)

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Framework (2)

- Clusters = **overlapping industrial districts** (Kerr & Kominers 2015)
- Firms trade off IRS, amenities vs. costs (Azarghi & Henderson 2008)

- Decay functions of these costs / benefits set cluster shape. For small tech firms, we know **interaction matters a lot, so tech clusters = overlapping sets of dense districts**
- **As any given tech district fills, movers/entrants shift to next-best 'nearby' district**

- Identification challenges mean policy shifters are helpful!
  - Location decisions are endogenous to firms' business models
  - Location decisions ⇔ cluster-level outcomes

Data + build

- **BSD plant level data, financial years 1997-2017:** covers over 99% of UK firms, geocoded to postcodes
- Plus Census, ONS demographics, TFL data for controls
- Build an LSOA panel: 101,503 area*year obs, for 4,835 LSOAs in Greater London:
  - Define cluster using 250m rings from Old St roundabout
  - 1km zone = 25 treated LSOAs
  - Controls taken from 1km exclusion zone around the cluster
  - Tech City policy happens in BSD year 2011
  - Outcomes: LSOA net counts + shares of tech firms, jobs; LSOA average tech revenue/worker
  - Look at digital content *and* digital tech (ONS 2015)

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Matched sample: PSM

Variable	Means, 1997-2010			T-test		V_e(T)/
	Treated	Control	%bias	*t*	*p>t*	V_e(C)
# plant entry ONS digitech & content	1.669	0.571	35.7	10.26	0	4.26*
Mean revenue ONS digitech & content	1441	1440	0	0	0.997	0.19*
Mean revenue/worker ONS digitech & content	136	138	-0.7	-0.09	0.925	0.17*
% plants ONS digital tech and content	0.302	0.264	33.5	6.98	0	0.84*
% employment ONS digital tech and content	0.240	0.196	29.1	5.95	0	0.92
Herfindahl Index	0.158	0.155	5.1	0.91	0.365	0.37*
% cafes and restaurants	0.028	0.027	4.3	0.93	0.351	0.73*
% bars cafes and clubs	0.015	0.015	-2.5	-0.46	0.645	0.58*
% coworking and shared offices	0.008	0.008	-3.8	-0.87	0.384	0.88
% galleries and museums	0.002	0.001	7.1	1.11	0.269	0.46*
% libraries	0.001	0.001	-2.9	-0.49	0.621	0.17*
% other accommodation	0.000	0.001	-3.7	-0.79	0.431	0.37*
% artists and performers	0.040	0.045	-13.6	-2.47	0.014	0.33*
% arts facilities and supp	0.001	0.001	5.7	1.45	0.146	1
% universities and colleges	0.002	0.002	5.3	1.14	0.255	0.33*
Count of TFL stations	0.120	0.103	5	1.02	0.306	0.76*
LA share of non-UK born	0.332	0.348	-23.9	-4.32	0	0.33*
LA share of residents aged 18-29	0.232	0.240	-25.5	-5.67	0	1.13
Observations	*350*	*2982*	*n/a*	*n/a*	*n/a*	*n/a*
Summary stats	*MeanBias*	*MedBias*	*B*	*R*		
	11.5	*5.2*	*71.5**	*1.26*		

Source: BSD 1997-2010, 1991/2001/2011 Census, ONS mid-year population estimates, TFL. Probit regression using nearest neighbour matching (nn = 1) where dependent variable = LSOA is in the Tech City Zone. Results shown for 25 Tech City LSOAs and 213 matched control LSOAs with the 25% highest propensity scores of all controls. Variance ratio should equal 1 if matched group is perfectly balanced with treatment group. * = variance ratio is 'of concern', i.e. variance ratio in [0.84, 1.19). B and R indicate Rubin's B and R ratios. For samples to be sufficiently balanced, B < 25 and 0.25 < R < 2. * = values outside these ranges.

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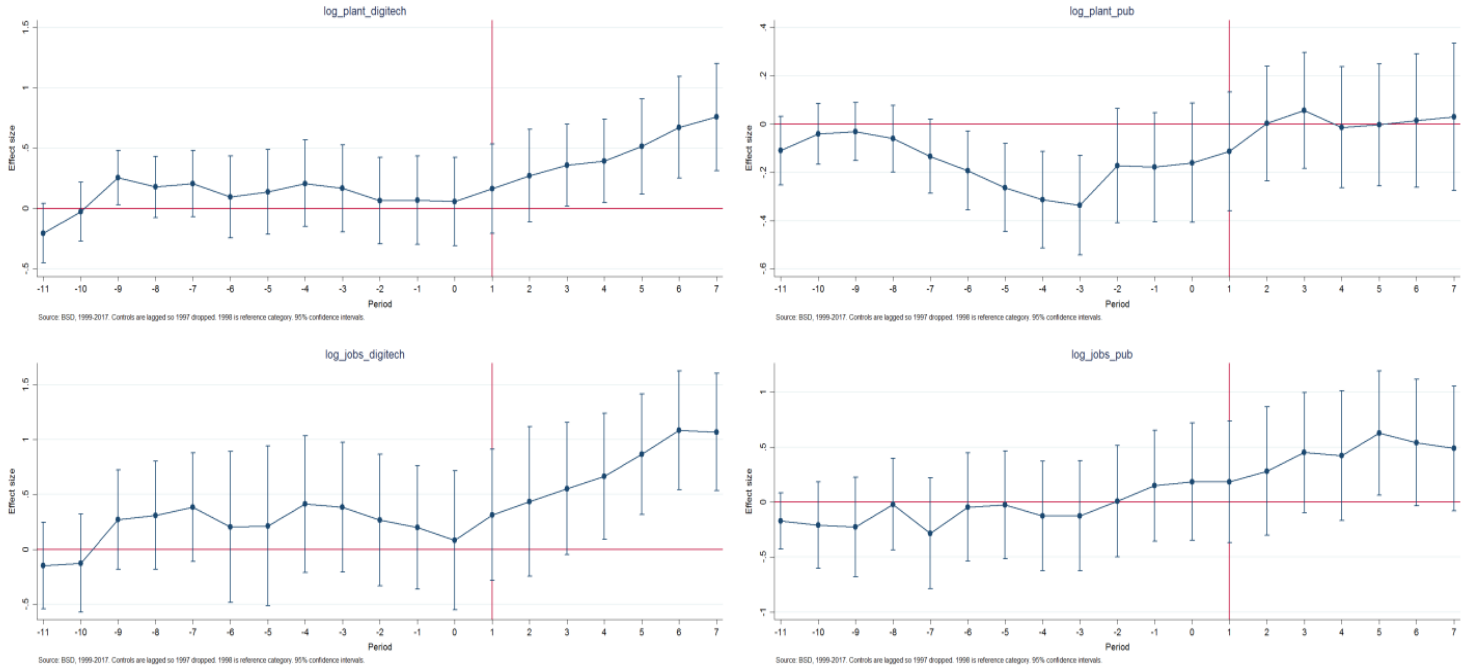
Matched sample: example balancing regressions



Source: BSD, Census, ONS mid-year population estimates, TFL. 95% confidence intervals. 1998 is reference category, 1997 dropped via lags. All regressions fit LSOA and year dummies. Time-varying controls fitted are one-year lags of LSOA all-sector plant entry, LSOA all-sector revenue/worker, LSOA Herfindahl Index, a vector of amenities (LSOA counts of cafes and restaurants, bars/pubs/clubs, co-working spaces, galleries and museums, libraries, accommodation, arts and arts support, venues, universities), TFL station count, LA share of migrants, LA share of under-30s. Standard errors clustered on LSOA.

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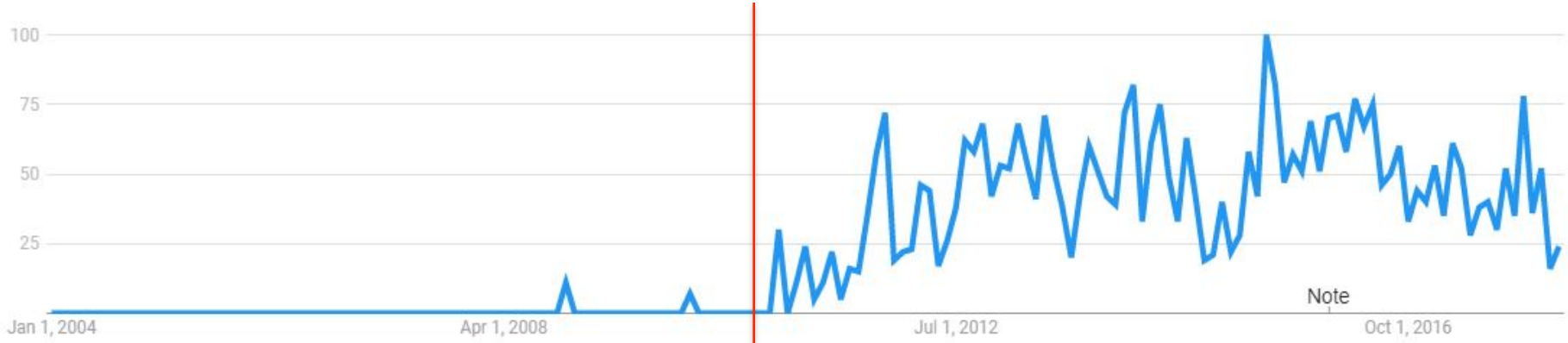
Pre-policy buzz



Source: Google Trends. Searches for “Tech City” + London

Source: Google Trends. Searches for “Silicon Roundabout” + London

methodology example

Variable	Tech City	Synthetic Tech City	Matched sample
Log content plants (1997)	2.613	2.609	1.626
Log content plants (1998)	2.722	2.721	1.645
Log content plants (1999)	2.757	2.775	1.665
Log content plants (2000)	2.781	2.758	1.698
Log content plants (2001)	2.773	2.810	1.747
Log content plants (2002)	2.805	2.778	1.754
Log content plants (2003)	3.234	3.256	2.260
Log content plants (2004)	3.311	3.334	2.335
Log content plants (2005)	3.323	3.347	2.414
Log content plants (2006)	3.356	3.344	2.485
Log content plants (2007)	3.431	3.417	2.563
Log content plants (2008)	3.495	3.448	2.448
Log content plants (2009)	3.500	3.488	2.454
Log content plants (2010)	3.468	3.457	2.413
Plant entry, all sectors	3.260	3.182	1.793
Revenue / worker, sectors	258.774	255.350	134.660
Herfindahl Index	0.136	0.136	0.146
LSOA plants, all sectors	238.760	228.364	127.748
LSOA jobs, all sectors	3836.394	3789.643	1467.235
LSOA total cafes and restaurants	7.074	7.135	4.045
LSOA total bars pubs and clubs	3.074	2.965	1.545
LSOA total coworking spaces	1.523	1.958	1.658
LSOA total musuems and galleries	0.169	0.165	0.156
LSOA total libraries	0.311	0.303	0.084
LSOA total other accommodation	0.063	0.062	0.065
LSOA total arts and arts support activities	10.669	10.900	5.596
LSOA total supporting arts orgs	0.249	0.314	0.153
LSOA total HEIs	0.506	0.507	0.255
LSOA count of TFL stations	0.111	0.126	0.098
LA population	187283.078	188577.406	2.36e+05
LA share of non-UK born	0.309	0.311	0.348
LA share of residents aged 18-29	0.229	0.230	0.241
Observations	*350*	*2982*	*2982*

Source: BSD

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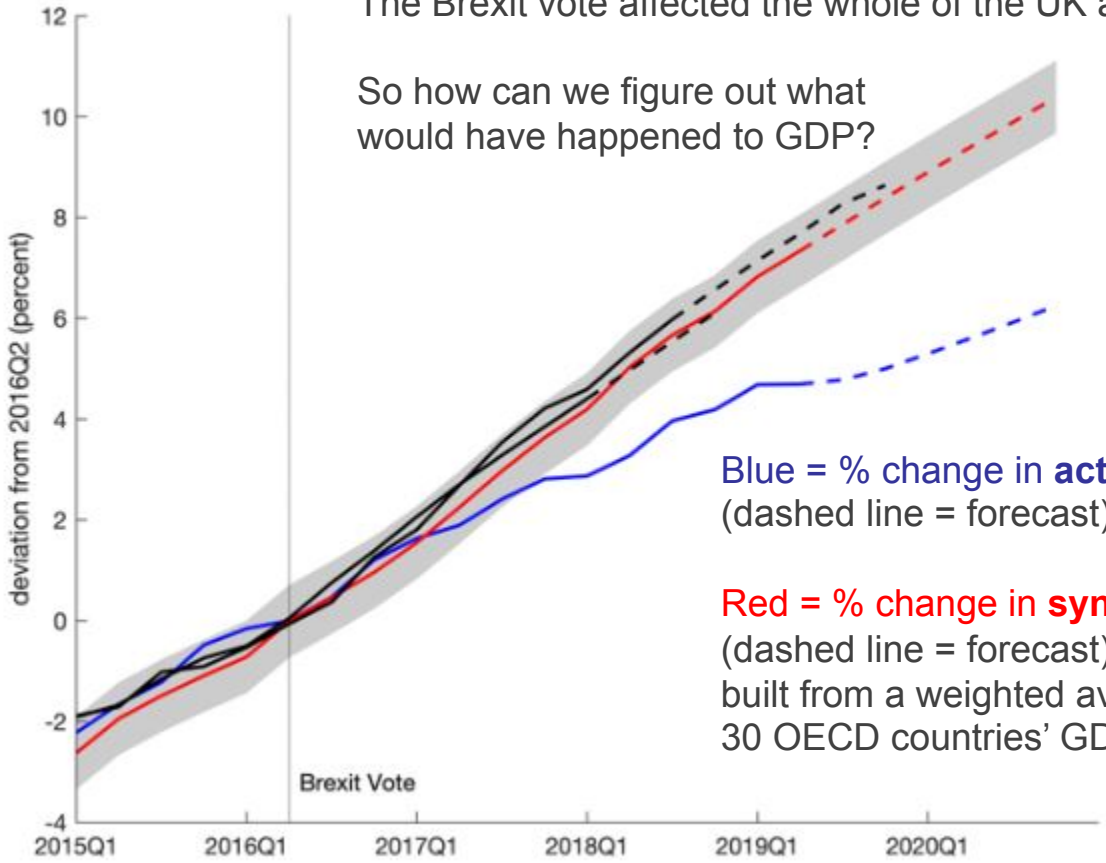
Example: Brexit vote and GDP

The Brexit vote affected the whole of the UK at once.

So how can we figure out what would have happened to GDP?



Blue = % change in **actual UK** output (dashed line = forecast)

Red = % change in **synthetic UK** output (dashed line = forecast) Synthetic UK is built from a weighted average of 30 OECD countries' GDP

Source: Born et al (2017): The Economic Consequences of the Brexit Vote, CFM Working Paper 2017-38
Note: black line = earlier estimates for synthetic UK

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Results: cluster size

A. Cluster size	Plants		Jobs	
	Digitech	Content	Digitech	Content
Synthetic control ATT	0.270***	0.079**	0.440***	0.123*
p-value	0.005	0.023	0.005	0.061
Pre-treatment RMSPE	0.024	0.023	0.028	0.035
Average pre-treatment quality	1	1	1	1
Diff-in-diff ATT	*0.28****	*0.06*	*0.42****	*0.13*
	-0.104	*-0.068*	*-0.131*	*-0.115*
Observations	*4500*	*4646*	*4494*	*4639*
R^2	*0.8*	*0.91*	*0.8*	*0.87*
Pre-treatment mean	15.954	56.551	172.891	898.126

Source: BSD / Census / ONS / TfL. Synthetic control panel shows *p*-values from permutation test on 2013 placebos , pre-treatment error rate and proportion of placebos with pre-treatment error rate ≥ average of the treated unit. Regressions fit lagged outcome predictors 1997-2010 plus 1-year lags of LSOA all-sector plant entry, LSOA all-sector revenue/worker, LSOA Herfindahl Index, a vector of amenities (LSOA counts of cafes and restaurants, bars/pubs/clubs, co-working spaces, galleries and museums, libraries, other accommodation, arts and arts support, venues, universities), TFL station count, LA share of migrants, LA share of under-30s. Weights optimised defining **V** as an identity matrix. DID regressions fit LSOA and year dummies plus controls as above. Standard errors clustered on LSOA. * significant at 10%, ** 5%, *** 1%.

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Results: cluster density

B. Cluster density	**% plants**		**% jobs**	
	Digitech	**Content**	**Digitech**	**Content**
Synthetic control ATT	0.013***	0.02*	0.031***	0.049***
p-value	0.005	0.084	0.009	0.009
Pre-treatment RMSPE	0.001	0.004	0.002	0.003
Average pre-treatment quality	1	1	1	1
Diff-in-diff ATT	*0.01**	*0*	*0.02***	*0.02*
	-0.007	*-0.009*	*-0.008*	*-0.017*
Observations	*4760*	*4760*	*4760*	*4760*
R^2	*0.58*	*0.7*	*0.47*	*0.6*
Pre-treatment mean	0.063	0.204	0.036	0.182

Source: BSD / Census / ONS / TfL. Synthetic control panel shows *p*-values from permutation test on 2013 placebos , pre-treatment error rate and proportion of placebos with pre-treatment error rate ≥ average of the treated unit. Regressions fit lagged outcome predictors 1997-2010 plus 1-year lags of LSOA all-sector plant entry, LSOA all-sector revenue/worker, LSOA Herfindahl Index, a vector of amenities (LSOA counts of cafes and restaurants, bars/pubs/clubs, co-working spaces, galleries and museums, libraries, other accommodation, arts and arts support, venues, universities), TFL station count, LA share of migrants, LA share of under-30s. Weights optimised defining **V** as an identity matrix. DID regressions fit LSOA and year dummies plus controls as above. Standard errors clustered on LSOA. * significant at 10%, ** 5%, *** 1%.

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Results: firm 'productivity'

C. Cluster firm performance	Revenue / worker	
	Digitech	**Content**
Sythentic control ATT	-0.043*	0.139**
p-value	0.07	0.042
Pre-treatment RMSPE	0.045	0.032
Average pre-treatment quality	0.986	0.986
Diff-in-diff ATT	*-0.02*	*0.03*
	-0.062	*-0.092*
Observations	*4489*	*4637*
R^2	*0.35*	*0.48*
Pre-treatment mean	86.119	146.662

Source: BSD / Census / ONS / TfL. Synthetic control panel shows *p*-values from permutation test on 2013 placebos , pre-treatment error rate and proportion of placebos with pre-treatment error rate ≥ average of the treated unit. Regressions fit lagged outcome predictors 1997-2010 plus 1-year lags of LSOA all-sector plant entry, LSOA all-sector revenue/worker, LSOA Herfindahl Index, a vector of amenities (LSOA counts of cafes and restaurants, bars/pubs/clubs, co-working spaces, galleries and museums, libraries, other accommodation, arts and arts support, venues, universities), TFL station count, LA share of migrants, LA share of under-30s. Weights optimised defining **V** as an identity matrix. DID regressions fit LSOA and year dummies plus controls as above. Standard errors clustered on LSOA. * significant at 10%, ** 5%, *** 1%.

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Timing / falsification

Specification	Plants		Jobs		% plants		% jobs		Ave rev/worker	
	Digitech	Content	Digitech	Content	Digitech	Content	Digitech	Content	Digitech	Content
A. Main synthetic control ATT	0.270***	0.079**	0.440***	0.123*	0.013***	0.02*	0.031***	0.049***	-0.043*	0.139**
p-value	*0.005*	*0.023*	*0.005*	*0.061*	*0.005*	*0.084*	*0.009*	*0.009*	*0.07*	*0.042*
RMSPE	*0.024*	*0.023*	*0.028*	*0.035*	*0.001*	*0.004*	*0.002*	*0.003*	*0.045*	*0.032*
B. Start treatment in 2008	0.451**	0.248**	0.495***	0.168	0.018***	0.038**	0.007*	0.064**	0.382**	0.048
p-value	*0.014*	*0.014*	*0.005*	*0.248*	*0.005*	*0.023*	*0.051*	*0.033*	*0.023*	*0.327*
RMSPE	*0.028*	*0.032*	*0.038*	*0.054*	*0.001*	*0.003*	*0.002*	*0.005*	*0.038*	*0.047*
C. Start treatment in 2008, end in 2010	0.347**	0.188**	0.284**	0.183	0.015***	0.034**	-0.013*	0.023*	0.679***	-0.017
p-value	*0.019*	*0.037*	*0.014*	*0.229*	*0.005*	*0.019*	*0.07*	*0.065*	*0.009*	*0.902*
RMSPE	*0.028*	*0.032*	*0.038*	*0.054*	*0.001*	*0.003*	*0.002*	*0.005*	*0.038*	*0.047*
D. End treatment in 2014	0.142**	0.011	0.422***	0.076	0.008***	0.014	0.022**	0.043**	-0.155**	0.173**
p-value	*0.042*	*0.238*	*0.005*	*0.112*	*0.005*	*0.168*	*0.014*	*0.019*	*0.047*	*0.028*
RMSPE	*0.024*	*0.023*	*0.028*	*0.035*	*0.001*	*0.004*	*0.002*	*0.003*	*0.045*	*0.032*
Effect size / year, 2011-2017	*0.039*	*0.011*	*0.063*	*0.018*	*0.002*	*0.003*	*0.004*	*0.007*	*-0.006*	*0.020*
Effect size / year, 2008-10	*0.116*	*0.063*	*0.095*	*0.061*	*0.005*	*0.011*	*-0.004*	*0.008*	*0.226*	*-0.006*
Effect size / year, 2011-2014	0.036	0.003	0.105	0.019	0.002	0.004	0.005	0.011	-0.039	0.043

Source: BSD / Census / ONS / TfL. Notes as in previous tables.

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Treatment intensity estimator

- For LSOA *i*, year *t*, I estimate:

$$Y_{it} = D250_i + D500_i + D750_i + D1000_i + T_t + a1TC250_{it} + a2TC500_{it} + a3TC750_{it} + a4TC1000_{it} + \mathbf{CTRLS}\boldsymbol{b}_{it} + e_{it} \quad (4)$$

- Y and **CTRLS** are specified as before.
- D250-D1000 are dummies taking the value 1 for LSOAs in distance rings 250-1000m from Old St roundabout.
- Coefficients of interest are *a1-a4*, which give the *relative effect* of treatment post-2011 in an LSOA *in that distance ring*, versus control LSOAs.

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Treatment intensity

	Plants		Jobs		% plants		% jobs	
	Digitech	Content	Digitech	Content	Digitech	Content	Digitech	Content
Diff in diff ATT	*0.28****	*0.06*	*0.42****	*0.13*	*0.01**	*0.00*	*0.02***	*0.02*
	(0.104)	*(0.068)*	*(0.131)*	*(0.115)*	*(0.007)*	*(0.009)*	*(0.008)*	*(0.017)*
Roundabout + 250m	1.03***	0.68***	0.76***	0.12	0.03***	-0.05***	0.00	-0.04
	(0.063)	(0.119)	(0.189)	(0.188)	(0.011)	(0.013)	(0.012)	(0.026)
Roundabout + 500m	-0.06	-0.11	-0.06	0.03	0.01	0.01	-0.01	-0.06
	(0.258)	(0.126)	(0.316)	(0.223)	(0.017)	(0.015)	(0.021)	(0.046)
Roundabout + 750m	0.16	-0.10	0.01	-0.49**	0.01	-0.04**	0.02	0.02
	(0.286)	(0.104)	(0.304)	(0.187)	(0.016)	(0.016)	(0.019)	(0.044)
Roundabout + 1000m	0.18	0.12	0.40**	0.37**	0.00	0.02*	0.01	0.03
	(0.143)	(0.094)	(0.175)	(0.147)	(0.009)	(0.013)	(0.008)	(0.021)
Observations	4500	4646	4494	4639	4760	4760	4760	4760
R^2	0.80	0.91	0.80	0.87	0.58	0.70	0.47	0.60
Area controls	Y	Y	Y	Y	Y	Y	Y	Y
Pre-treatment controls	Y	Y	Y	Y	Y	Y	Y	Y

Source: BSD / Census / ONS / TfL. Difference in difference analysis on matched sample. Distance ring coefficients give the relative effect of treatment on neighbourhoods in that distance ring, relative to control LSOAs outside the cluster. Controls are 1-year lags of LSOA all-sector plant entry, plant counts and job counts, LSOA all-sector revenue/worker, LSOA Herfindahl Index, LSOA counts of cafes and restaurants, bars/pubs/clubs, co-working spaces, galleries and museums, libraries, hotels and other accommodation, arts and arts support, venues, universities, count of tube and rail stations, LA population, LA share of migrants, LA share of under-30s, plus LSOA and year dummies. Standard errors clustered on LSOA. * significant at 10%, ** 5%, *** 1%.

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Churn

A. All tech plants	2009-2010		2013-2014		2016-2017	
	count	%	count	%	count	%
In the UK	460,926		498,082		595,583	
In Tech City Zone	3,469		3,985		6,323	
Stayers	2,208	63.7	2,277	57.1	3,516	55.6
Entrants	635	18.3	988	24.8	2,082	32.9
Leavers	626	18.0	720	18.1	718	11.4
Entrants						
Movers from rest of London	*173*	*27.2*	*187*	*18.9*	*488*	*23.4*
Movers from rest of UK	*37*	*5.8*	*67*	*6.8*	*130*	*6.2*
New plant	*425*	*67*	*734*	*74.3*	*1,471*	*70.4*
Leavers						
Moved to rest of London	*158*	*25.2*	*222*	*30.8*	*310*	*43.2*
Moved to rest of UK	*45*	*7.2*	*35*	*4.9*	*79*	*11*
Died	*423*	*67.6*	*463*	*64.3*	*329*	*45.8*

Source: BSD

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Scaling

	# High-growth episodes: revenue/worker		# High-growth episodes: jobs	
	digitech	content	digitech	content
Synthetic control ATT	1.082	0.503	0.261	0.279
p-value	0.103	0.178	0.276	0.150
Number of placebos	213	213	213	213
Pre-treatment RMSPE	0.184	0.700	0.072	0.123
Average pre-treatment quality	0.793	0.502	0.183	0.437
Pre-treatment mean	*36.143*	*127.214*	*9.00*	*24.71*

Source: BSD / Census / ONS / TfL. Synthetic control panel shows *p*-values from permutation test, number of placebos used, pre-treatment error rate and proportion of placebos with pre-treatment error rate ≥ average of the treated unit. Regressions fit lagged outcome predictors 1997-2010 plus 1-year lags of LSOA all-sector plant entry, LSOA all-sector revenue/worker, LSOA Herfindahl Index, a vector of amenities (LSOA counts of cafes and restaurants, bars/pubs/clubs, co-working spaces, galleries and museums, libraries, other accommodation, arts and arts support, venues, universities), TFL station count, LA share of migrants, LA share of under-30s. Weights optimised defining **V** as an identity matrix. DID regressions fit LSOA and year dummies plus controls as above. Standard errors clustered on LSOA. * significant at 10%, ** 5%, *** 1%.