

Spatial analysis and its uses for causal inference

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Overview

- View of causality as the looking at the effects of causes (or interventions)
- Interest in causality is generally quite easy to justify
- Not on spatial analysis in terms of advance statistical methods per
- Spatial analysis as in knowing the history and context behind administrative borders for example (e.g. more banal stuff)

The potential outcomes framework

- What would have happened if an intervention did not happen?
- Different possible world

The potential outcomes framework

	Outcome	
	Intervention	No intervention
Person 1	1.3	1
Person 2	2.6	2.2
Person 3	3.8	3.4
Person 4	2.3	2.4
Person 5	1.5	1.3
Person 6	4.1	3.2
....		
Average	2.6	2.25

The potential outcomes framework

	Outcome	
	Intervention	No intervention
Person 1	X	1
Person 2	2.6	X
Person 3	X	3.4
Person 4	X	2.4
Person 5	1.5	X
Person 6	4.1	X
....		
Average	2.7333333333	2.266666667

The potential outcomes framework

- Key is randomisation – methodologically agnostic
- If not completely random, assume *conditionally* random
- Finding a suitable control group is hard
- My background (education): lack of confounders is always in doubt due to self-selection

Space and causal inference

- My current research (mainly housing) making causal inference:
 1. Policy is dispensed at areal level (e.g. individuals don't self-select)
 2. Policy is dispensed by policy-makers (e.g. can consult documents implementation)
 3. **Devolution of power across levels of government (national/ local departmental)**

Example

Glasgow stock transfer – an urban regeneration scheme

- City limits are under-bounded
- Glasgow's city limits were changed for unrelated reasons few years prior

The Glasgow stock transfer

- 2003: Glasgow council transferred all of its social housing stock
- £4 Billion funding for infrastructure (~£1.5 Billion in first 10 years a ongoing)
- Example of area based regeneration and intervention

Who are the treatment group?

- People living in Glasgow in 2001 (prior to 2002 ballot)
- Main interventions:
 - 1) Change of governance from council to local housing organisation
 - 2) Infrastructure repairs and demolitions
 - 3) Direct capital spend (and employment multiplier effect)
- Note: Second stage transfer of housing not completed by 2011

The control group

- The intervention took place entirely within Glasgow city council boundaries
- Glasgow city is sprawling for historical reasons – the city grew faster than its administrative limits
- Historical towns resisted absorption into Glasgow City (Clyde)
- Electoral border reform meant that the city borders shrank in 1996
- Lots of social housing was built on the city periphery

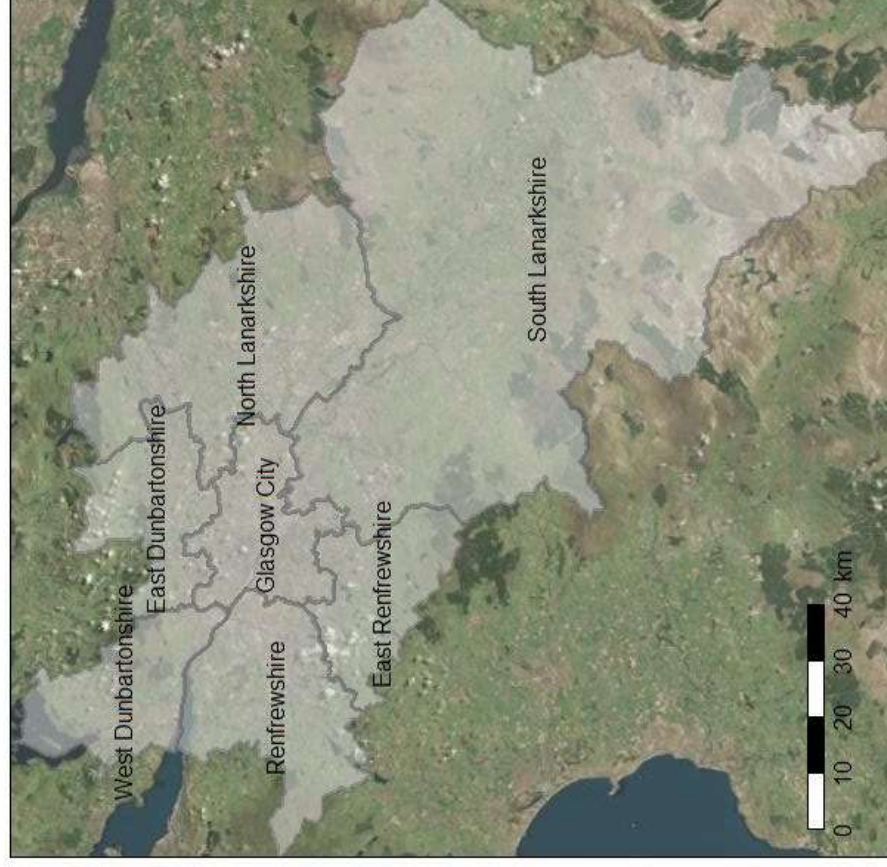
Who are the control group(s)?

- The treatment took place within Glasgow city limits
- 1) Glasgow's urban area is larger than its city limits
- 2) Several contiguous social housing estates overspill its borders
- 3) Glasgow's borders shrunk in 1996 for unrelated reasons
- Difference in Difference (eliminates time invariant differences)

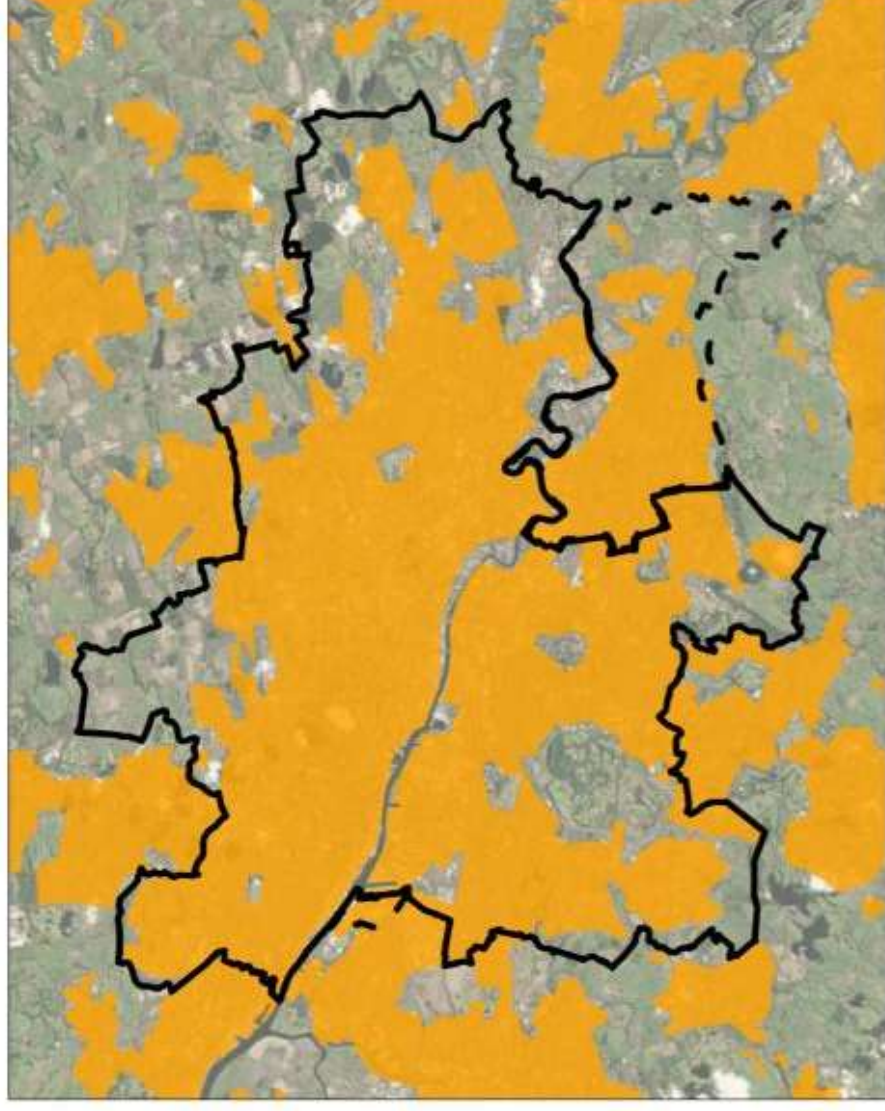
Data

- Using Scottish Longitudinal Study (SLS) sample and enumeration postcodes (1991 – 2001 – 2011)
- The Scottish Longitudinal Study (SLS) is a large-scale linkage study created using data from administrative and statistical sources, it is 5.3% representative sample based on the Scottish censuses (<https://sls.lscs.ac.uk/>)
- Compare changes in employment in 2001 – 2011 for SLS members who lived in Glasgow and other control areas

Using surrounding areas as controls

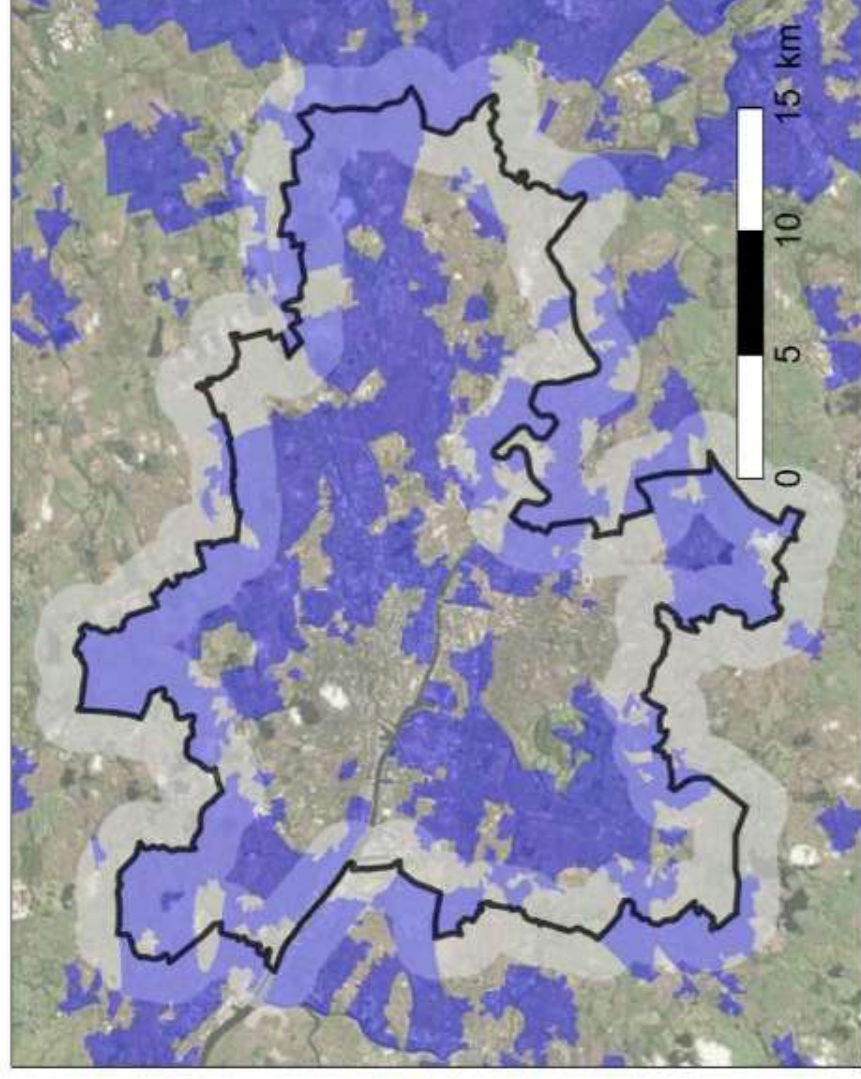


Using pre-1996 Glasgow areas as controls



Source: ONS Strategi map (Yellow = Build up areas)

Using periphery neighbourhoods as controls



Source: Census 2001 (Blue = Datazones > 20% social renters)

Quick methods

- Exact matching on age
- Tested for pre-intervention effects using 1991 – 2001 SLS data
- Auxiliary analysis matching on distance between controls and treatments (plus other variables)
- Does not substantively change main results which are...

Main results

- Positive effect on employment for NON-social renters (including HMOs and private renters; homeowners) [Effect size: 3.3% - 4.4%]
- No effect [$<0.5\%$] on LA social renters in Glasgow either through:
 1. Direct spending or employment multiplier effects
 2. The combined effects of infrastructure and housing governance
- Context: Employment was not a **primary** objective of the intervention

Equitable benefits?

- Economic contribution due to capital spending is a noted benefit
- Who is benefitting? Further subgroup analyses:
 1. Men not women
 2. Families without dependent children
 3. Individuals with post-secondary qualifications
 4. ...and not LA social-renters
- Relevance to the ongoing affordable housing supply

Concluding remarks

‘If your experiment needs statistics, you ought to have done a better experiment’ Ernest Rutherford

- It is easier to address confounding using research design first and statistically adjust later
- Due to their deployment, policy in certain fields (e.g. housing) are more amenable to causal inference than others

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