EU Regional Policy in the UK and the prospect of Brexit

Marco Di Cataldo

London School of Economics

RSA Winter Conference

London, 15th November 2018

Regional Studies Association

THE GLOBAL FORUM FOR CITY AND REGIONAL RESEARCH, DEVELOPMENT AND POLICY

EU funds in the UK: before the Brexit Referendum

- Vote Leave Manifesto, 14th June 2016:

*"There is more than enough money to ensure that **those who now get funding from the EU will continue to do so** while also ensuring that we save money that can be spent on our priorities.*

*If the public votes to leave on 23 June, we will **continue to fund EU programmes in the UK until 2020**. We will also be able to spend the money much more effectively."*
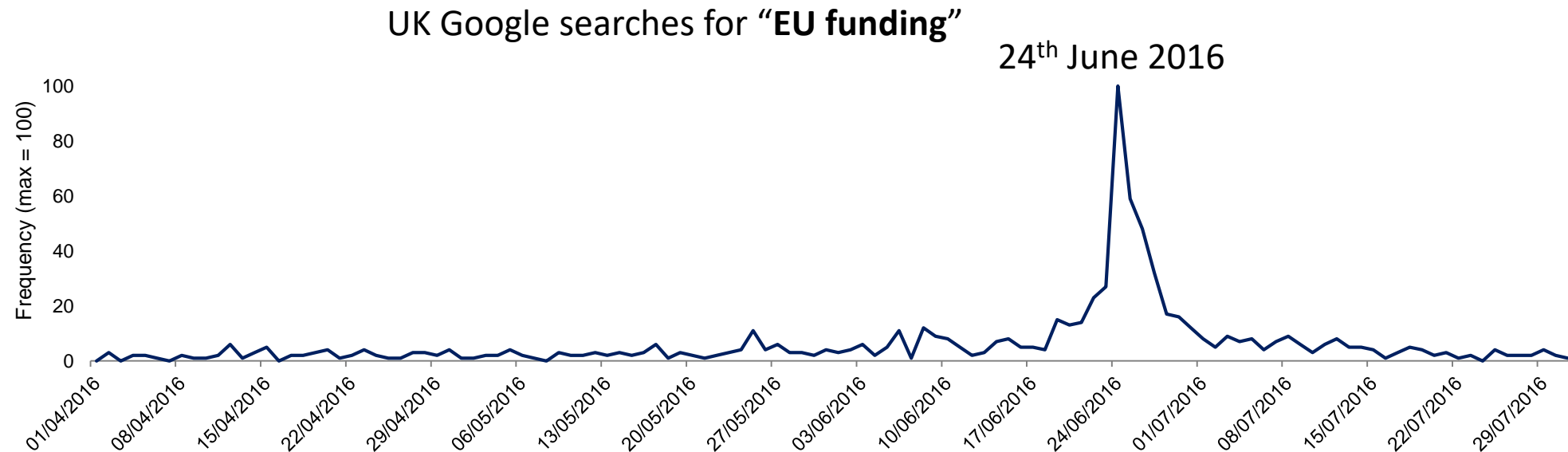
EU funds in the UK: when Brexit happened

Cornwall issues plea to keep EU funding after voting for Brexit

Cornwall receives millions of pounds in EU subsidies every year

Will Worley | @willrworley | Friday 24 June 2016 | 💬 1117 comments

The Independent on 24th June 2016

UK Google searches for "**EU funding**"

24th June 2016

EU funds after Brexit: where are we now?

Funding from EU programmes guaranteed until the end of 2020

UK organisations that secure funding through EU programmes, from now until the end of 2020, will be guaranteed by the UK government even in a no deal scenario.

Published 24 July 2018
From: HM Treasury

BBC NEWS

EU aid to be replaced by new fund, Conservatives pledge

🕐 18 May 2017

f 💬 🐦 ✉ ⤴ Share

A new **'Shared Prosperity Fund'** to replace Structural Funds

- Intended to 'reduce inequalities between communities'
- Unclear how it will be designed/how big it will be
- Public consultation December 2018

EU funds in the UK: some key questions

1. Have EU funds been effective in the UK?

2. What type of regions have benefitted the most?

3. How? (What have been the most successful policy designs?)

4. Have EU funds contributed to a more favourable view of Europe in the country?
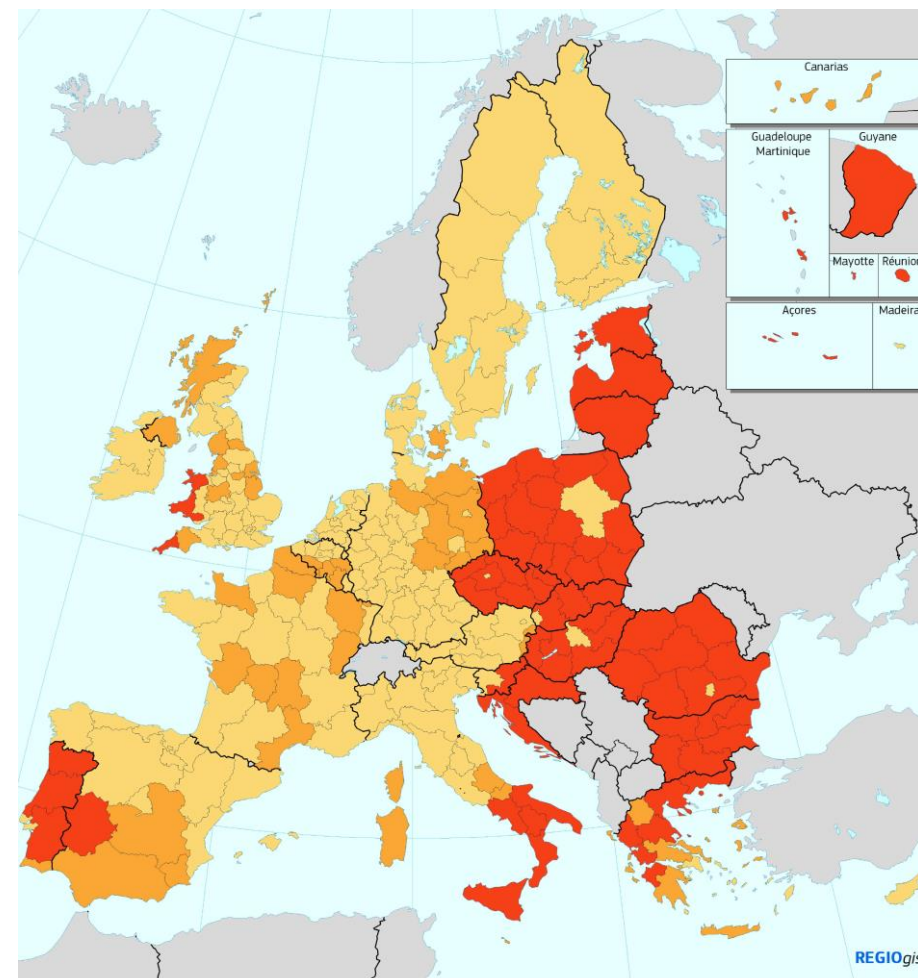
EU Structural and Investment Funds (ESIF)

ESIF: funds are used on a wide number of development projects aiming to promote growth and employment

'Less developed regions' (Objective 1): regions with GDP per head below 75% of the EU average

- Eligibility for Objective 1 funds is awarded to NUTS2 regions before the beginning of 7-year EU budget periods
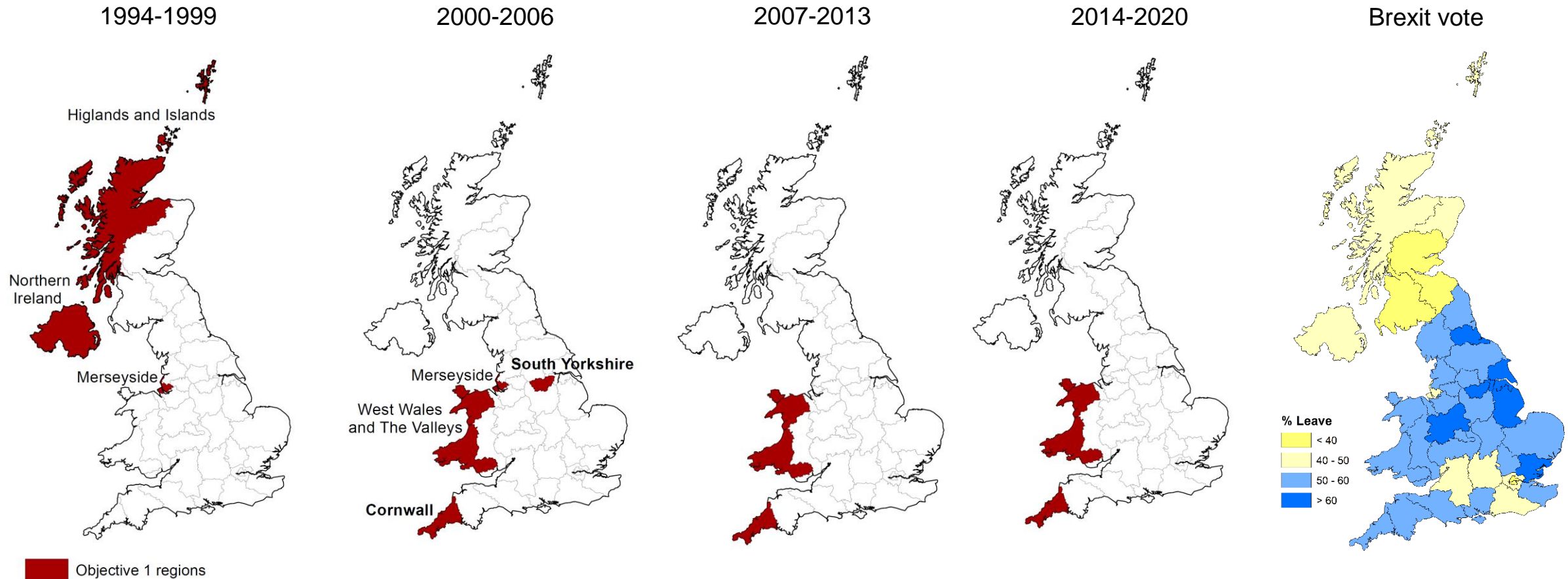
Total 2014-2020 budget **in the UK**: €16.5 bn, of which €2.6 to less developed regions

Structural Funds (ERDF and ESF) eligibility 2014-2020

Category

▬ Less developed regions (GDP/head < 75% of EU-27 average)

▬ Transition regions (GDP/head between >= 75% and < 90% of EU-27 average)

▬ More developed regions (GDP/head >= 90% of EU-27 average)

EU funds in the UK: Objective 1/less developed regions

1994-1999 | 2000-2006 | 2007-2013 | 2014-2020 | Brexit vote

Objective 1 regions

% Leave
< 40
40 - 50
50 - 60
> 60

- EU funding represents an important source of investment for poorer UK areas

- Both 'less developed regions' at the time of the referendum favoured Brexit`

Annual € of ESIF pc in UK regions, 1994-1999, 2000-2006, 2007-2013

Region	1994-1999	Region	2000-2006	Region	2007-2013
Northern Ireland	110.5	**Cornwall & Isles of Scilly**	138.0	**Cornwall & Isles of Scilly**	162.7
Highlands & The Islands	91.1	**Merseyside**	137.3	**West Wales & The Valley**	159.5
Merseyside	61.9	**South Yorkshire**	126.8	Merseyside	73.4
Tees Valley & Durham	32.1	**West Wales & The Valley**	97.3	Northern Ireland	68.3
Greater Manchester	28.7	Northern Ireland	94.2	Highlands & The Islands	60.8
West Wales & The Valley	28.6	Highlands & The Islands	81.9	South Yorkshire	54.3
South Yorkshire	27.5	Tees Valley & Durham	54.2	Tees Valley & Durham	39.3
Northumberland & T&W	27.0	Northumberland & T&W	52.3	Northumberland & T&W	37.3
Cornwall & Isles of Scilly	26.8	West Midlands	45.4	East Yorkshire & N Linc.	27.6
West Midlands	26.5	Greater Manchester	44.0	South Western Scotland	26.3
Cumbria	24.3	East Yorkshire & N Linc.	40.5	East Wales	24.2
East Yorkshire & N Linc.	23.5	Cumbria	36.3	Greater Manchester	23.9
South Western Scotland	22.5	Devon	36.3	Cumbria	23.2
Eastern Scotland	20.3	Lincolnshire	35.5	West Yorkshire	23.1
East Wales	18.6	Shropshire & Staffordshire	32.3	Lincolnshire	22.4
Derbyshire & Nottinghamsh.	17.1	Lancashire	31.0	Eastern Scotland	21.7
Devon	16.1	West Yorkshire	30.9	North Yorkshire	21.5
Shropshire & Staffordshire	14.5	Derbyshire & Nottinghamsh.	30.0	Derbyshire & Nottinghamsh.	21.3
West Yorkshire	10.1	South Western Scotland	27.3	West Midlands	21.2
Lancashire	9.1	North Yorkshire	26.4	Devon	20.8
North Yorkshire	8.6	Est Wales	25.1	Lancashire	20.3
Lincolnshire	7.7	Inner London	22.2	North Eastern Scotland	20.2
Herefordshire Worc. & Warw.	7.1	East Anglia	21.1	Cheshire	17.6
Inner London	5.3	Eastern Scotland	21.0	Leicestershire, Rutland & Northampt.	15.6

Annual € of ESIF pc in UK regions, 1994-1999, 2000-2006, 2007-2013

Region	1994-1999	Region	2000-2006	Region	2007-2013
Northern Ireland	110.5	**Cornwall & Isles of Scilly**	138.0	**Cornwall & Isles of Scilly**	162.7
Highlands & The Islands	91.1	**Merseyside**	137.3	**West Wales & The Valley**	159.5
Merseyside	61.9	**South Yorkshire**	126.8	Merseyside	73.4
Tees Valley & Durham	32.1	**West Wales & The Valley**	97.3	Northern Ireland	68.3
Greater Manchester	28.7	Northern Ireland	94.2	Highlands & The Islands	60.8
West Wales & The Valley	28.6	Highlands & The Islands	81.9	South Yorkshire	54.3
South Yorkshire	27.5	Tees Valley & Durham	54.2	Tees Valley & Durham	39.3
Northumberland & T&W	27.0	Northumberland & T&W	52.3	Northumberland & T&W	37.3
Cornwall & Isles of Scilly	26.8	West Midlands	45.4	East Yorkshire & N Linc.	27.6
West Midlands	26.5	Greater Manchester	44.0	South Western Scotland	26.3
Cumbria	24.3	East Yorkshire & N Linc.	40.5	East Wales	24.2
East Yorkshire & N Linc.	23.5	Cumbria	36.3	Greater Manchester	23.9
South Western Scotland	22.5	Devon	36.3	Cumbria	23.2
Eastern Scotland	20.3	Lincolnshire	35.5	West Yorkshire	23.1
East Wales	18.6	Shropshire & Staffordshire	32.3	Lincolnshire	22.4
Derbyshire & Nottinghamsh.	17.1	Lancashire	31.0	Eastern Scotland	21.7
Devon	16.1	West Yorkshire	30.9	North Yorkshire	21.5
Shropshire & Staffordshire	14.5	Derbyshire & Nottinghamsh.	30.0	Derbyshire & Nottinghamsh.	21.3
West Yorkshire	10.1	South Western Scotland	27.3	West Midlands	21.2
Lancashire	9.1	North Yorkshire	26.4	Devon	20.8
North Yorkshire	8.6	Est Wales	25.1	Lancashire	20.3
Lincolnshire	7.7	Inner London	22.2	North Eastern Scotland	20.2
Herefordshire Worc. & Warw.	7.1	East Anglia	21.1	Cheshire	17.6
Inner London	5.3	Eastern Scotland	21.0	Leicestershire, Rutland & Northampt.	15.6

1. **Have EU funds been effective in the UK?**

2. **What type of regions have benefitted the most?**

3. How? (What have been the most successful policy designs?)

4. Have EU funds contributed to a more favourable view of Europe in the country?

EU funds in the UK: a simple empirical model

Regression model estimated for the 37 UK NUTS2 regions, 1994-2013

Studying the relationship between **ESIF** and two outcomes:

1. **Unemployment**
2. **GDP per capita**

We test the effect of:

- *Intensity of funding* – proportion of funds paid (source: DG Regio)
- *Assignment into 'less developed/Objective 1' status* – dummy for most financed regions

Controlling for:

Lagged dependent variable, a set of regional socio-economic characteristics, FE

EU funds in the UK: a simple empirical model

Dep. Variable:	Δ %Unemployment bc		Δ ln GDP per capita		
	(1)	(2)	(3)	(4)	(5)
EU funds pc	-0.000188 (0.000359)		0.000114** (4.49e-05)		0.000135* (7.67e-05)
EU funds pc squared					-1.05e-07 (3.89e-07)
Objective 1 regions		-0.0768** (0.0348)		0.00857* (0.00437)	
Controls	✓	✓	✓	✓	✓
FE	✓	✓	✓	✓	✓
Observations	646	646	613	613	613
R-squared	0.914	0.915	0.778	0.776	0.778
UK NUTS2 regions	37	37	37	37	37

Positive relationship between EU grants and economic growth: an increase of €10 funds pc associated with a growth rate 0.11 pp higher

Regions assigned into **Objective 1** status reduced unemployment more and grew 0.8pp faster annually

the association between EU funds and regional growth is **linear**

The impact of EU Objective 1 funds on regional development: Evidence from the UK and the prospect of Brexit.

Counterfactual assessment: case-study analysis

(Becker et al 2010 2013 2018, Pellegrini et al 2013, Barone et al 2016, Cerqua & Pellegrini 2017, Giua 2017, Crescenzi & Giua 2018, Bachtrogler 2018)

Focus on two UK less developed/Objective 1 regions: **Cornwall** and **South Yorkshire**
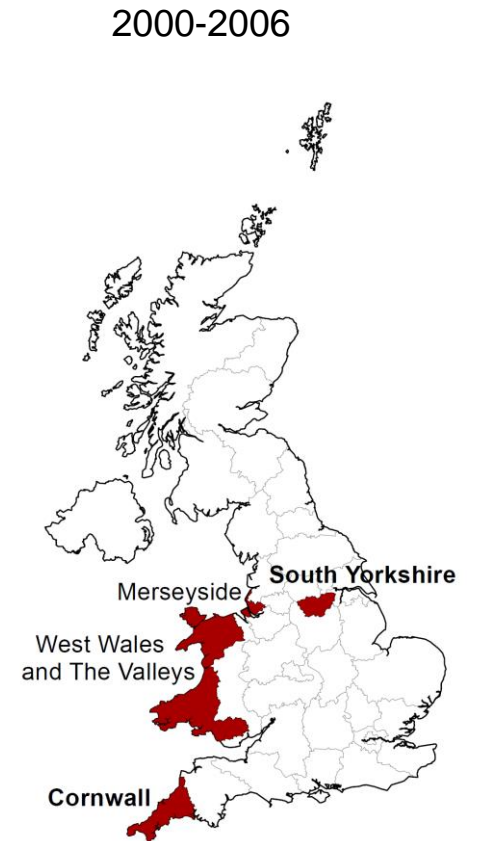
2000-2006

Different history of 'Objective 1' eligibility:

- *Both became eligible in 2000*

1998 NUTS2 reform: Devon and Cornwall separated in a statistical sense

- *Cornwall retained eligibility until today*

- *South Yorkshire lost it in 2007*

Effect tested on **unemployment** and **GDP pc** with a Diffs-in-diffs model
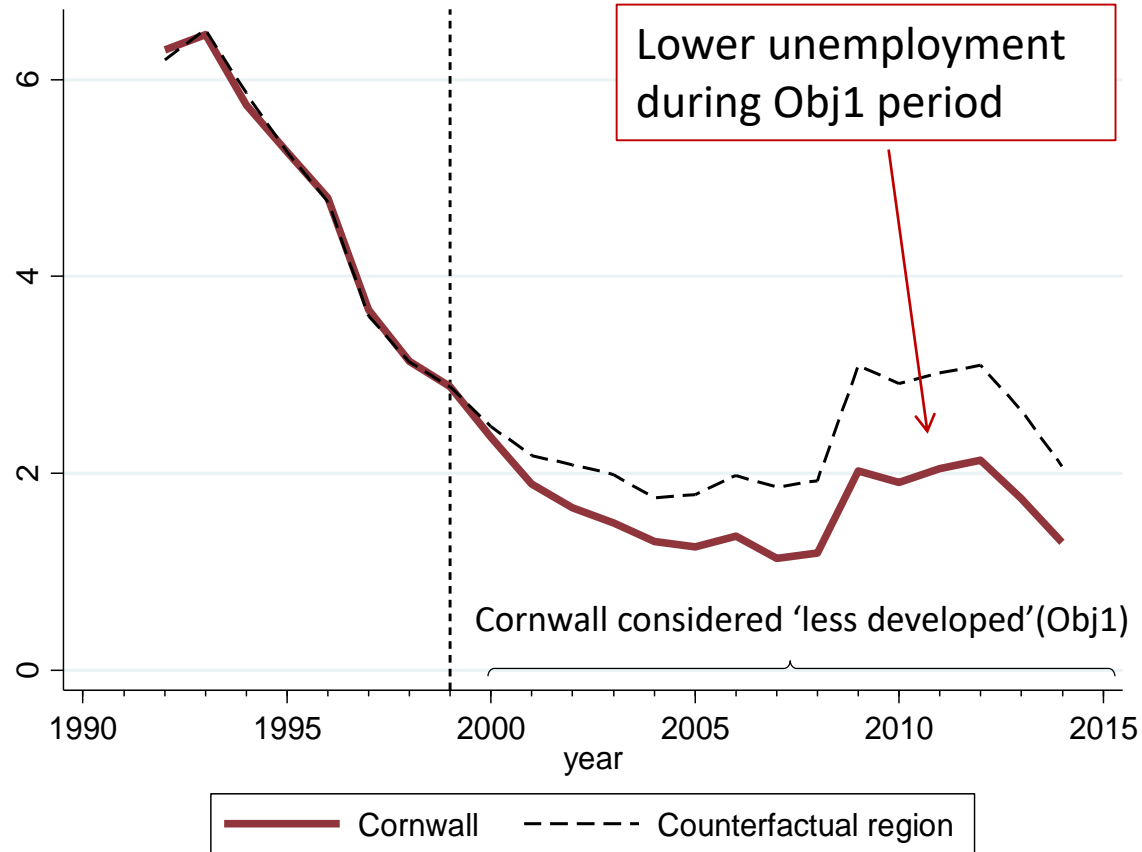(synthetic control method)
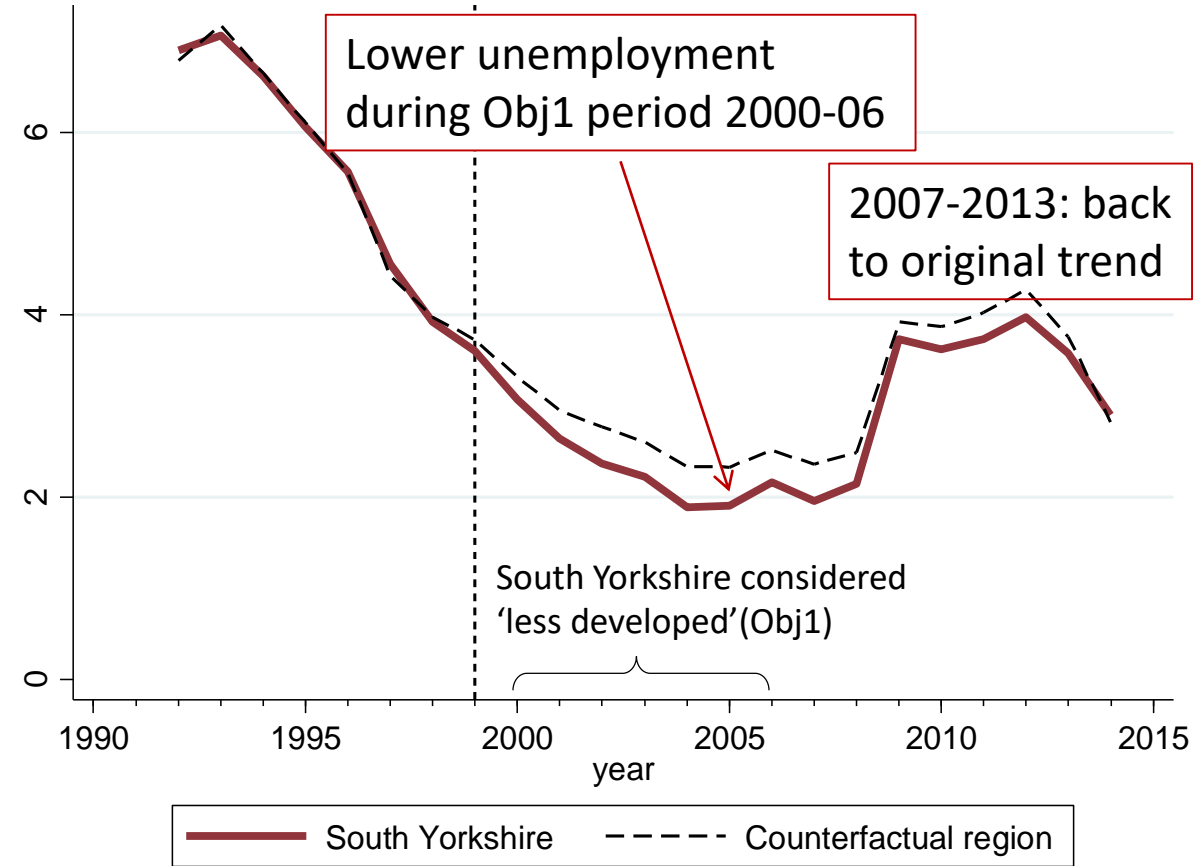
Case-studies and counterfactuals (1992-1999)

Variable	Pre-treatment averages				
	Cornwall	Counterfactual Cornwall	South Yorkshire	Counterfactual South Yorkshire	England
Euros of Structural Funds per capita	26.74	20.62	28.69	25.92	11.08
Per capita GDP	10,980	15,665	13,840	19,640	18,155
Population in employment	53.23	53.77	52.20	53.69	58.51
Economically inactive population	41.14	40.32	41.04	39.73	36.53
Female employment	21.33	22.75	22.24	22.61	23.77
Full-time workers	52.35	52.92	49.47	51.58	56.61
Self-employed workers	11.64	7.54	5.17	5.41	7.42
Long-term unemployment rate	26.18	27.07	29.98	35.41	25.27
Sectorial shares (percentage)					
Agriculture & Mining	6.28	3.07	0.6	0.88	2.19
Manufacturing	11.63	16.48	18.95	18.48	16.85
Construction	5.41	4.87	5.61	4.83	4.64
Wholesale & retail trade	25.80	25.34	27.33	25.66	25.95
Financial & insurance activities	9.68	11.97	11.78	12.50	14.33
Real Estate; scientific activities; public administration and defence; education	31.37	33.62	36.68	31.06	30.08
Education and training					
16-19 year old in full-time education	3.37	3.16	2.73	2.92	3.31
Working age population with NVQ 3+	33.88	33.97	31.45	33.42	36.35
Working age population receiving job related training	10.64	11.79	12.62	12.36	12.20

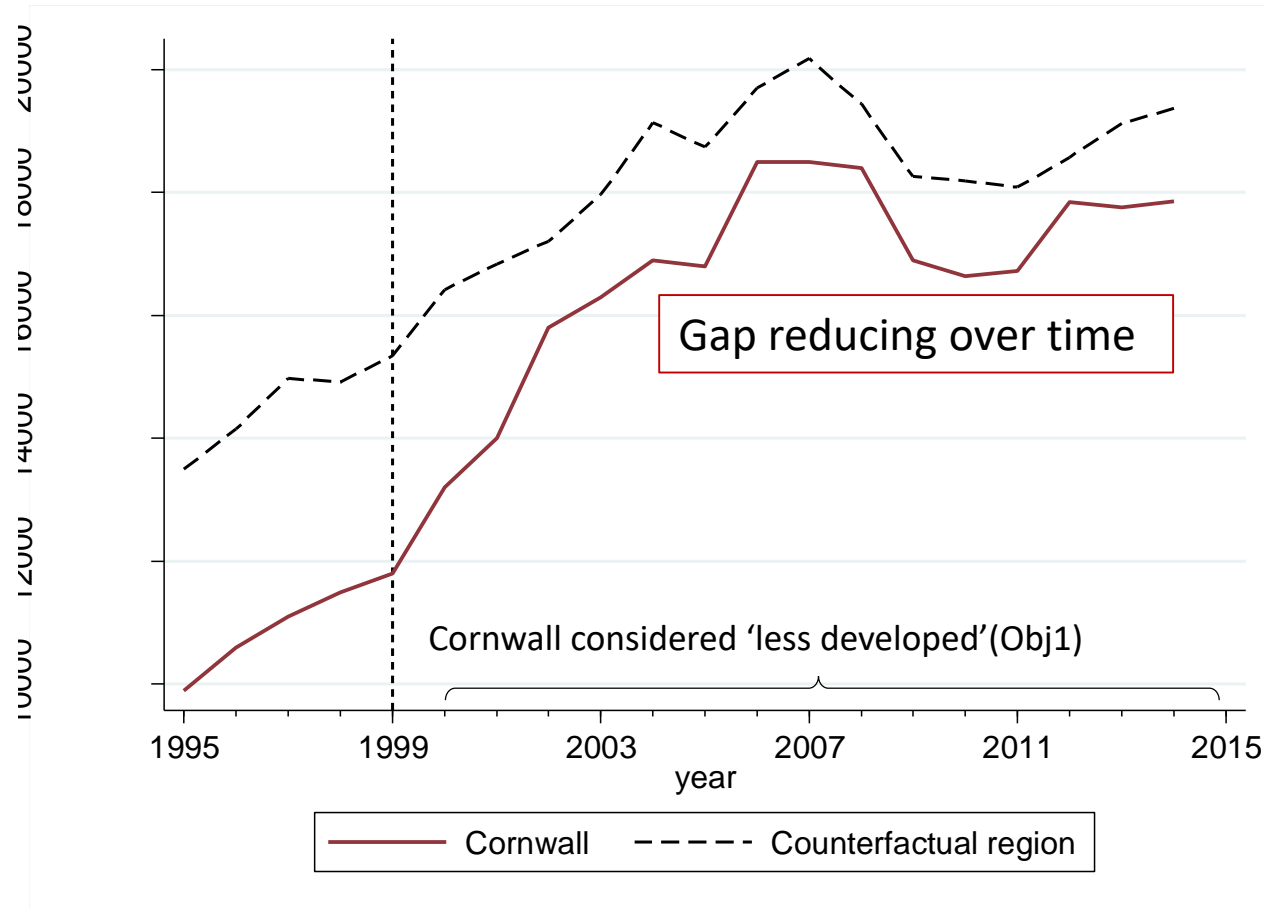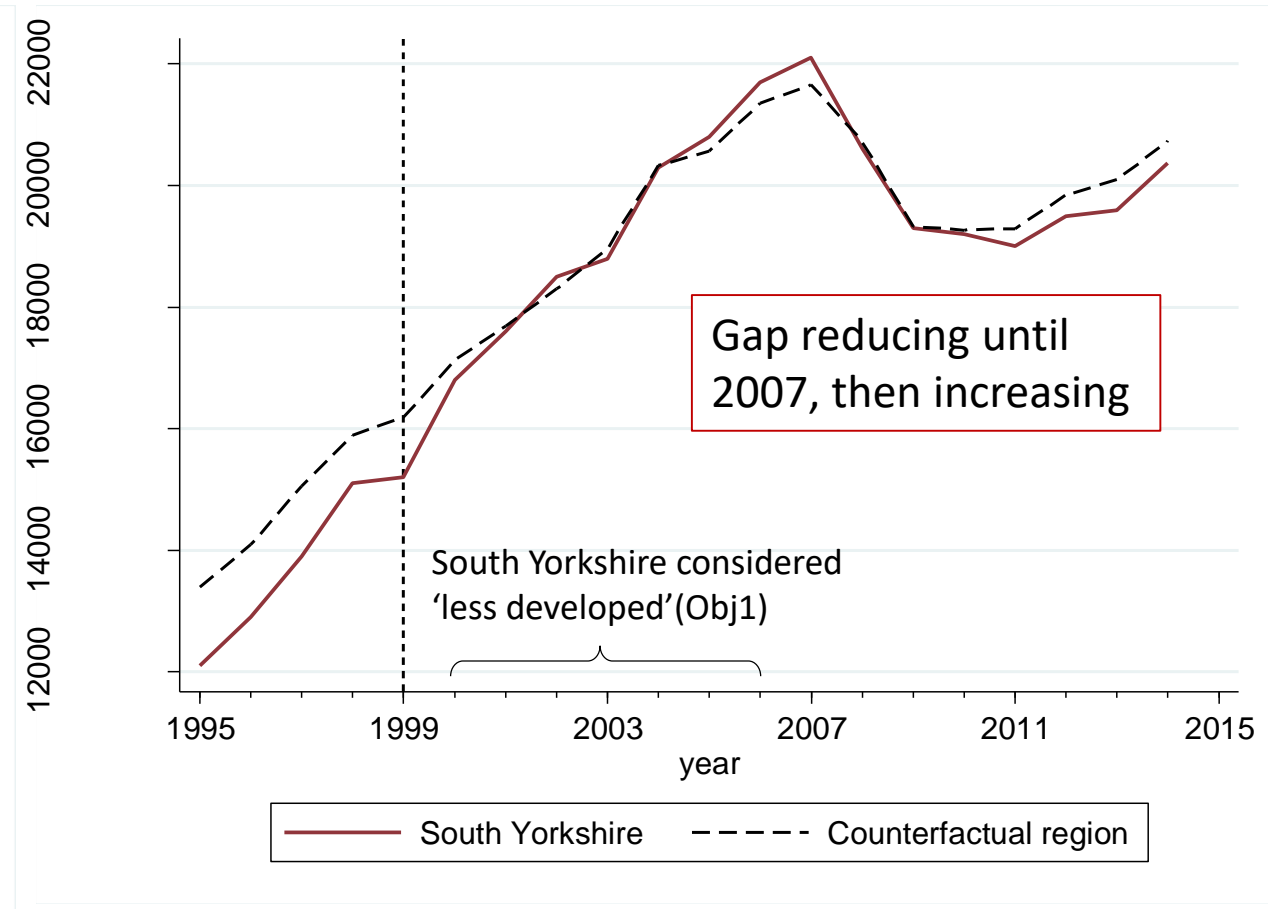# Unemployment trends – highly-funded and counterfactual regions

GDP pc trends – highly-funded and counterfactual regions

Cornwall

South Yorkshire

Gap reducing over time

Gap reducing until 2007, then increasing

Cornwall considered 'less developed'(Obj1)

South Yorkshire considered 'less developed'(Obj1)

Cornwall — — — Counterfactual region

South Yorkshire — — — Counterfactual region

Robustness tests suggest that these results are not driven by possibly confounding policies or by displacement

Research questions

1. **Have EU funds been effective in the UK?**
   - Robust **linear** relationship between EU funds and **economic growth** in UK regions
   - Risks from **drastic decrease** of funding (de-assignment from Objective 1 status)

2. **What type of regions have benefitted the most?**
   - **Less developed** regions – recipient of 'Objective 1' funds
   - Objective 1 regions: better performance in terms of **labour market and economic outcomes**

3. How? (What have been the most successful policy designs?)

4. Have EU funds contributed to a more favourable view of Europe in the country?

Research questions

1. Have EU funds been effective in the UK?
   - Robust linear relationship between EU funds and economic growth in UK regions
   - Risks from drastic decrease of funding (de-assignment from Objective 1 status)

2. What type of regions have benefitted the most?
   - Less developed regions – recipient of 'Objective 1' funds
   - Objective 1 regions: better performance in terms of labour market and economic outcomes

3. **How? (What have been the most successful policy designs?)**

4. Have EU funds contributed to a more favourable view of Europe in the country?

Regional needs, regional targeting and regional growth: an assessment of the impact of EU funds in UK regions. (with V Monastiriotis)

- Commitment allocations by field of intervention (FOI), aggregated and matched by FOI for programming periods 2000-2006 and 2007-2013. Kindly provided by L. Dijkstra (DG Regio)

  - *transport infrastructure*

  - *research technological development and innovation (RTDI)*

  - *human resources*

  - *tourism, culture and regeneration*

  - *business development*

- Using variables related to each investment axis, measured at t=0, we describe *initial conditions* of regions in each pillar:

  Transport infrastructure: km roads p/c , km roads p/km^2 of land;
  RTDI: % employed in high-tech, patent applications p/c;
  Human resources: % U benefit claimants , % tertiary educated;
  Tourism culture: tourist arrivals p/c, tourist establishments p/c;
  Business devt: Ratio of GVA to wages in manufacturing, manufacturing investment rate

Policy design of EU funds in UK regions

Regression analysis studying the relationship between key characteristics of **EU strategies** and **regional GDP pc growth**

(Rodríguez-Pose & Fratesi 2004, Sotiriou & Tsiapa 2015, Crescenzi & Giua 2016, Crescenzi et al 2017)

We consider three aspects of EU strategies:

1) *Concentration of investment* in one investment axis:
Transport infrastructure; Business development; Research & Innovation; Human resources; Tourism & regeneration

2) *Misalignment allocations/needs* – dissimilarity between investment priorities and regional needs (initial weaknesses) across the 5 development axes (Transport; Business; RTDI; Human resource; Tourism culture) within regions

3) *Specialization* – investment in an area of initial relative strength

Concentration and misalignment

Dep. var.: **GDP pc growth**	(1)	(2)	(3)
Share of EU funds for:			
Human resources	-0.0136 (0.0293)		
Transport infrastructure	0.100 (0.0680)		
RTD & Innovation	0.0277 (0.0401)		
Tourism, culture and regeneration	-0.0279 (0.0275)		
Business development	0.0292 (0.0191)		
Concentration of funds		-0.0181* (0.0103)	
Misalignment allocation-needs			-0.00104*** (0.000352)
Controls	✓	✓	✓
FE	✓	✓	✓
Observations	74	74	74
R-squared	0.983	0.980	0.981
UK NUTS2 regions	37	37	37

No single pillar emerges as the most growth-conducive, **no evidence of positive effects of concentration**

If anything, concentration of funds is harmful for growth

investment strategies **not targeted** towards the **needs** of regions, are **less growth-enhancing**

Specialization

EU funds pc for / initial strength in:

Dep. Variable: GDP pc growth	Human resources	Transport infrastructure	RTD & Innovation	Tourism, culture and regeneration	Business development
	(1)	(2)	(3)	(4)	(5)
EU funds pc in investment pillar	0.000220*** (0.000061)	0.000134 (0.000165)	-6.66e-05* (3.90e-05)	5.08e-06 (0.000041)	0.000056 (0.000036)
Initial strength in investment pillar	0.00809 (0.0203)	0.0764 (0.0658)	0.0331*** (0.0109)	0.0101 (0.0221)	0.00329 (0.00447)
(EU funds pc in pillar) x (initial strength in pillar)	-0.000257*** (7.46e-05)	3.16e-05 (0.000206)	0.000492*** (0.000179)	0.000187* (0.000115)	0.000122 (0.00012)
Controls	✓	✓	✓	✓	✓
FE	✓	✓	✓	✓	✓
Observations	74	74	74	74	74
R-squared	0.984	0.982	0.985	0.986	0.984
UK NUTS2 regions	37	37	37	37	37

Investment in **human resources** is associated with growth in regions with weaker initial HR conditions

Innovation spending is more growth-conducive in regions already specialised in Research & Innovation

1. Have EU funds been effective in the UK?
   - Robust linear relationship between EU funds and economic growth in UK regions
   - Risks from drastic decrease of funding (de-assignment from Objective 1 status)

2. What type of regions have benefitted the most?
   - Less developed regions – recipient of 'Objective 1' funds
   - Objective 1 regions: better performance in terms of labour market and economic outcomes

3. **How? (What have been the most successful policy designs?)**
   - **Overconcentration** of funding does not lead to better economic performance, unless regions **specialise in innovation**
   - Strategies prioritising on **local relative weaknesses** are more economically effective – particularly if addressing issues of high unemployment/scarce human capital

4. Have EU funds contributed to a more favourable view of the EU in the country?

Research questions

1. Have EU funds been effective in the UK?
   - Robust linear relationship between EU funds and economic growth in UK regions
   - Risks from drastic decrease of funding (de-assignment from Objective 1 status)

2. What type of regions have benefitted the most?
   - Less developed regions – recipient of 'Objective 1' funds
   - Objective 1 regions: better performance in terms of labour market and economic outcomes

3. How? (What have been the most successful policy designs?)
   - Overconcentration of funding does not lead to better economic performance, unless regions specialise in innovation
   - Strategies prioritising on local relative weaknesses are more economically effective – particularly if addressing issues of high unemployment/scarce human capital

4. **Have EU funds contributed to a more favourable view of the EU in the country?**

Have EU funds helped against Brexit? A spatial RDD analysis.
(with R Crescenzi & M Giua)

The surge of nationalist and populist movements across Europe makes it more and more urgent for the EU to contain anti-EU feelings

EU Cohesion Policy regarded as crucial for improving public opinions towards the EU
(Dellmuth & Chalmers 2015, Bachtler & Mendez 2017, Capello & Perucca 2017, Bachtrogler & Oberhofer 2018, Borin et al 2018)

UK: ideal context to understand the role of EU Cohesion Policy in shaping attitudes towards EU

- *What has been the **impact of EU Cohesion Policy on voting choices** at the Referendum on Brexit?*

- *Has the effect of EU funds on the Referendum results been **mediated by key local conditions**?*

Counterfactual analysis drawing on data on Referendum outcome at the level of electoral ward (source: BBC)

Compare the voting outcomes of wards that received high proportion of EU funds vs. those of counterfactual wards

Beneficiaries and distance from regional borders

2014-2020

Wales

Beneficiaries

- ○ < 7m
- ○ 7m - 22m
- ○ 22m - 70m
- ○ 70m - 126m
- ○ > 126m
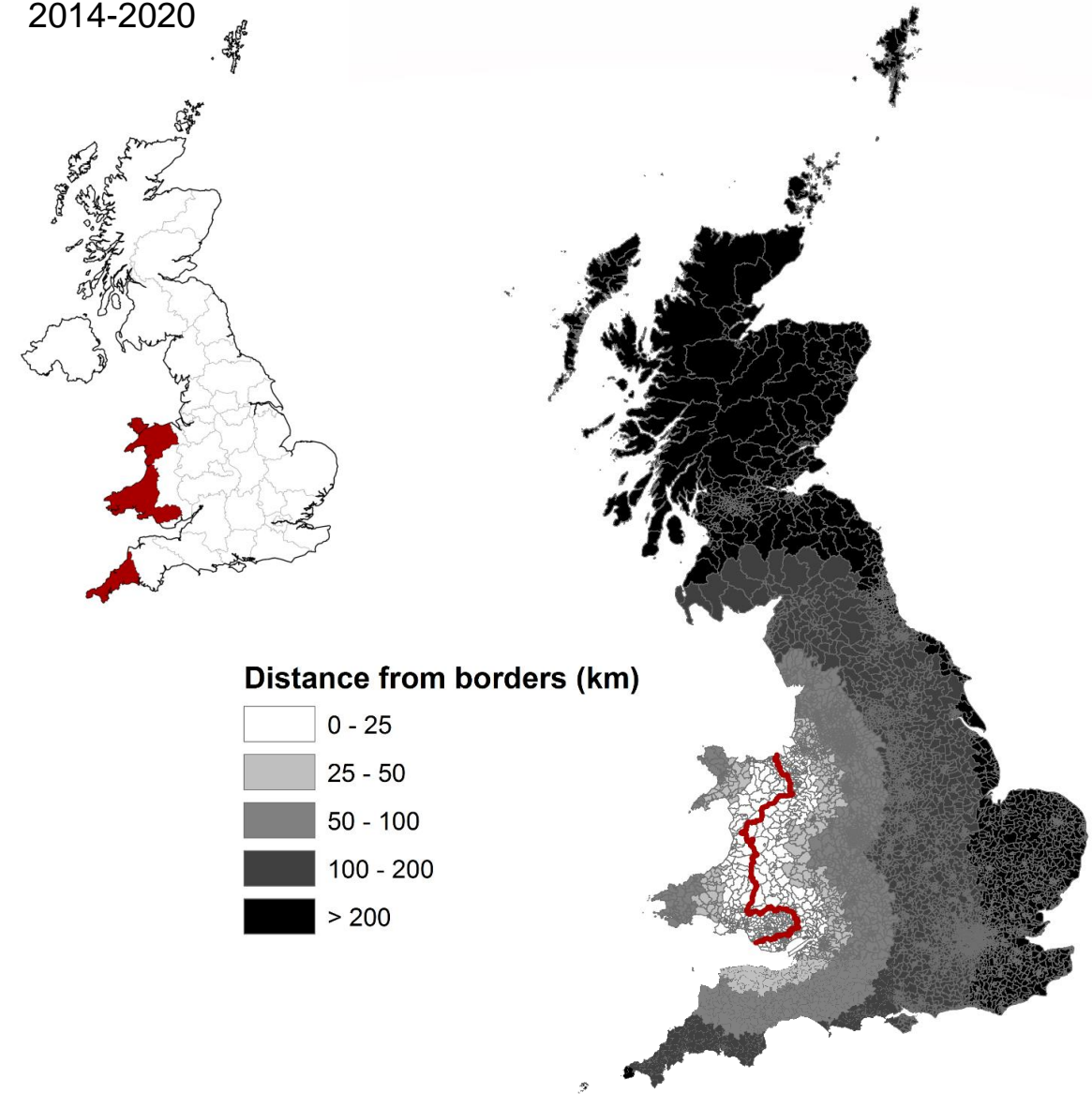
Distance from borders (km)

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 200
- > 200
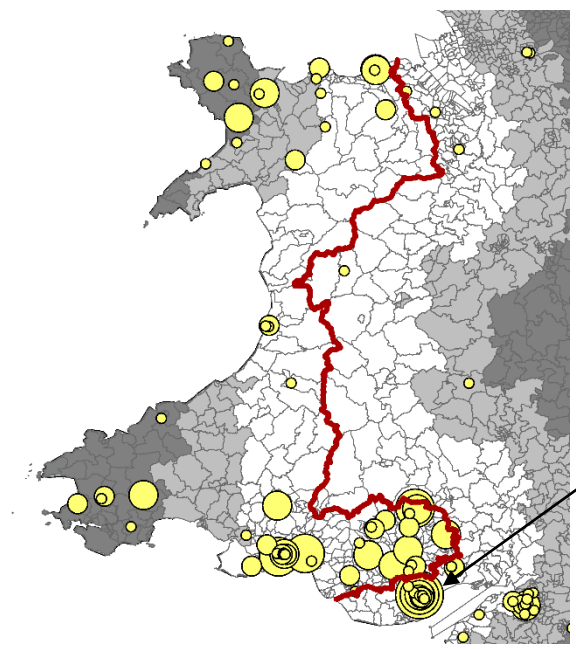
Clear discontinuity between West Wales and East Wales: more EU funds in border wards, west of boundary

Cardiff (to be excluded from analysis)

Balancing test: near the border, treatment and control are similar

No difference between highly-funded and less-funded wards (conditioning on distance from border)

- coefficient
- 95% confidence interval

Sample: 50km from border (excluding Cardiff)

Estimation model (Spatial RDD)

Dependent variable: share of *Remain* votes at ward level

Key explanatory variable: dummy equal to 1 for **wards** belonging to West Wales

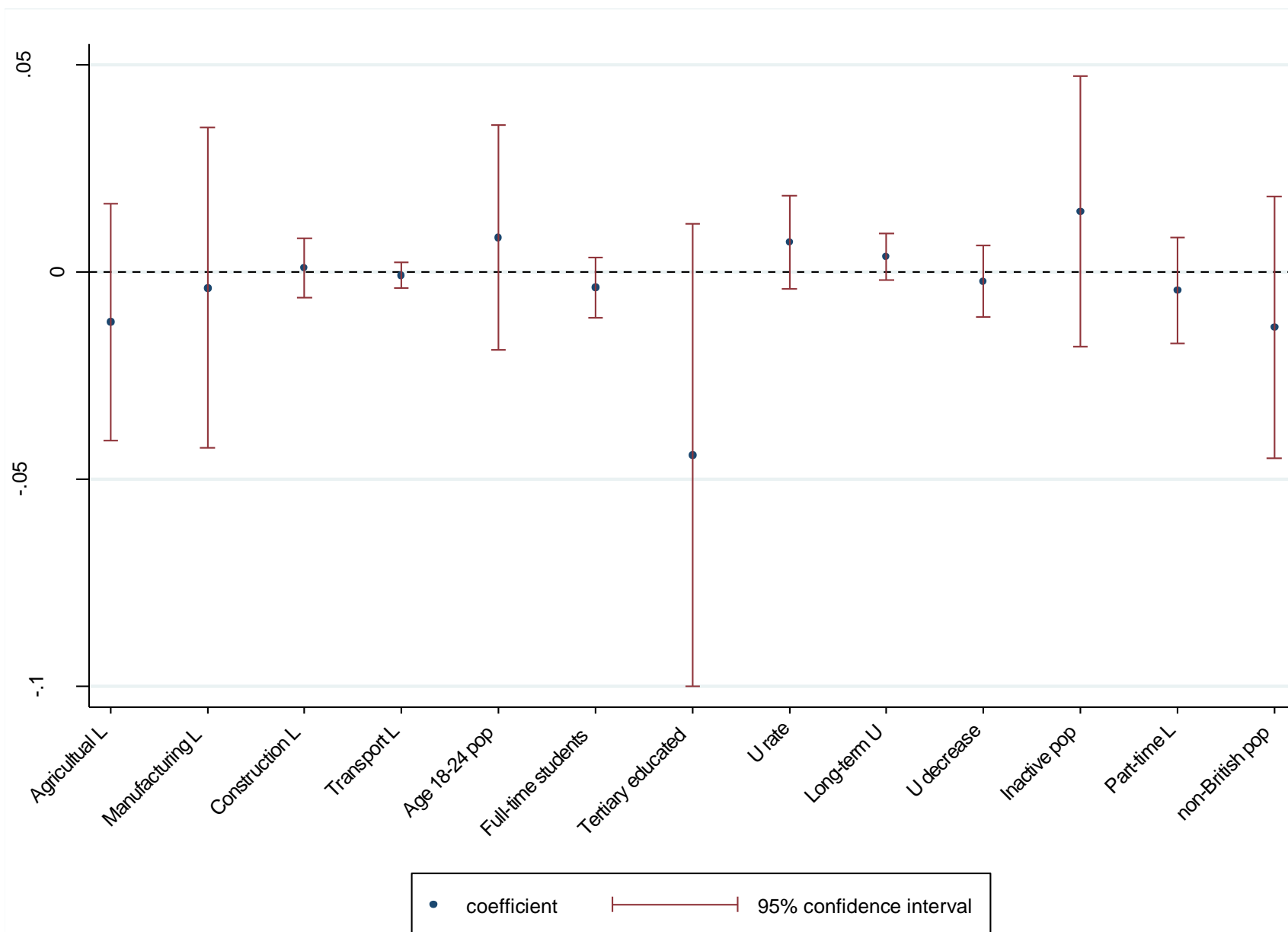**Discontinuity:** the boundary between East Wales and West Wales

Forcing variable: *Distance* from the border in kilometres

By assigning more weight to wards close to the boundary (very similar) we are in a randomized setting

Model specifications:

- all wards belonging to Wales
- selected distance from border (25, 50km)

Distance from borders (km)

0 - 25
25 - 50
50 - 100
100 - 200
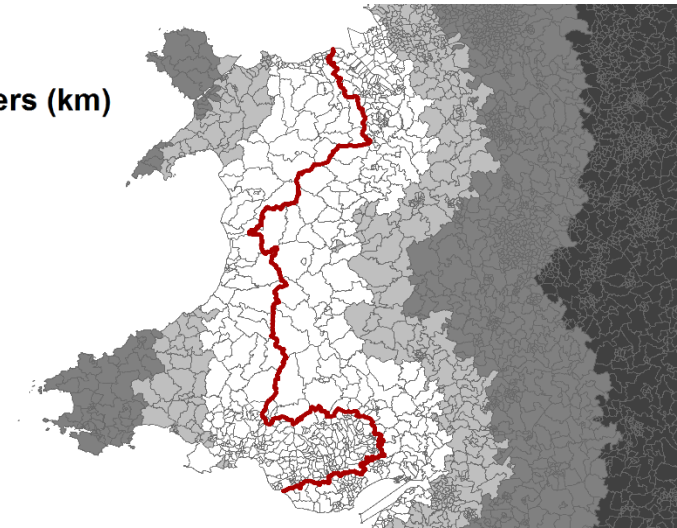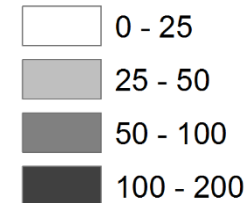
Results: EU funds and Brexit (RDD graphs)

Blue: treatment wards   Red: control wards
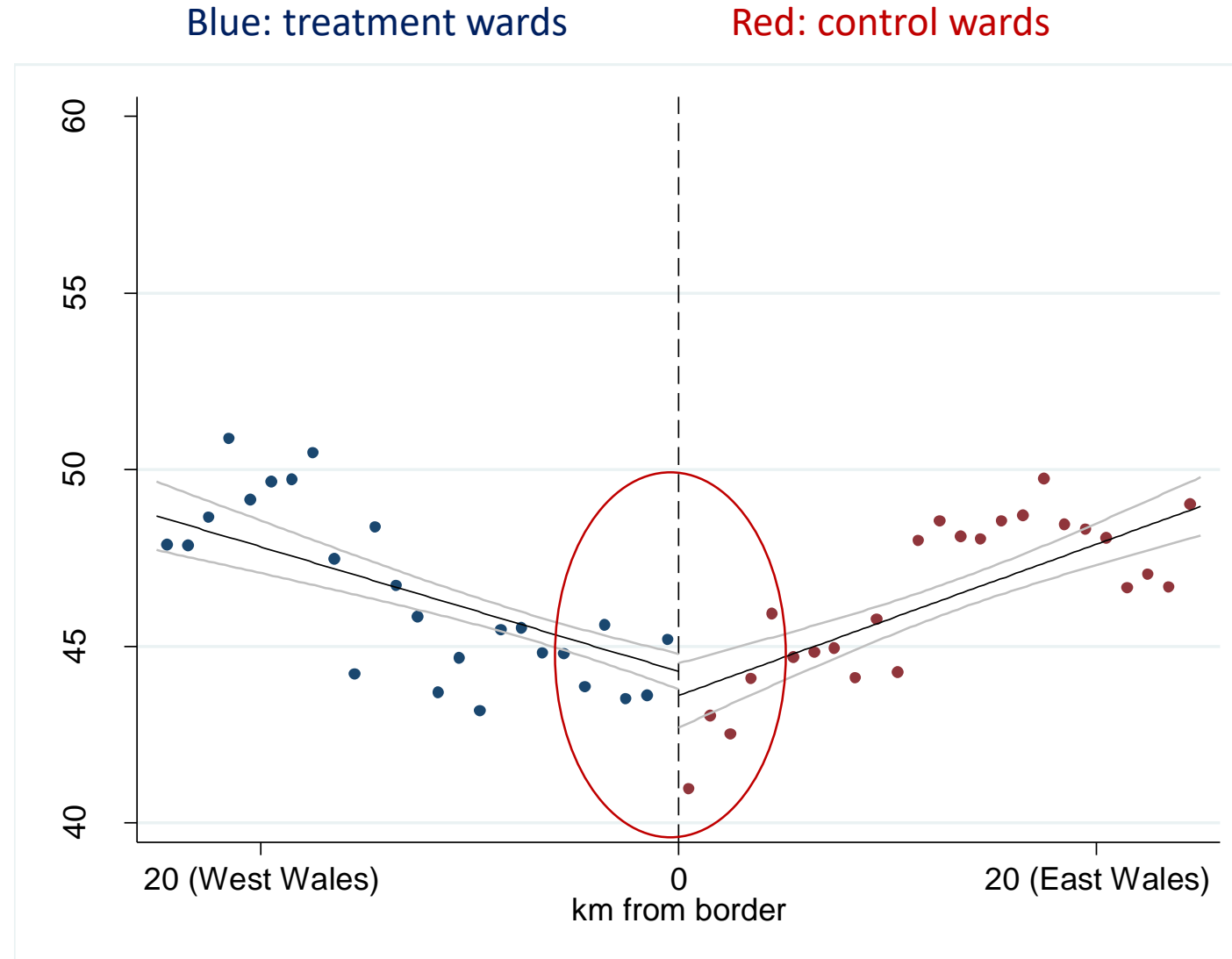
No significant discontinuity at the border → no effect of EU funds on Brexit vote

Sample: wards 25 km from border

EU funds and Brexit: mediating factors

What if the effect of EU funds on Brexit is **mediated by key local conditions**?

Interaction term between 'treatment variable' (West Wales/East Wales dummy) and:

- Share of tertiary educated at the time of Referendum

Higher endowment of human capital may correspond to a higher ***awareness*** of the policy (Osterloh 2011, Capello & Perucca, 2017), and to a better capacity to make use of the funds (Becker et al. 2013)

- Unemployment reduction from the moment in which West Wales became Objective 1 and the Referendum date

A decrease in unemployment reflects an improvement of local labour market conditions which may be the result of a stronger **impact** of EU funds

EU funds and Brexit: mediating factors

EU funds, tertiary educated, and Brexit

EU funds, unemployment reduction, and Brexit
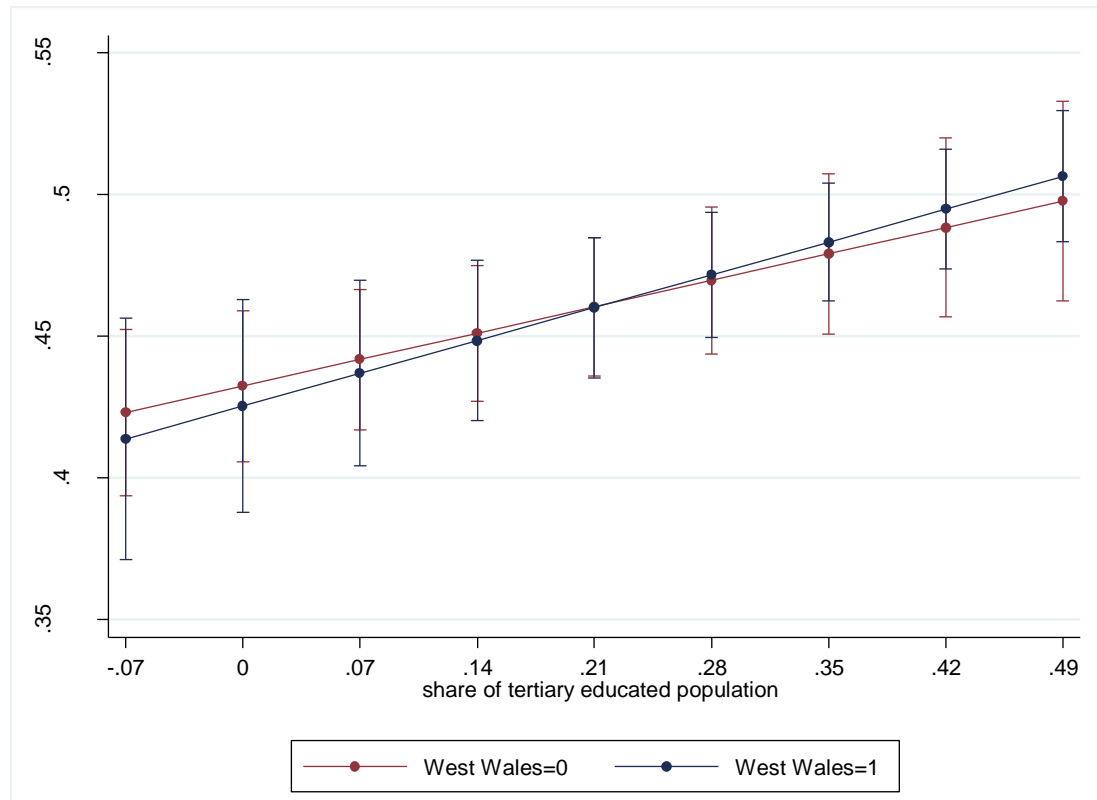
No different effect of **human capital** on
Referendum outcome in
highly-funded vs. less-funded wards
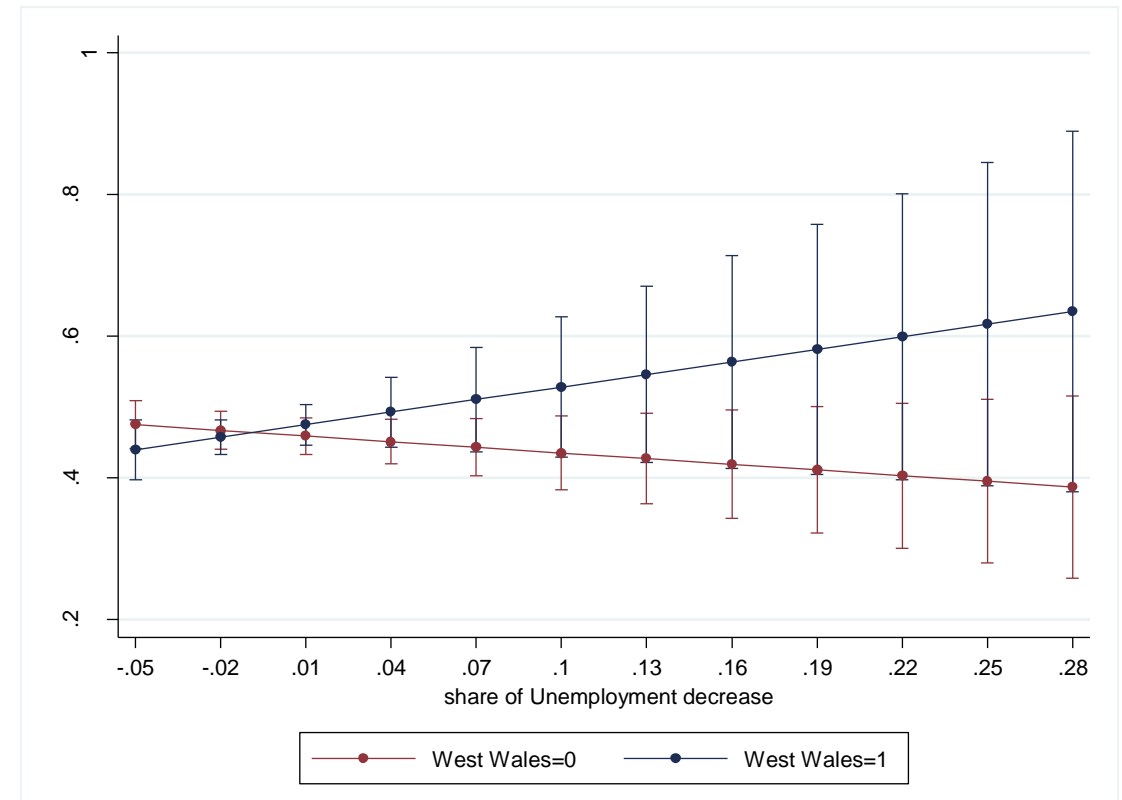
Some evidence that areas in **W Wales**
where **unemployment decreased** more
voted **Remain more** (than control wards)

Triple interaction model (EU funds, U reduction, human capital)

Is the effect on Brexit of EU funds and unemployment decrease itself varying *depending on the level of human capital*?

Blue: West Wales   Red: East Wales
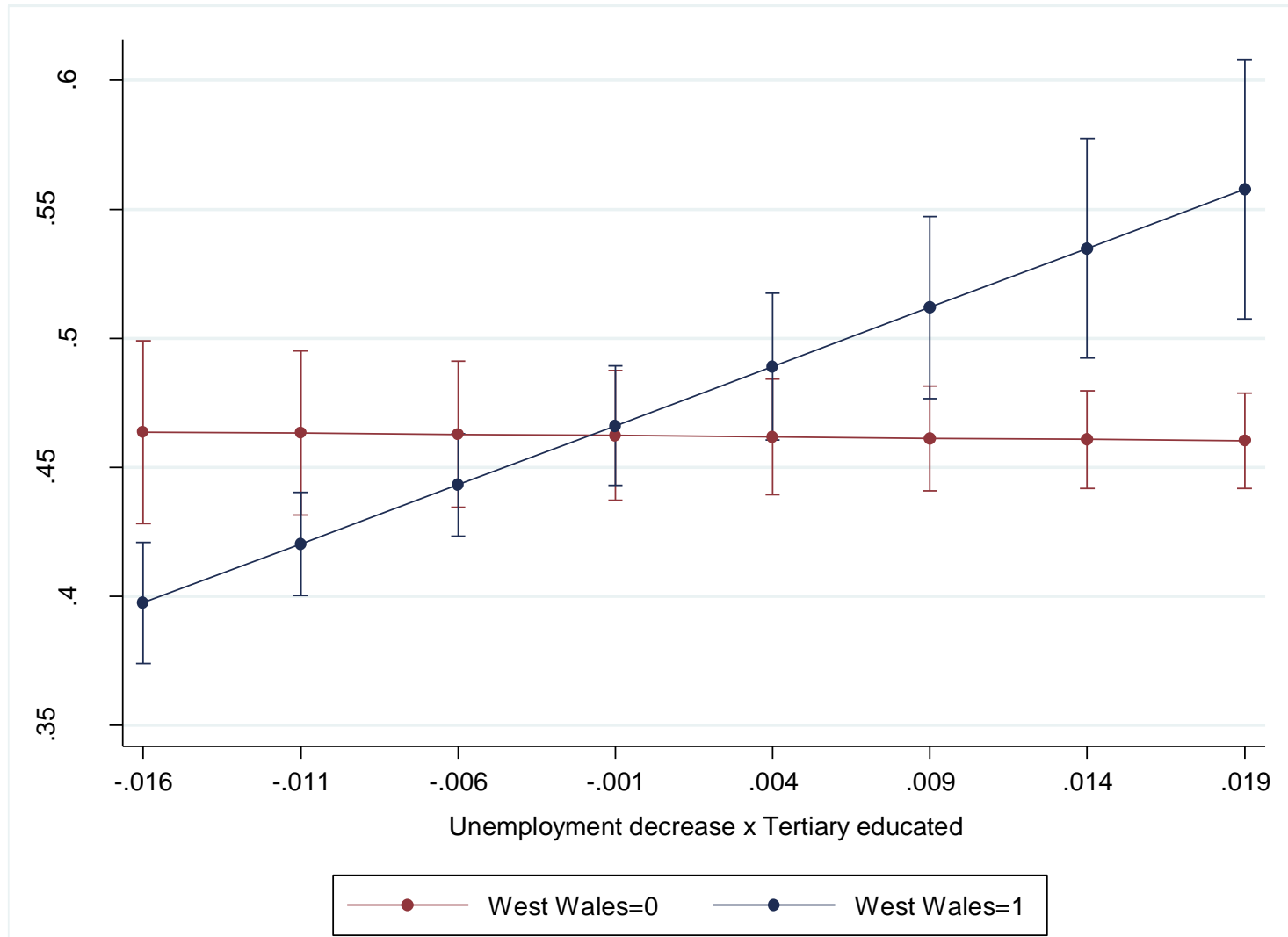
Areas in **West Wales** where:
unemployment decreased more +
human capital is higher
voted **Remain more**
(than control wards)

Research questions

1. Have EU funds been effective in the UK?
   - Robust linear relationship between EU funds and economic growth in UK regions
   - Risks from drastic decrease of funding (de-assignment from Objective 1 status)

2. What type of regions have benefitted the most?
   - Less developed regions – recipient of 'Objective 1' funds
   - Objective 1 regions: better performance in terms of labour market and economic outcomes

3. How? (What have been the most successful policy designs?)
   - Overconcentration of funding does not lead to better economic performance, unless regions specialise in innovation
   - Strategies prioritising on local relative weaknesses are more economically effective – particularly if addressing issues of high unemployment/scarce human capital

4. **Have EU funds contributed to a more favourable view of Europe in the country?**
   - No evidence of more 'Remain' votes in highly-funded areas
   - More pro-Europe votes only where **labour market conditions have improved** (stronger impact) – an effect **reinforced by human capital** (higher awareness)

EU funds in the UK: some implications

Some implications for Britain:

- EU Cohesion Policy seems to have been a significant force of regional **growth and convergence** in the UK

- **Loss of EU Structural Funds** might expose the economy of less developed regions more dependent on EU aid to potential adverse effects

- The future UK regional policy (*Shared Prosperity Fund*) may choose to emulate some successful features of EU Cohesion Policy, such as:

    - <u>Targeted to disadvantage</u>: substantial resources invested in 'lagging behind' territories

    - <u>MFF</u>: long-time horizon for investment strategies

    - <u>Needs-targeting</u>: balanced strategies (focusing on multiple development objectives) tailored to local specificities

EU funds in the UK: some implications

Some implications for the EU:

- A more favourable view of the EU is found only in areas where *local economic conditions have improved* during the funding period – possibly *because of* Cohesion Policy

- This is valued more if people have higher educational qualifications – possibly reflecting (1) higher awareness over the existence of the funds and (2) higher capacity to absorb them

Therefore:

- Strengthening the **communication** over the presence of structural funds might be important to shape public support for the EU

- Yet this may foster a stronger feeling of European identification only if EU investment programmes produce **tangible effects** in disadvantaged areas

Thank you for your attention

Marco Di Cataldo

m.di-cataldo@lse.ac.uk

Di Cataldo, M. (2017). The impact of EU Objective 1 funds on regional development: Evidence from the U.K. and the prospect of Brexit. *Journal of Regional Science*

Di Cataldo, M. and V. Monastiriotis (2018). Regional needs, regional targeting and regional growth: an assessment of the impact of EU funds in the UK regions. *Regional Studies*

Crescenzi, R., M. Di Cataldo and M. Giua (2018). Have EU funds helped against Brexit? A spatial RDD analysis.

Leave votes and EU funds

Dep. Variable: % Leave votes	(1)	(2)	(3)	(4)
EU funds per inhabitant	**-0.0137**	**-0.0149**	**-0.0111**	**-0.0107**
	(0.00835)	**(0.00911)**	**(0.00825)**	**(0.00886)**
Inward European FDI per capita (million $)	-0.00266	-0.00265	-0.00377	-0.00692**
	(0.00175)	(0.00183)	(0.00231)	(0.00302)
% votes for UKIP at 2015 elections	1.199***	1.176***	1.147***	1.158***
	(0.0484)	(0.102)	(0.116)	(0.123)
20-34 year old population	-0.827**	-0.799**	-0.697**	-0.849**
	(0.264)	(0.292)	(0.290)	(0.323)
Unemployment benefit claimants	2.676**	2.263	2.320*	2.678*
	(1.020)	(1.293)	(1.198)	(1.250)
Employed people with tertiary education	0.0288	0.0185	0.0137	0.0123
	(0.0360)	(0.0544)	(0.0453)	(0.0472)
Growth of migrants from outside the UK		1.489	1.353	2.114
		(3.165)	(3.100)	(3.165)
Percentage of exports towards the EU			0.352	0.432
			(0.392)	(0.391)
Outward European FDI per capita				0.00297
				(0.00166)
Observations	33	32	32	32
R-squared	0.952	0.945	0.947	0.949

Robustness checks – leave-neighbours-out

Cornwall
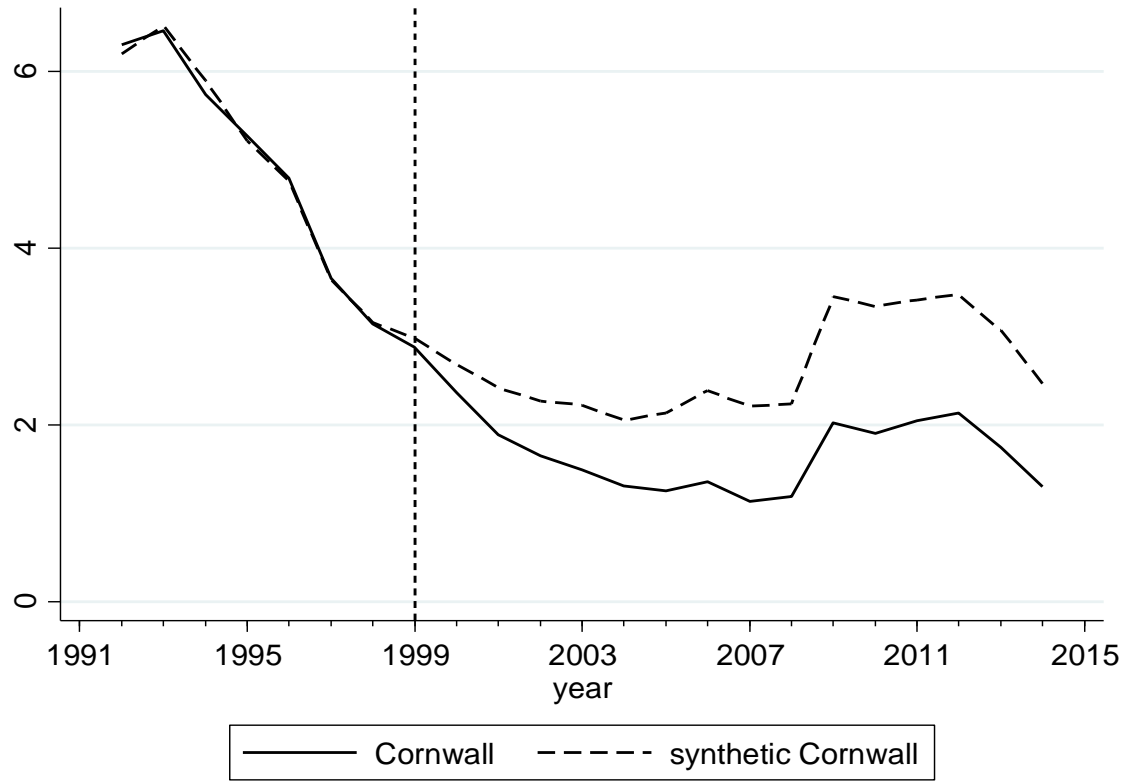
South Yorkshire
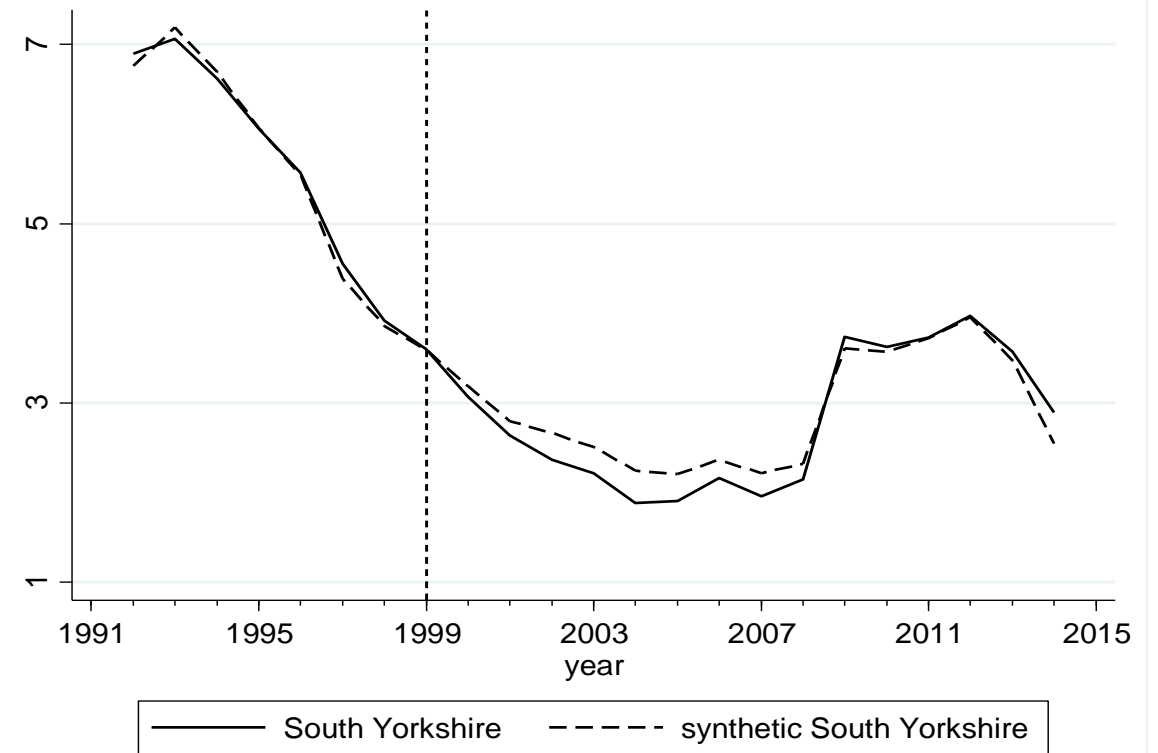
Minimise spillovers: replicate analysis by excluding neighbours from set of 'donors'

Cornwall: Devon

SY: North Yorkshire, East Yorkshire, West Yorkshire, Lincolnshire, Derbyshire and Nottingham

Robustness checks – placebo treatment

Cornwall
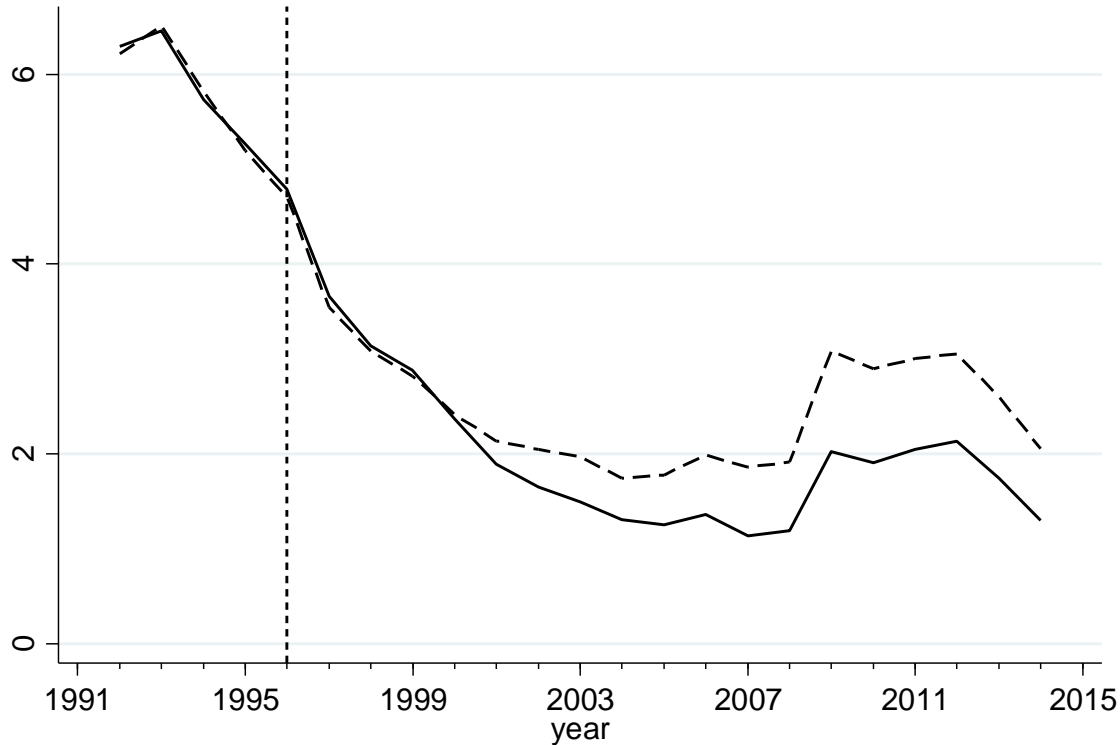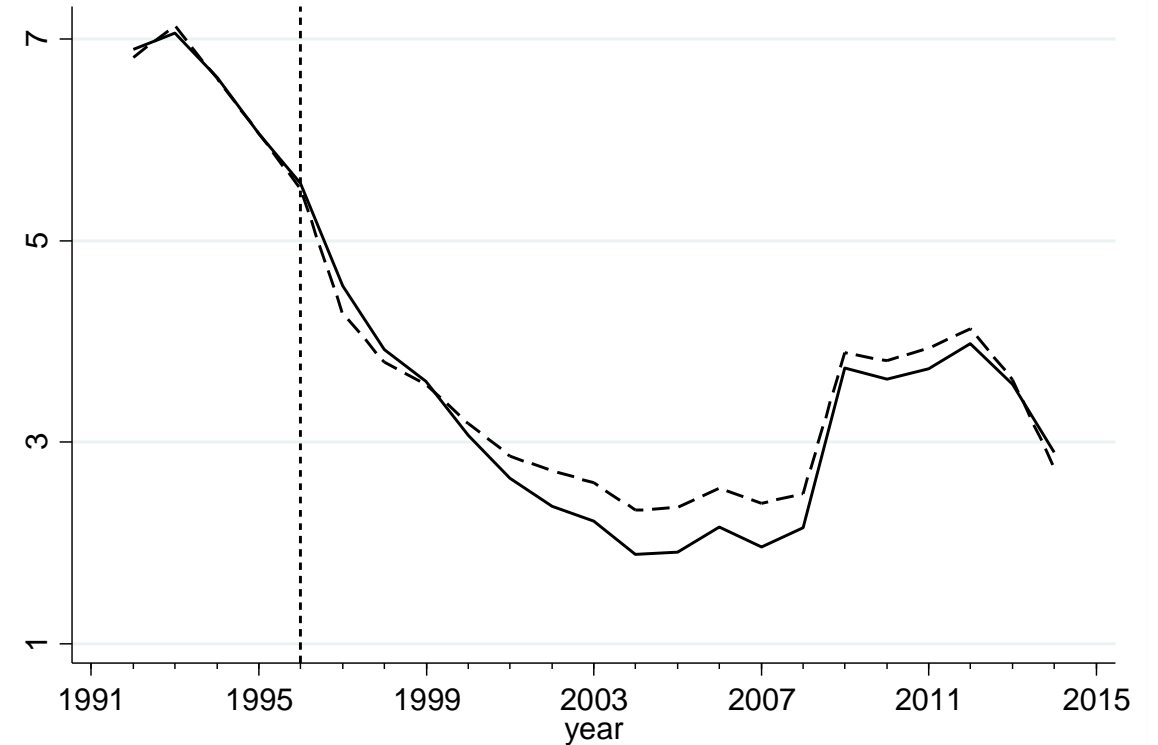
South Yorkshire

Minimise anticipation effects: placebo test allowing for treatment effects to materialise after 1996

(before 1997 National elections)

Balancing test after PSM

Variable	Cornwall		t-test	South Yorkshire		t-test
	Mean			Mean		
	treated (Cornwall)	control (matched)	p>t	treated (South Yorkshire)	control (matched)	p>t
Unemployment (1996-1999)	3.72	3.72	**0.998**	4.24	4.46	**0.453**
1991 Census variables:						
Employed people in agriculture, forestry and fishing	7.40	6.81	**0.536**	0.55	0.59	**0.768**
Employed people in mining	2.16	2.43	**0.521**	4.77	5.08	**0.606**
Employed people in manufacturing	8.67	8.39	**0.550**	15.62	15.05	**0.379**
Employed people in construction	8.62	8.20	**0.302**	7.20	7.02	**0.559**
Employed people in distribution and catering	21.79	22.54	**0.404**	18.48	17.93	**0.363**
Employed people in transportation	4.45	3.93	**0.142**	5.82	5.45	**0.369**
Employed people in banking and finance	6.78	6.60	**0.626**	4.57	4.75	**0.469**
Employed people in other services	26.44	26.78	**0.723**	22.70	22.84	**0.896**
Self-employed workers	11.25	10.94	**0.607**	4.09	3.98	**0.669**
Full-time workers	57.91	57.57	**0.786**	50.87	51.63	**0.466**
Female employment	21.38	21.39	**0.979**	21.01	21.20	**0.356**
Inactive population	38.38	38.93	**0.511**	35.39	35.64	**0.724**
People whose ethnic group is white	99.49	99.44	**0.237**	97.22	98.01	**0.261**
Migrants (within/between wards or from outside UK)	10.39	10.93	**0.238**	9.02	9.96	**0.081**
Students	3.17	3.11	**0.768**	2.73	2.53	**0.411**
wards	134	134		94	94	

Summary of results

Cornwall

2000-2014 Objective 1 period

Significant and large unemployment decrease, GDP pc gap reduced relative to control regions/wards

2007-2013

Effect is smaller relative to the first 7 years of Objective 1 funds, but still significant
Similar magnitude to SY in 2000-2006

South Yorkshire

2000-2006 Objective 1 period

reduction of unemployment, GDP pc increase relative to control regions/wards

2007-2013

Effects are partially or completely offset in the medium-term
Objective 1 funds have not led to a new self-sustaining development path

Implications

- **Brexit**: losing the possibility to access EU Structural Funds is likely to expose the economy of less developed UK regions to potential adverse effects

- **South Yorkshire's experience** – short-term shock, medium-term struggle
    - may represent a valuable lesson for highly subsidised UK regions in case of Brexit (Cornwall, West Wales)

- Cornwall is *not* bound to follow the destiny of South Yorkshire
    - There are *differences* between the two regions, e.g. in terms of investment strategy adopted

Implications

- **Brexit**: losing the possibility to access EU Structural Funds is likely to expose the economy of less developed UK regions to potential adverse effects

- **South Yorkshire's experience** – short-term shock, medium-term struggle
  - may represent a valuable lesson for highly subsidised UK regions in case of Brexit (Cornwall, West Wales)

- Cornwall is *not* bound to follow the destiny of South Yorkshire
  - There are differences between the two regions, e.g. in terms of investment strategy adopted

- But Cornwall *would not be entitled to receive EU transition funding*, should the UK leave the EU
  - This makes a negative shock more likely, particularly in absence of compensatory policies from the central government

Themes and research questions

- **Impact of EU regional policy in the UK**
  - What are the key features of successful investment strategies? (Di Cataldo & Monastiriotis 2018)
  - Have structural funds been effective in the regions 'in highest need'? (Di Cataldo 2017)
  - Have structural funds helped against Brexit? (Crescenzi, Di Cataldo & Giua 2018)

- Prospect of Brexit in Britain
  - What may be the consequences of a sudden interruption of EU funds? (Di Cataldo 2017)
  - If EU funds are to be replaced, how should the new regional policy be devised? (Di Cataldo & Monastiriotis 2018)

- Implications for the EU and for future Cohesion Policy
  - What is the effect of a regional investment policy across its full cycle? (Di Cataldo 2017)
  - Under which conditions can EU funds contribute to foster a more favourable view of Europe? (Crescenzi, Di Cataldo & Giua 2018)

Data

- Dependent variables:
  - **Unemployment benefit claimants**
    (Nomis dataset, available 1992-2014 at ward level)
  - **Per capita GDP**
    (OECD, available 1995-2014 at NUTS2 level)

- Analysis performed at 2 levels: regions and wards

Level of analysis	Variable	Data source
NUTS2 Region	Structural Funds payments	DG Regional Policy
	Socioeconomic and labour force characteristics; Sectorial shares	Eurostat; LFS Local Area Data
Ward	1991 Sectorial shares; 1991 Labour force characteristics	1991 Census

$$Remain_w = \beta_0 + \boldsymbol{\beta_1} T_w + \sum_{\rho=1}^{3} \gamma_\rho (f_w)^\rho + (T_w) \sum_{\rho=1}^{3} \gamma_\rho (f_w)^\rho + \varepsilon_w$$

$Remain_w$ is the share of Remain votes at the 2016 Referendum in ward w

T_w is the treatment variable, a dummy equal to 1 for wards belonging to West Wales and 0 otherwise

f_w is the forcing variable, which can enter with a polynomial degree up to 3rd order, also interacted with the treatment variable

Standard errors clustered at NUTS3 level

Spatial RDD

Dep. Variable: **share of Remain votes**

Sample:	Wales	50km from border	25km from border	Wales	50km from border	25km from border	Wales	50km from border	25km from border	Wales	50km from border	25km from border
									Cardiff wards excluded			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
West Wales	-0.0172 (0.0394)	-0.0471 (0.0302)	-0.0323 (0.0375)	-0.0389 (0.0330)	-0.0255 (0.0373)	-0.0285 (0.0313)	0.00763 (0.0270)	-0.0319 (0.0237)	-0.00730 (0.0244)	-0.0127 (0.0193)	0.00354 (0.0236)	-0.00511 (0.0207)
Polynomial	1-1	1-1	1-1	3-3	3-3	3-3	1-1	1-1	1-1	3-3	3-3	3-3
Observations	852	1,344	765	852	1,344	765	823	1,315	736	823	1,315	736
R-squared	0.044	0.098	0.086	0.245	0.117	0.100	0.075	0.102	0.129	0.327	0.140	0.161
Best polynomial degree (AIC)				✓	✓	✓				✓	✓	✓

Forcing variable: distance (km from border). Consistent results using alternative forcing variable (geographical coordinates)

No significant effect of treatment on Brexit vote

Robustness checks

	Dep. Variable: **share of Remain votes**					
Treatment variable:	West Wales dummy		**Beneficiaries (€ per capita)**			
Sample:	50km from border	50km from border	Wales	Wales	Wales	Wales
	Control wards < 10km from border excluded			Cardiff wards excluded		Cardiff wards excluded
	(1)	(2)	(3)	(4)	(5)	(6)
West Wales	-0.00539 (0.0188)	0.0192 (0.0143)				
Beneficiaries (€ per capita)			-3.84e-07 (8.45e-07)	-1.45e-07 (1.14e-06)	6.84e-07* (3.90e-07)	5.56e-07 (4.26e-07)
Tertiary educated	0.198** (0.0907)	0.228** (0.0947)	0.183* (0.0951)	0.223** (0.0852)	0.183* (0.0957)	0.222** (0.0863)
WWales/Benef x Tertiary educ.	0.113 (0.0714)		2.10e-06 (4.79e-06)	5.59e-07 (7.37e-06)		
U reduction	0.340 (0.485)	-0.0356 (0.469)	0.697 (0.858)	1.124 (0.721)	0.692 (0.847)	1.120 (0.708)
WWales/Benef x U reduction		1.122** (0.418)			0.000147** (5.90e-05)	0.000131* (6.60e-05)
Controls	✓	✓	✓	✓	✓	✓
Observations	947	947	831	802	831	802
R-squared	0.425	0.427	0.442	0.411	0.445	0.415

Controlling for socio-economic, demographic, labour market characteristics

Synthetic control method

- Compare trends in Cornwall and South Yorkshire with a **weighted combination** of untreated English regions

- Synthetic control regions are constructed on the basis of **pre-treatment observables**

$$Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}$$

- Where Y_{1t} is outcome of treated unit under treatment, $\sum_{j=2}^{J+1} w_j^* Y_{jt}$ approximates outcome in absence of treatment applying optimal weight w* to untreated units

Abadie and Gadeazabal 2003, Abadie et al. 2010

Synth – regional weights

Region	Synthetic Cornwall Weight	Synthetic South Yorkshire Weight
Tees Valley & Durham	0.088	0.365
Northumberland	0.125	0.100
Cumbria	0	0
Cheshire	0	0
Greater Manchester	0	0.156
Lancashire	0	0
East Yorkshire	0	0.251
North Yorkshire	0	0
West Yorkshire	0	0
Derbyshire & Nottinghamshire	0	0
Leicestershire Rutland	0	0
Lincolnshire	0	0
Herefordshire Worcestershire	0	0
Shropshire & Staffordshire	0	0
West Midlands	0.212	0
East Anglia	0	0
Bedfordshire & Hertfordshire	0	0
Essex	0	0
Inner London	0	0.128
Outer London	0	0
Berkshire Buckinghamshire	0	0
Surrey East & West Sussex	0	0
Hampshire & Isle of Wight	0	0
Kent	0	0
Gloucestershire Wiltshire	0	0
Dorset & Somerset	0	0
Devon	0.575	0

Ward-level – difference-in-differences

DiD model:

$$Ugrowth_{i,t} = \beta \ Obj1 \ region_i + \gamma \ (Obj1 \ region_i \times period_t) + \delta_t + \varepsilon_{i,t}$$

$Ugrowth_{i,t}$ = Unemployment growth rate of ward i in year t

$Obj1 \ region_i$ = 134 wards of Cornwall, 94 wards of South Yorkshire

$period_t$ = 2000-2014 treatment period, or sub-periods 2000-2006, 2007-2014

Control groups: obtained from untreated 8269 England wards using Propensity Score Matching

Period of analysis: 1996-2014

FE in wards are differenced out as growth rates are computed

Standard errors clustered at NUTS2 level

DiD model - results

Dependent variable: U growth	Period:								
	2000-2014		2000-2006		2007-2014		2000-2014	2000-2006	2007-2014
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cornwall wards	0.00575 (0.0092)	0.00891 (0.0092)	0.00574 (0.0092)	0.00892 (0.0092)	0.00575 (0.0092)	0.00892 (0.0092)			
Cornwall wards × period	**-0.038*** (0.0130)**	**-0.044*** (0.0131)**	**-0.049*** (0.0135)**	**-0.056*** (0.0135)**	**-0.028* (0.0151)**	**-0.033** (0.0151)**			
South Yorkshire wards							-0.00087 (0.0081)	-0.00087 (0.0081)	-0.00087 (0.0081)
South Yorkshire wards × period							**-0.0035 (0.0113)**	**-0.0258* (0.0134)**	**0.0160 (0.00974)**
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	4,787	3,923	2,659	2,179	2,932	2,385	3,382	1,880	2,065
R-squared	0.372	0.353	0.091	0.084	0.458	0.440	0.643	0.332	0.694
Wards	268	220	268	220	268	220	188	188	188

DiD model - results

Dependent variable: U growth	Period:								
	2000-2014		2000-2006		2007-2014		2000-2014	2000-2006	2007-2014
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cornwall wards	0.00575 (0.0092)	0.00891 (0.0092)	0.00574 (0.0092)	0.00892 (0.0092)	0.00575 (0.0092)	0.00892 (0.0092)			
Cornwall wards × period	-0.038*** (0.0130)	-0.044*** (0.0131)	-0.049*** (0.0135)	-0.056*** (0.0135)	-0.028* (0.0151)	-0.033** (0.0151)			

*Control for a <u>potentially confounding policy</u>, **Regional Selective Assistance** (RSA): UK national government providing grants to manufacturing firms located in UK areas characterised by high unemployment*

*Changes in eligibility for RSA occur in coincidence with the start of new EU programming periods, and most of Cornwall's territory was eligible for RSA before 2000. However, **48 wards of Cornwall became eligible for RSA transfers in 2000:** test if DiD estimates are sensitive to the exclusion of these 48 wards*

Columns (2), (4), (6): 48 Cornwall wards eligible for RSA in 2000 are excluded

DiD model - results

	Period:								
Dependent variable: U growth	**2000-2014**		**2000-2006**		**2007-2014**		**2000-2014**	**2000-2006**	**2007-2014**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cornwall wards	0.00575 (0.0092)	0.00891 (0.0092)	0.00574 (0.0092)	0.00892 (0.0092)	0.00575 (0.0092)	0.00892 (0.0092)			
Cornwall wards × period	**-0.038*** (0.0130)**	**-0.044*** (0.0131)**	**-0.049*** (0.0135)**	**-0.056*** (0.0135)**	**-0.028* (0.0151)**	**-0.033** (0.0151)**			
South Yorkshire wards							-0.00087 (0.0081)	-0.00087 (0.0081)	-0.00087 (0.0081)
South Yorkshire wards × period							**-0.0035 (0.0113)**	**-0.0258* (0.0134)**	**0.0160 (0.00974)**
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	4,787	3,923	2,659	2,179	2,932	2,385	3,382	1,880	2,065
R-squared	0.372	0.353	0.091	0.084	0.458	0.440	0.643	0.332	0.694
Wards	268	220	268	220	268	220	188	188	188

Columns (2), (4), (6): 48 Cornwall wards eligible for RSA in 2000 are excluded

Triple interaction model

	Dep. Variable: **share of Remain votes**					
Sample:	Wales	50km from border	25km from border	Wales	50km from border	25km from border
					Cardiff wards excluded	
	(1)	(2)	(3)	(4)	(5)	(6)
West Wales	0.0311	0.00644	0.0152	0.00913	0.0162	-0.00657
	(0.0320)	(0.0317)	(0.0295)	(0.0240)	(0.0274)	(0.0221)
Tertiary educated	0.284***	0.241***	0.279***	0.168***	0.203***	0.170***
	(0.0891)	(0.0415)	(0.0793)	(0.0349)	(0.0353)	(0.0298)
U reduction	-1.321	-0.253	-1.506	-0.291	0.147	-0.706
	(1.103)	(0.801)	(0.907)	(0.297)	(0.684)	(0.437)
West Wales x Tertiary educ.	-1.731	-5.870	-0.192	-0.0981	-5.965	1.538
	(2.244)	(4.946)	(2.395)	(0.396)	(5.298)	(1.786)
West Wales x U reduction	1.124	-0.0873	1.083	0.0941	-0.488	0.283
	(1.132)	(0.851)	(0.941)	(0.391)	(0.742)	(0.504)
West Wales x U reduction x Tertiary educ.	6.308**	10.95**	5.867*	4.675***	11.05*	4.136
	(2.369)	(5.151)	(3.619)	(0.858)	(5.490)	(3.172)
Polynomial	3-3	3-3	3-3	3-3	3-3	3-3
Observations	831	1,086	690	802	1,057	661
R-squared	0.377	0.312	0.302	0.427	0.324	0.342
Best polynomial degree (AIC)	✓	✓	✓	✓	✓	✓

Synth results – test for significance

Cornwall

South Yorkshire

Largest gap 2002-14

Largest gap 2002-06
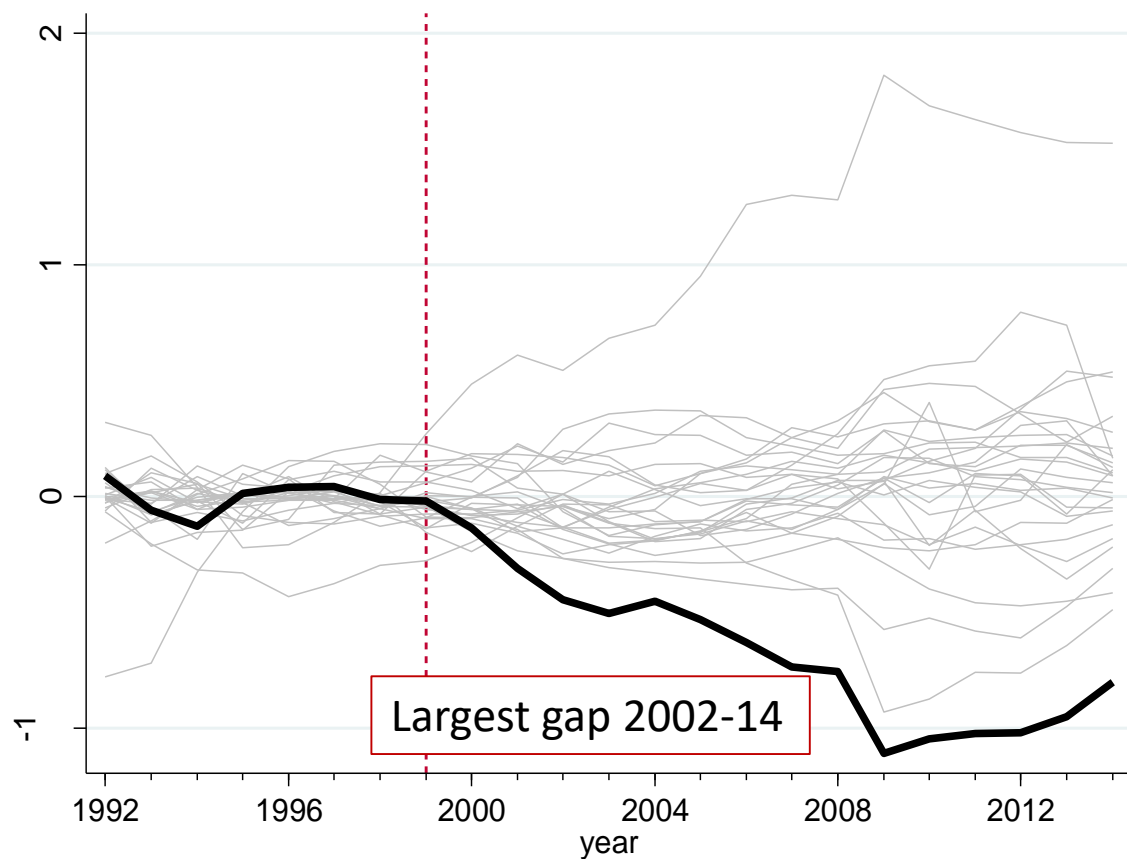
Cornwall — control regions
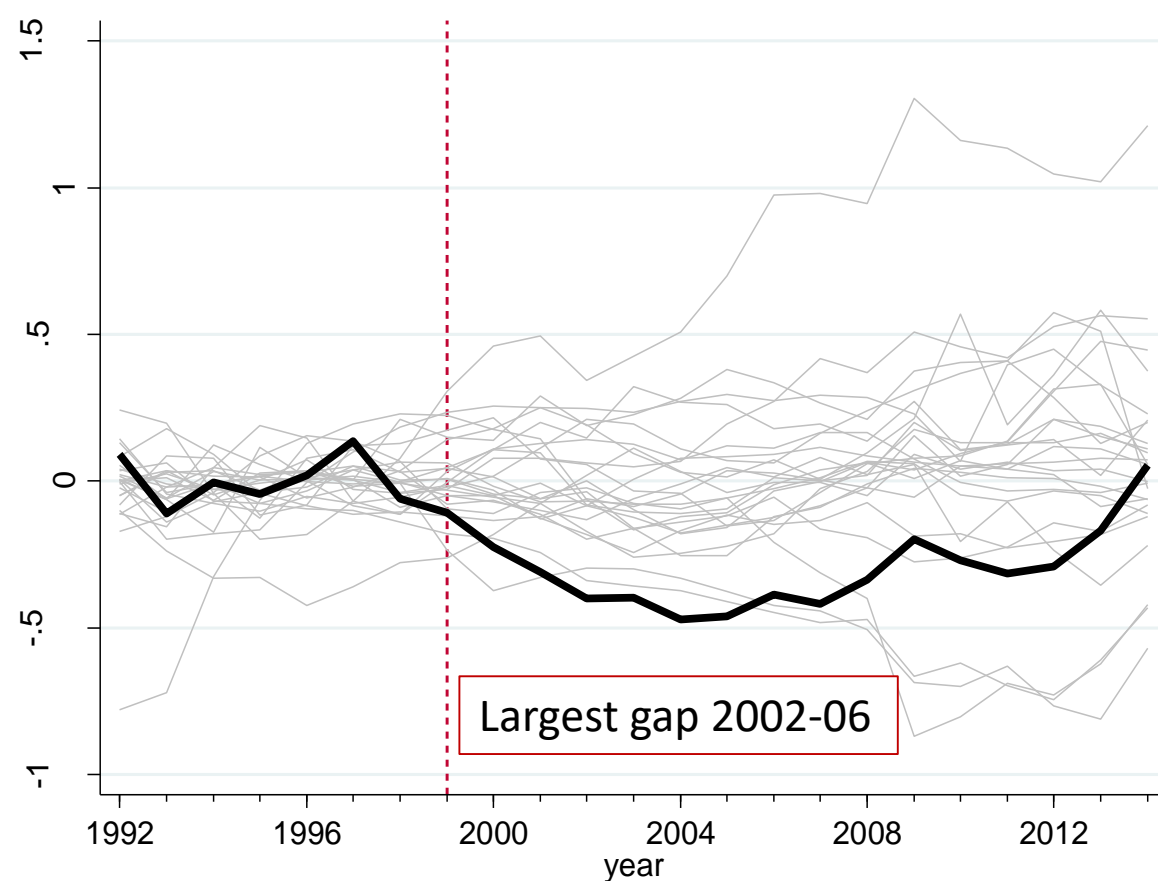
South Yorkshire — control regions

Compare estimated gaps with placebo gaps for all untreated regions

Synth on GDP pc – pre-treatment characteristics (1995-1999)

Variable	Cornwall	Counterfactual Cornwall	South Yorkshire	Counterfactual South Yorkshire
		Pre-treatment averages		
Euros of Structural Funds per capita	26.74	27.32	28.69	28.63
Gross fixed capital formation as % of GDP	10.83	10.99	8.14	10.8
Patent applications per 10,000 inhabitants	0.40	0.44	0.29	0.34
Human resources in science and technology	26.16	25.74	25.09	26.32
Km of roads per squared km of land	2.13	2.07	3.80	2.77
Population in employment	53.23	53.68	52.20	52.21
Economically inactive population	41.14	39.75	41.04	41.13
Long-term unemployment rate	26.18	30.96	29.98	35.96
Sectorial shares (percentage)				
Agriculture & Mining	6.28	2.16	0.6	0.71
Manufacturing	11.63	19.73	18.95	19.03
Construction	5.41	5.37	5.61	5.41
Wholesale & retail trade	25.80	24.51	27.33	24.65
Financial & insurance activities	9.68	8.74	11.78	10.51
Real Estate; scientific activities; public administration and defense; education	31.37	31.76	36.68	33.21
Education and training				
16-19 year old in full-time education	3.37	3.17	2.95	3.21
Working age population with NVQ 3 or above	33.88	31.34	31.45	32.28
Working age population receiving job related training	10.64	11.99	12.62	11.78

Per capita GDP as dependent variable
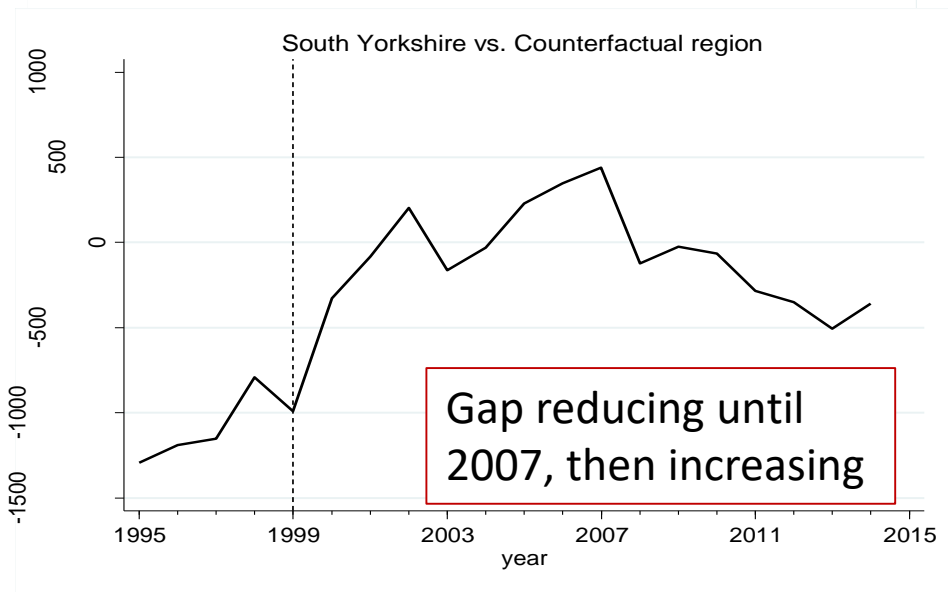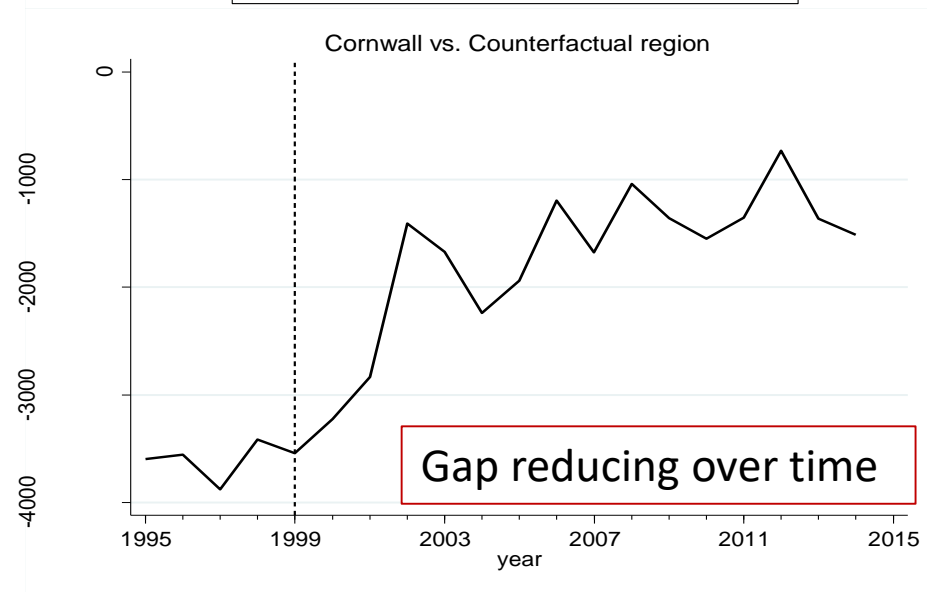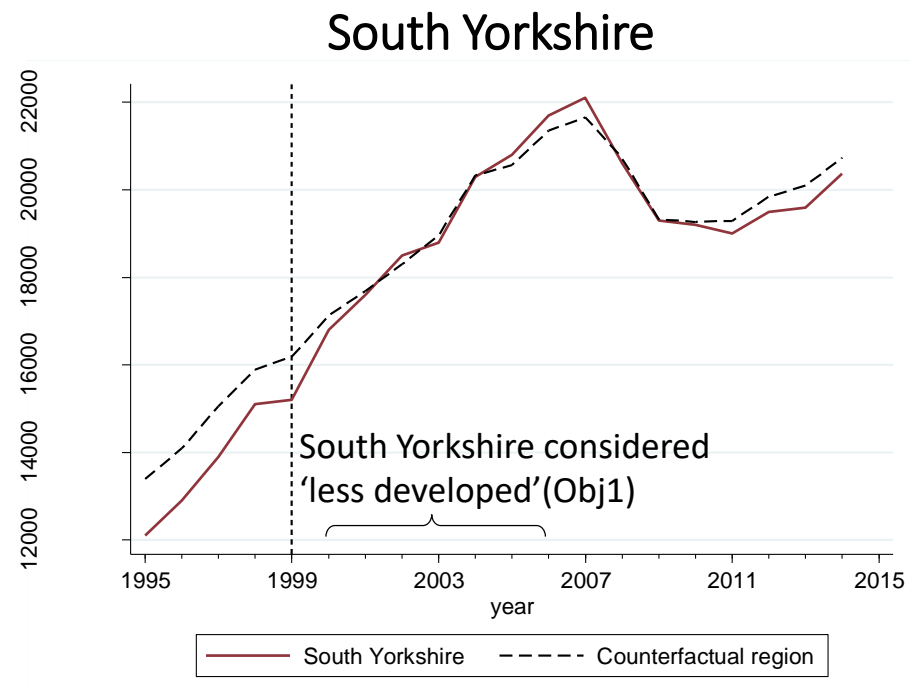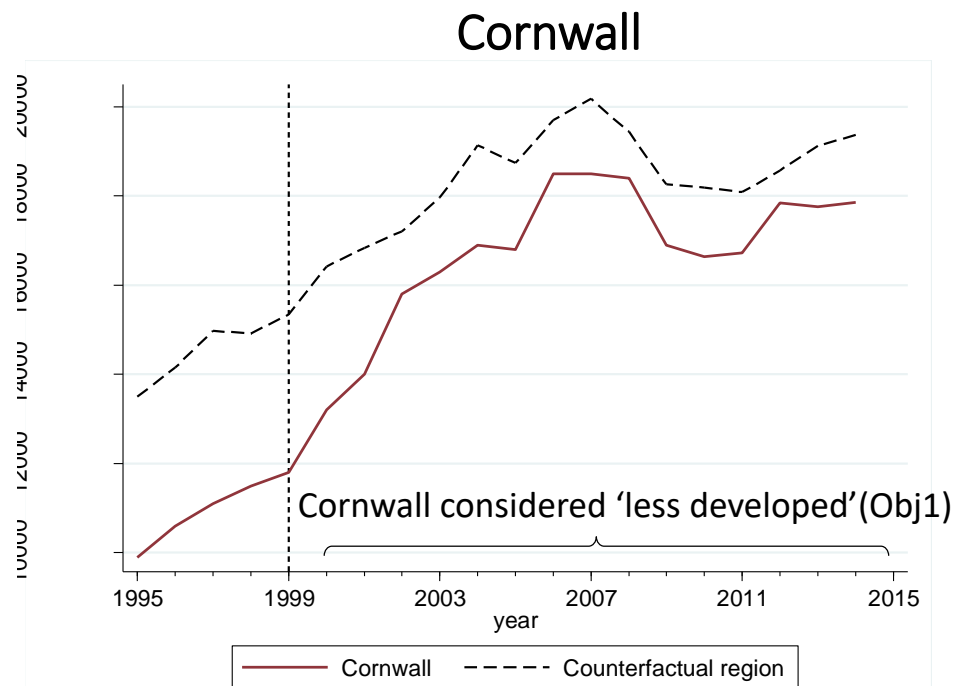
Results H-ATE: human capital

Dep. Variable: **share of Remain votes**

Sample:	Wales	50km from border	25km from border	Wales	50km from border	25km from border	Wales	50km from border	25km from border	Wales	50km from border	25km from border
									Cardiff wards excluded			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
West Wales	-0.0111 (0.0341)	-0.0267 (0.0313)	-0.0273 (0.0366)	-0.0124 (0.0283)	-0.0198 (0.0381)	-0.0230 (0.0282)	-0.00348 (0.0239)	-0.0161 (0.0255)	-0.0158 (0.0251)	-0.00703 (0.0224)	-0.000475 (0.0303)	-0.0220 (0.0235)
Tertiary educated	0.200*** (0.0588)	0.253*** (0.0660)	0.216*** (0.0523)	0.218*** (0.0582)	0.257*** (0.0680)	0.220*** (0.0604)	0.118** (0.0421)	0.217*** (0.0719)	0.140*** (0.0263)	0.133*** (0.0343)	0.225*** (0.0724)	0.130*** (0.0289)
West Wales x Tertiary educ.	0.0346 (0.0687)	0.00612 (0.0719)	0.0364 (0.0697)	-0.0255 (0.0600)	0.0195 (0.0774)	0.0385 (0.0743)	0.0890 (0.0634)	0.0260 (0.0738)	0.0789 (0.0624)	0.0321 (0.0525)	0.0357 (0.0776)	0.0951 (0.0655)
Polynomial	1-1	1-1	1-1	3-3	3-3	3-3	1-1	1-1	1-1	3-3	3-3	3-3
Observations	852	1,344	765	852	1,344	765	823	1,315	736	823	1,315	736
R-squared	0.044	0.098	0.086	0.245	0.117	0.100	0.075	0.102	0.129	0.327	0.140	0.161
Best polynomial degree (AIC)				✓	✓	✓				✓	✓	✓

No conditioning effect of Human capital on Brexit vote in treated area

Results H-ATE: unemployment reduction

Dep. Variable: **share of Remain votes**

Sample:	Wales	50km from border	25km from border	Wales	50km from border	25km from border	Wales	50km from border	25km from border	Wales	50km from border	25km from border
									Cardiff wards excluded			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
West Wales	0.0170 (0.0274)	-0.00811 (0.0239)	-0.00414 (0.0259)	-0.00482 (0.0195)	-0.00152 (0.0267)	-0.000293 (0.0185)	0.0292 (0.0228)	0.00397 (0.0185)	0.00964 (0.0194)	0.00739 (0.0153)	0.0188 (0.0187)	0.00976 (0.0161)
U reduction	-0.377 (0.803)	-0.814 (0.632)	-0.360 (0.736)	-0.397 (0.790)	-0.819 (0.642)	-0.408 (0.689)	0.430** (0.149)	-0.588 (0.664)	0.381* (0.214)	0.416** (0.150)	-0.566 (0.653)	0.275 (0.235)
West Wales x U reduction	1.912 (1.127)	1.799** (0.777)	1.750* (0.952)	1.801 (1.011)	1.887** (0.705)	1.818* (0.911)	1.403* (0.761)	1.582** (0.678)	0.897 (0.525)	0.857* (0.446)	1.601** (0.699)	0.999* (0.512)
Polynomial	1-1	1-1	1-1	3-3	3-3	3-3	1-1	1-1	1-1	3-3	3-3	3-3
Observations	831	1,086	690	831	1,086	690	802	1,057	661	802	1,057	661
R-squared	0.129	0.165	0.129	0.282	0.178	0.139	0.181	0.191	0.183	0.374	0.209	0.217
Best polynomial degree (AIC)				✓	✓	✓				✓	✓	✓

Positive effect of unemployment reduction on Brexit vote in treated area

Robustness checks: sorting and alternative treatment variable

Dep. Variable: **share of Remain votes**

Treatment variable:	West Wales dummy			*Beneficiaries (€ per capita)*	
Sample:	Wales	50km from border	25km from border	Wales	Wales
	Control wards < 10km from border excluded				Cardiff wards excluded
	(1)	(2)	(3)	(4)	(5)
West Wales	-0.00190 (0.0180)	0.0140 (0.0151)	-0.00774 (0.0141)		
Beneficiaries (€ per capita)				1.80e-07 (3.85e-07)	1.28e-07 (5.28e-07)
Controls	✓	✓	✓	✓	✓
Observations	693	947	551	852	802
R-squared	0.262	0.459	0.404	0.423	0.390

OLS model controlling for socio-economic, demographic, labour market characteristics (source: Census)
(No conditioning on distance from border)

Sample split

Dep. Variable: **share of Remain votes**

	Human capital below median *(less than 26% holding tertiary education degree)*						**Human capital above median** *(more than 26% holding tertiary education degree)*					
Sample:	Wales	50km from border	25km from border	Wales	50km from border	25km from border	Wales	50km from border	25km from border	Wales	50km from border	25km from border
					Cardiff wards excluded						Cardiff wards excluded	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
West Wales	-0.0106	-0.00264	-0.0168	0.000620	0.0178	-0.00845	-0.00558	-0.00250	0.00135	0.0154	0.0244	0.0212
	(0.0205)	(0.0291)	(0.0180)	(0.0193)	(0.0219)	(0.0170)	(0.0267)	(0.0332)	(0.0266)	(0.0153)	(0.0210)	(0.0167)
U reduction	-0.801	-1.018	-0.856	0.298	-0.722	0.0912	-1.585	-1.551	-1.359	-0.341	-1.123	-0.326
	(1.177)	(0.647)	(1.002)	(0.244)	(0.645)	(0.269)	(1.107)	(0.961)	(0.895)	(0.239)	(0.931)	(0.305)
West Wales x U reduction	1.395	1.656*	1.519	0.297	1.360*	0.572	1.819*	3.227**	3.063**	2.727**	1.983***	2.636**
	(1.235)	(0.874)	(1.093)	(0.449)	(0.772)	(0.511)	(1.093)	(1.167)	(1.111)	(1.207)	(0.440)	(1.085)
Polynomial	3-3	3-3	3-3	3-3	3-3	3-3	3-3	3-3	3-3	3-3	3-3	3-3
Observations	495	615	421	485	605	411	336	471	269	317	452	250
R-squared	0.396	0.277	0.177	0.479	0.313	0.267	0.189	0.111	0.089	0.277	0.130	0.142
Best polynomial degree (AIC)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Conditioning factor in the U reduction-EU funds model

Finally, we test if the effect between EU funds and unemployment decrease is itself varying *depending on the level of human capital*

Two ways to do this:

1) *Triple interaction* model

2) *Sample split*: estimating interaction model between EU funds and U reduction by sub-samples of wards above/below the median of human capital