European Funds and Firm Performance: Evidence from a Natural Experiment

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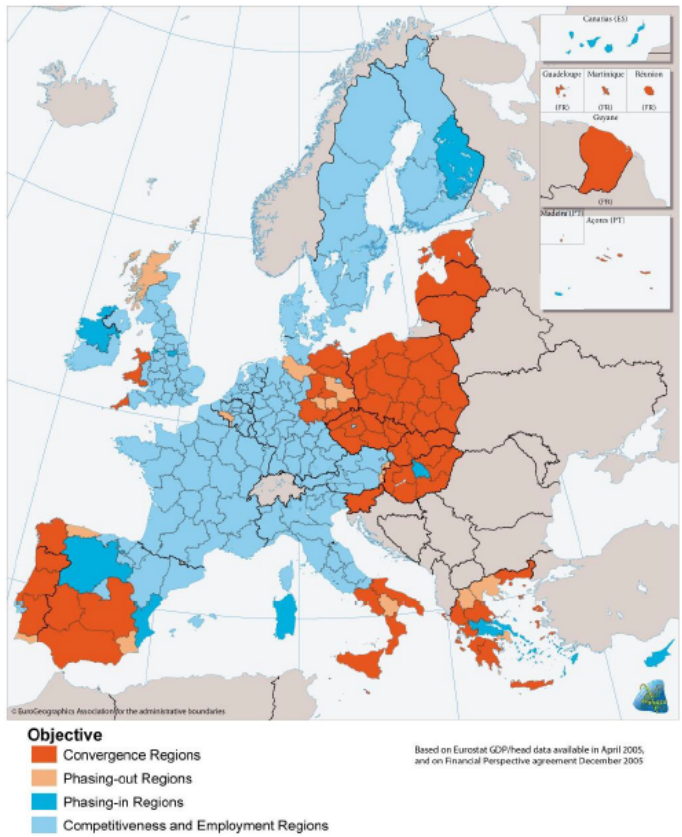
Overview

EU Cohesion Funds

- Convergence has been a political priority of the EU for decades
  - Substantial funds have been channeled to regions with income per capita below 75% of the EU average



EU Cohesion Funds

EU Cohesion Policy 2007-2013

Objective, 2007-2013	**Share**	**Total**
1- Convergence	81.7%	251.33
2 - Regional competitiveness and employment	15.8%	48.79
3 - European territorial cooperation	2.50%	7.5
Total		307.6
Share in the total EU budget		35.7%

Note: Thousands of millions EUR

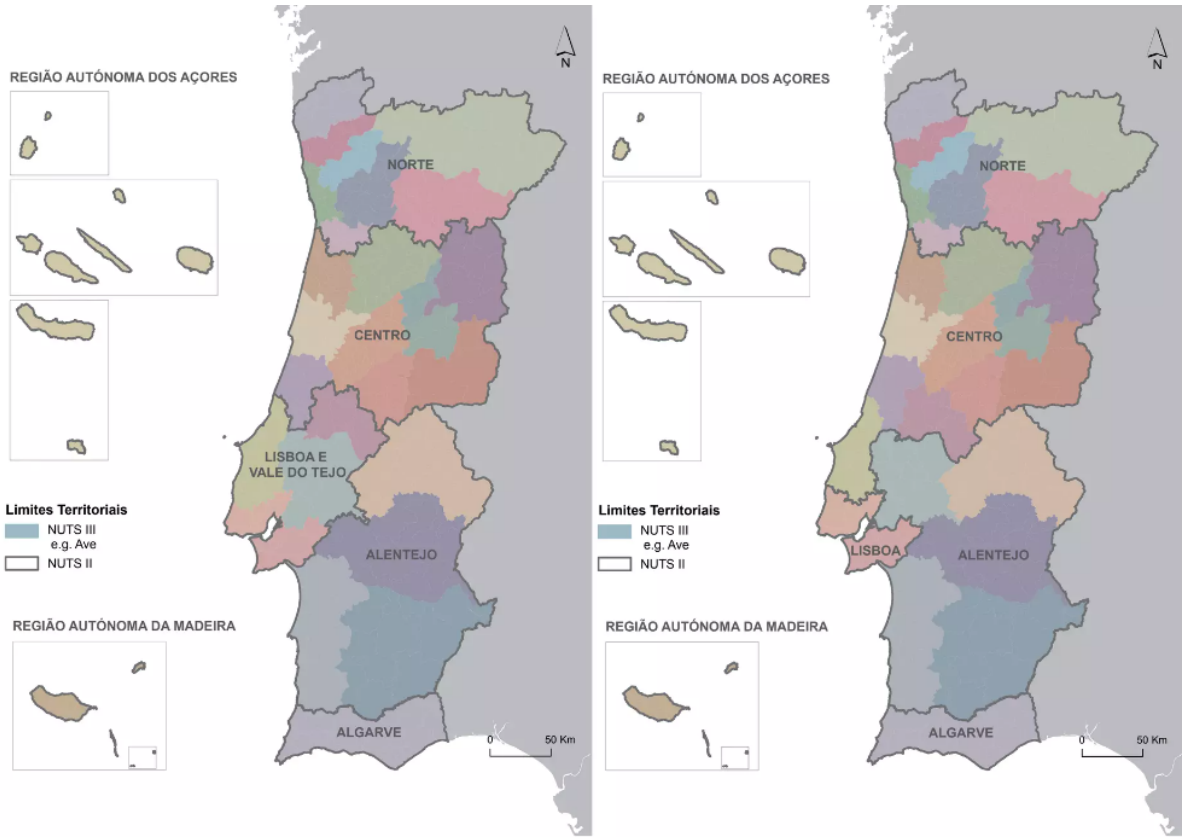
Literature Review

The results of EU cohesion policy are hard to assess.

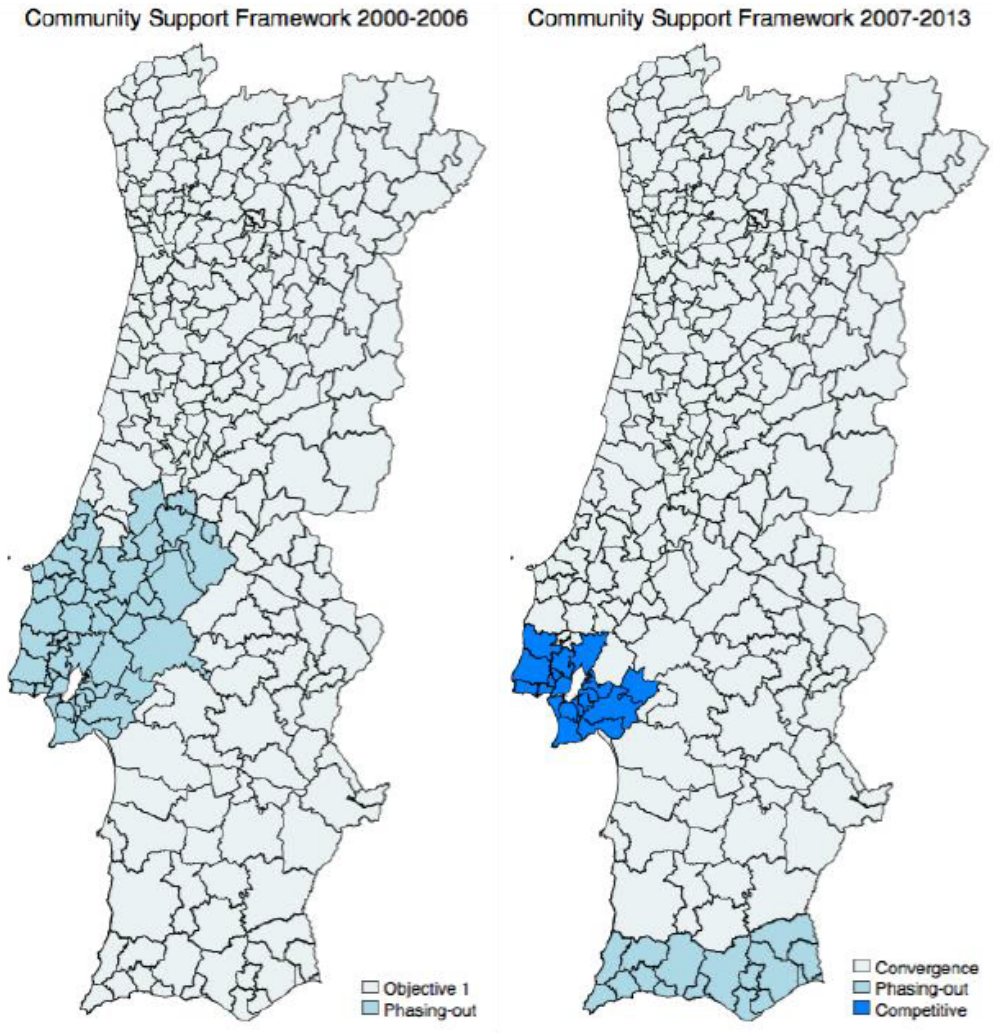
- The **empirical evidence** suggests that, on average, transfers appear to have been effective in promoting growth and lowering regional disparities (Becker et al. 2010; Pellegrini et al. 2013; Giua 2017).
- The effects vary depending on local conditions (Becker et al. 2013) and cohesion transfers may suffer from decreasing returns (Becker et al. 2012; Cerqua and Pellegrini 2018) or have only temporary effects (Barone et al. 2016; Di Cataldo 2017; Becker et al. 2018).
- GDP per capita across EU-15 metro regions has been diverging since the mid-2000s (Ehrlich and Overman 2020).

Identification strategy

- Natural experiment exploiting a spatial discontinuity in access to EU funds that **increased eligibility** for firms in treated municipalities

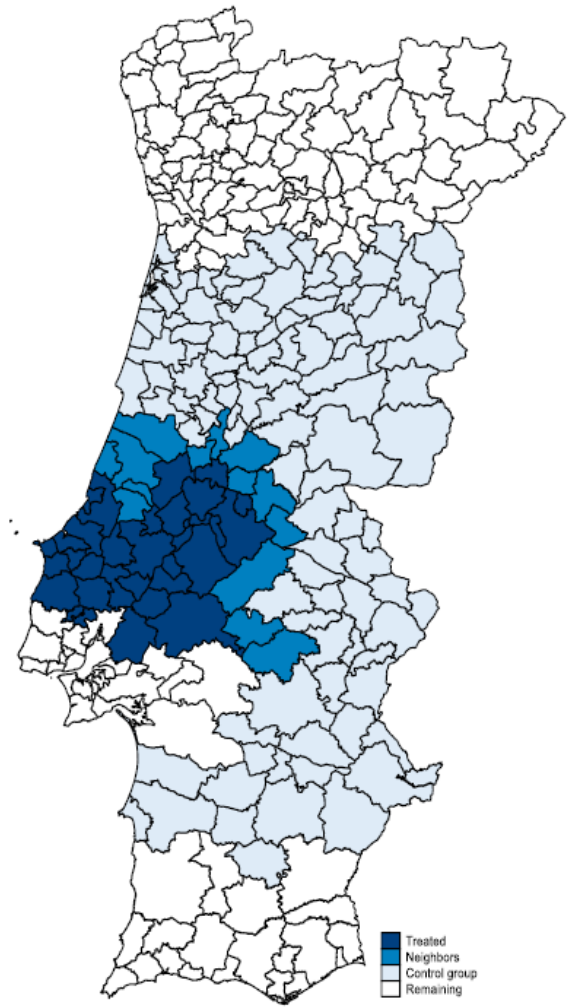


Identification strategy



The quasi-natural experiment

- "Donut-hole" or "buffer-zone" approach: 33 municipalities treated, 14 neighbors, and 104 comparison



Research Questions

- What were the impacts of **increased eligibility** on firm performance?
- Were there **spillover effects** from treated to neighbor areas?

Data

- We exploit a longitudinal administrative linked employer-employee dataset, *Quadros de Pessoal*, which covers virtually all firms with at least one wage earner in mainland Portugal
- We retrieved information both at the **worker level** – including earnings and education, and **firm level** – sales, number of employees, sector of economic activity, location, and legal structure
- We complement our analysis with municipal-level administrative data obtained from Statistics Portugal, the government agency for Energy and Geology (DGEG), and the Directorate general of local government (DGAL)
- We use data from 2003 to 2010 - in total, we observe around 40 000 firms in the 33 treated municipalities

Methodology

We exploit this natural experiment using a difference-in-differences event study design:

$$Y_{imt} = \alpha_i + \alpha_m + \lambda_t + \sum_{k=2003}^{2006} \gamma_k \text{Treated}_m + \sum_{j=2007}^{2010} \gamma_j \text{Treated}_m + \epsilon_{imt}$$

- Dependent variables (winsorized at 1% level):
  - Sales (measured in ihs)
  - Employment (measured in ihs)
  - Employment with bachelor degree (measured in ihs)
  - Labour Productivity
  - Average Wages
- Standard errors are clustered at the NUTS III level

Descriptive statistics

Is the control group similar to the treated group?

Variable:	N	Mean	SD
Panel A. Firm-level			
Treated			
Sales (€ / year)	158 912	450 965	1 077 308
Total Workers	158 952	5,13	8,97
Average Wages (€ / month)	158 952	673,88	283,35
Labor Productivity (Sales / Workers)	158 912	69 924	102 354
Neighbours			
Sales (€ / year)	80 437	490 083	1 103 751
Total Workers	80 458	5,65	9,60
Average Wages (€ / month)	80 458	722,58	319,59
Labor Productivity (Sales / Workers)	80 437	71 238	101 708
Control group			
Sales (€ / year)	310 185	421 021	1 026 399
Total Workers	310 283	5,32	9,48
Average Wages (€ / month)	310 283	655,80	277,87
Labor Productivity (Sales / Workers)	310 184	64 732	93 583

Variable:	N	Mean	SD
Panel B. Municipal-level			
Treated			
Government transfers	264	7 022 024	3 723 572
EU transfers – firms	264	415 352	816 405
EU transfers - municipalities	264	1 197 675	1 174 696
Municipalities' current expenses	264	10 873	6 422
Electricity for domestic purposes	264	32 578	23 706
Electricity for industrial purposes	264	43 306	44 015
Neighbours			
Government transfers	112	7 395 859	4 260 908
EU transfers – firms	112	1 334 892	2 410 486
EU transfers - municipalities	112	1 084 268	908 869
Municipalities' current expenses	112	9 371	9 184
Electricity for domestic purposes	112	29 687	41 147
Electricity for industrial purposes	112	70 622	116 876
Control group			
Government transfers	832	6 925 835	3 562 690
EU transfers – firms	832	1 033 265	3 094 024
EU transfers - municipalities	832	1 163 089	1 482 077
Municipalities' current expenses	832	8 334	7 725
Electricity for domestic purposes	832	21 520	28 730
Electricity for industrial purposes	832	51 728	141 915

Descriptive statistics

Is the control group similar to the treated group? Balance tests

Variable:	Treated (1)	Control group (2)	Diff (3)
Panel A. Firm-level			
Sales (ihs)	11,57	11,55	0,02
	(3,87)	(3,78)	(0,88)
Total Workers (ihs)	1,79	1,80	-0,01
	(0,93)	(0,95)	(0,84)
Average Wages (€ / month)	664,15	650,93	13,21
	(273,97)	(274,65)	(0,28)
Labor Productivity (Sales / Workers)	67 683,97	63 256,22	4 427,75
	(100 658,07)	(93 009,20)	(0,14)
N	19 826	38 300	58 126

Notes: The analysis corresponds to 2006, the last year prior to treatment. Clustered standard errors, at the NUT3 level, are presented in parenthesis, except for column (3), where p-values are in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

- No significant differences between treated and control group in the year before treatment

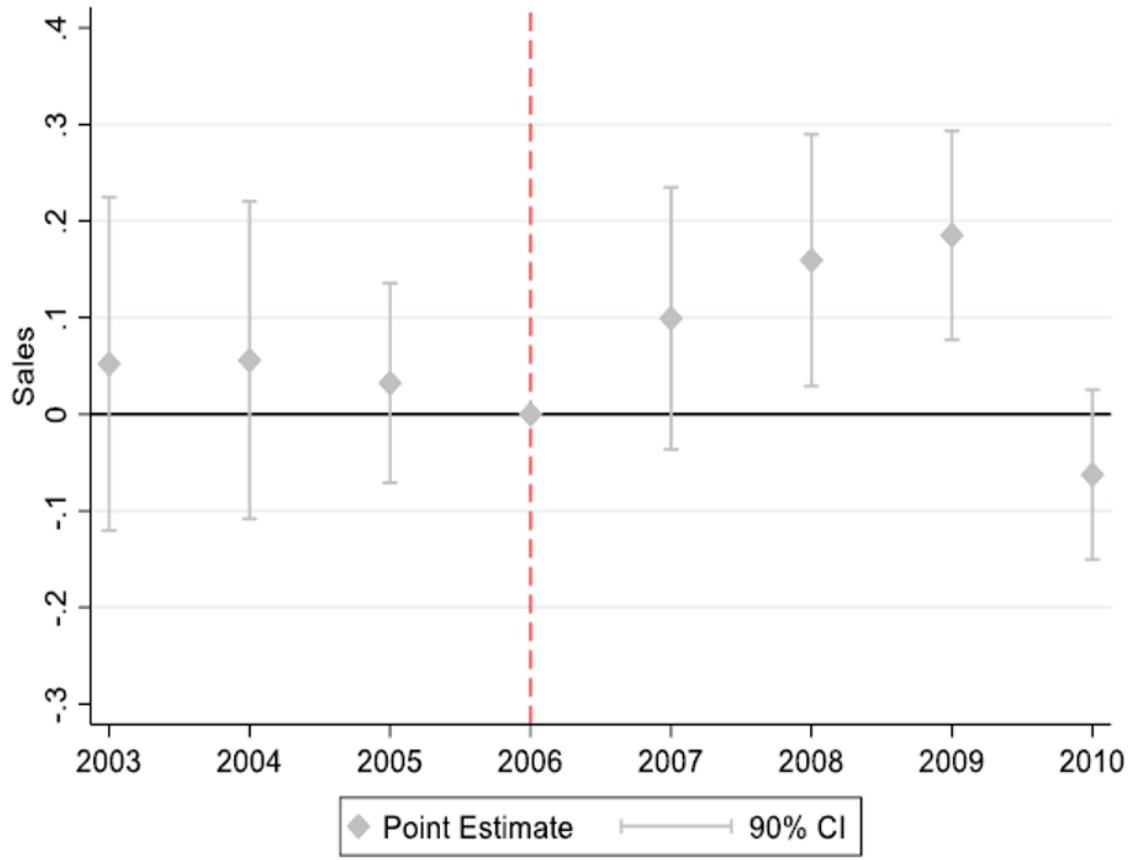
Results - Was there an impact on firm performance?

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity
	(1)	(2)	(3)	(4)
Panel A: Full Sample				
Treated * Post-Treatment	0,074*	-0,003	11,193***	1 575,692**
	(0,04)	(0,02)	(2,42)	(704,46)
Adj R2	0,36	0,88	0,73	0,71
N	451 318	451 442	451 442	451 317
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes

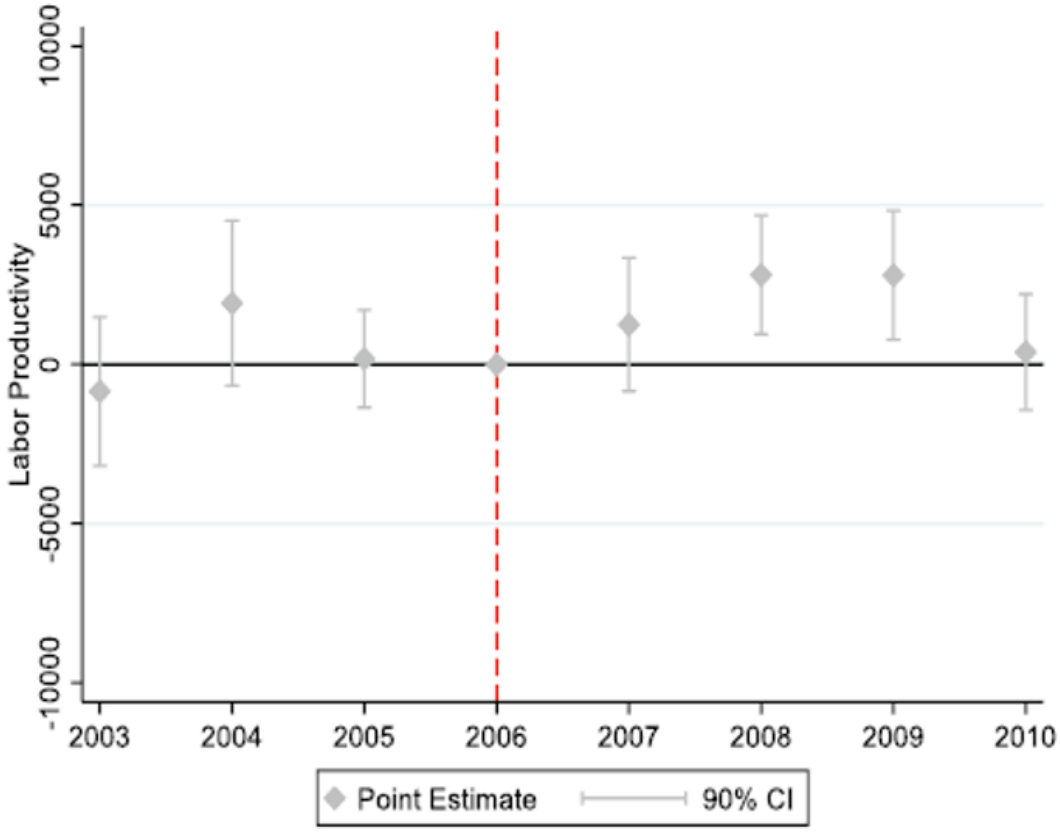
Notes: : Dependent variables in columns (1) and (2) were transformed using the inverse hyperbolic sine approach; Our regressor of interest, Treated * Post-Treatment, indicates firms producing in one of the 33 Treated municipalities, during the treatment period (2007-2010). Our analysis includes the 2003-2010 period. Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

- Yes! Significant increase in sales and average wages
  - Estimate an increase of 7.4% in sales, and 11€ on average monthly wages (1.6%)

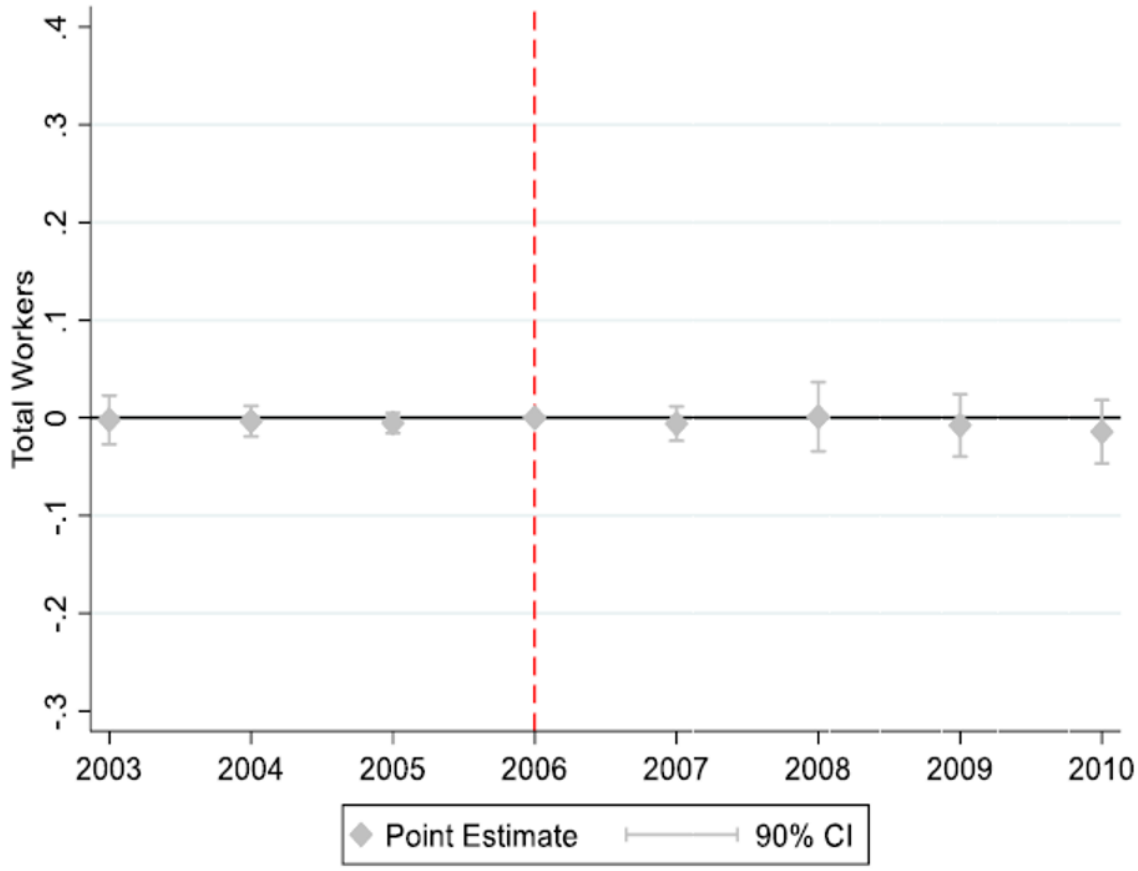
Event studies - Sales



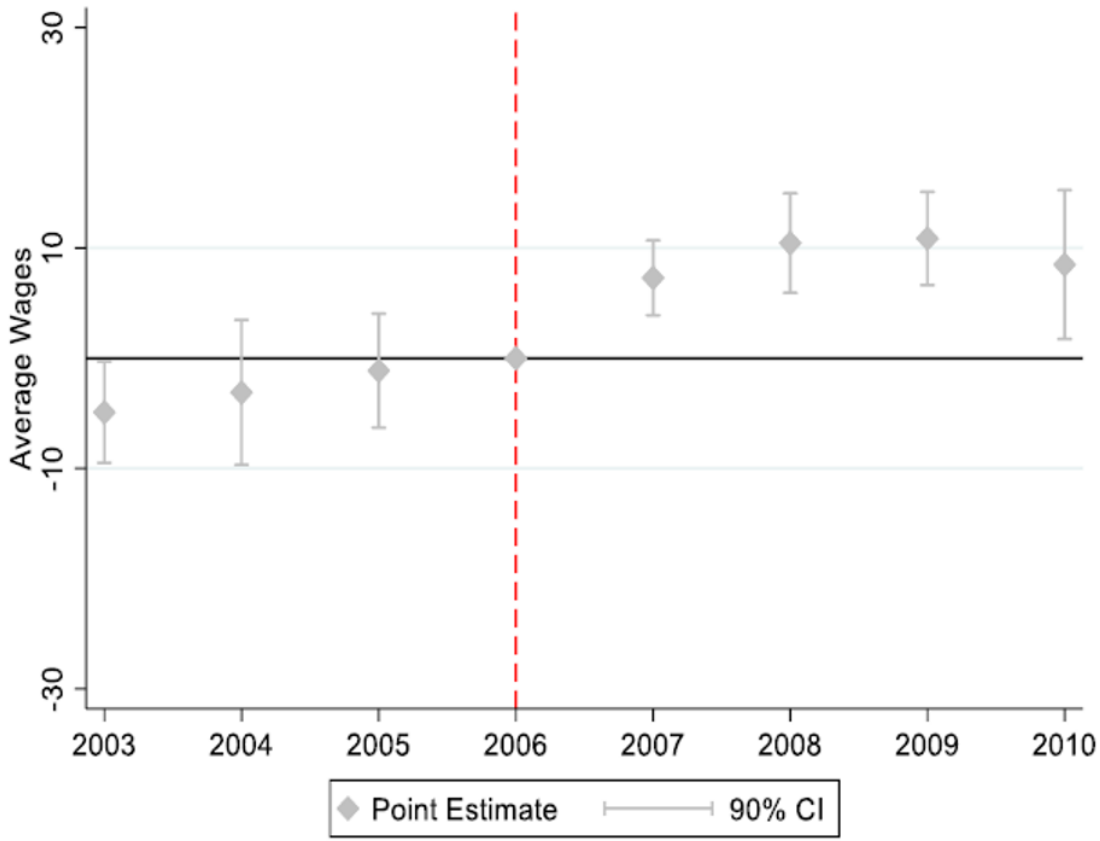
Event studies - Labor Productivity



Event studies - Employment



Event studies - Wages



Results - Are there differences across sectors?

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity
	(1)	(2)	(3)	(4)
Panel A: Full Sample				
Treated * Post-Treatment	0,074*	-0,003	11,193***	1 575,692**
	(0,04)	(0,02)	(2,42)	(704,46)
Adj R2	0,36	0,88	0,73	0,71
N	451 318	451 442	451 442	451 317
Panel B: By Sector – Non-Tradable versus Tradable				
Non-Tradable				
Treated * Post-Treatment	0,094**	-0,004	11,334***	2 108,291**
	(0,04)	(0,02)	(3,20)	(831,16)
Adj R2	0,36	0,87	0,73	0,74
N	297 737	297 811	297 811	297 736
Tradable				
Treated * Post-Treatment	0,022	-0,001	10,695***	-124,995
	(0,06)	(0,02)	(3,03)	(940,35)
Adj R2	0,38	0,90	0,73	0,64
N	151 226	151 274	151 274	151 226
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes

Notes: : Dependent variables in columns (1) and (2) were transformed using the inverse hyperbolic sine approach; Our regressor of interest, Treated * Post-Treatment, indicates firms producing in one of the 33 Treated municipalities, during the treatment period (2007-2010). Our analysis includes the 2003-2010 period. Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

- Yes! Effect on sales is driven entirely by the less competitive *Non-Tradable* sector

Results - Are there effects on firm dynamics?

	Number of firms (ihs) (1)	Number of new firms (ihs) (2)	Probability of closing (3)
Panel A: Baseline			
Treated * Post-Treatment	-0,011	0,046	0,003
	0,040	0,052	0,005
Adj R2	0,99	0,91	0,35
N	1 096	1 096	451 442
Year Fixed Effects	Yes	Yes	Yes
Municipal Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	No	No	Yes

Notes: Dependent variables in column (1), and (2) have suffered an inverse hyperbolic sine transformation; The first two columns are presented at the municipality level, while column (3) is at the firm level; We define entry in the market if the firm was not observed in the previous two years, and exit if the firm is not observed in the following two years. Our regressor of interest, Treated * Post-Treatment, indicates firms producing in one of the 33 Treated municipalities, during the treatment period (2007-2010). Our analysis includes the 2003-2010 period. Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

- No! We estimate no changes in the total number of firms

Were there spillover effects?

- Place-based policies, such as the EU Structural and Cohesion funds, can deliver effects that go beyond those found in the targeted area (Glaeser and Gottlieb, 2009).
- In theory, spillover effects can have either positive or negative effects:
  - If policies are successful at creating new establishments and jobs that would not have emerged in the absence of incentives, there may be a positive effect on surrounding areas through the forces of agglomeration and local multipliers (Moretti, 2010).
  - The effects on the neighboring areas may also be negative if spatially targeted policies have business-stealing effects (Hanson and Rohlin 2013; Andini and Blasio 2014; Einiö and Overman 2020).

Results: Were there spillover effects?

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity
	(1)	(2)	(3)	(4)
Neighbours * Post-Treatment	0,013	-0,003	20,147***	2 604,540***
	(0,04)	(0,01)	(5,13)	(793,69)
Adj R2	0,36	0,88	0,74	0,70
N	376 606	376 719	376 719	376 605
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes

Notes: Dependent variables in columns (1) and (2) were transformed using the inverse hyperbolic sine approach; Our regressor of interest, Neighbours * Post-Treatment, indicates firms producing in one of the 14 municipalities neighbours to the Treated municipalities, during the treatment period (2007-2010). Our analysis includes the 2003-2010 period. Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

Discussion

	EU transfers – firms (ihs)	EU transfers – municipalities (ihs)	Government transfers (ihs)	Municipalities' current expenses (ihs)	Electricity	
					For domestic purposes (ihs)	For industrial purposes (ihs)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Treated						
Treated * Post-Treatment	1,787**	-0,264	0,015	0,014	0,032***	-0,016
	(0,72)	(0,76)	(0,01)	(0,02)	(0,00)	(0,10)
Adj R2	0,43	0,53	0,96	0,97	1,00	0,98
N	1 096	1 096	1 096	1 096	1 096	1 096
Panel B: Neighbours						
Neighbours * Post-Treatment	-0,995	0,141	0,030**	0,005	-0,010	-0,073
	(1,28)	(0,22)	(0,01)	(0,08)	(0,01)	(0,08)
Adj R2	0,446	0,56	0,97	0,79	1,00	0,98
N	944	944	944	944	944	944
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Municipality Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Our regressors of interest, Treated * Post-Treatment and Neighbours * Post-Treatment indicate firms producing in Treated or Neighbors municipalities, respectively, during the treatment period (2007-2010). Our analysis spans the 2003-2010 period. Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

- As expected, we see an increase in EU transfers to firms
- No effect on other possible confounding factors
- Increase in electricity consumption for domestic purposes only

Robustness Checks

- Alternative transformation: using ln(y)
- In time: Drop crisis period (2009 and 2010)
- In space: Include North Nuts 2 municipalities (86)
- Comparison group using a (pre-treatment) Coarsened Exact Matching resembling the Treated firms more closely in terms of pre-treatment observable characteristics
- In space: Drop Top 5/10 closer municipalities to Lisbon
- Alternative cluster of standard errors at the municipal level

Robustness - Employing a logarithmic transformation

	Sales (log) (1)	Total Workers (log) (2)
Panel A: Full Sample		
Treated * Post-Treatment	0,071*	-0,003
	(0,04)	(0,02)
Adj R2	0,37	0,89
N	451 318	451 442
Panel B: By Sector – Tradable versus Non-Tradable		
Non-Tradable		
Treated * Post-Treatment	0,091**	-0,003
	(0,04)	(0,02)
Adj R2	0,37	0,88
N	297 737	297 811
Tradable		
Treated * Post-Treatment	0,021	-0,001
	(0,06)	(0,02)
Adj R2	0,39	0,91
N	151 226	151 274
Year Fixed Effects	Yes	Yes
Firm Fixed Effects	Yes	Yes

Notes: Dependent variables suffered a logarithmic transformation; Our regressor of interest, Treated * Post-Treatment, indicates firms producing in one of the 33 Treated municipalities, during the treatment period (2007-2010). Our analysis includes the 2003-2010 period. Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

Robustness - Including the North Region in control group

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity
	(1)	(2)	(3)	(4)
Panel A: Baseline				
Treated * Post-Treatment	0,036	-0,017	11,947***	1 337,932***
	(0,03)	(0,02)	(1,92)	(350,33)
Adj R2	0,36	0,88	0,75	0,71
N	1 094 724	1 094 982	1 094 982	1 094 716
Panel B: By Sector – Tradable versus Non-Tradable				
Non-Tradable				
Treated * Post-Treatment	0,070*	-0,022	11,705***	996,115*
	(0,04)	(0,02)	(2,17)	(482,56)
Adj R2	0,36	0,86	0,75	0,73
N	703 766	703 933	703 933	703 759
Tradable				
Treated * Post-Treatment	-0,048	-0,010	12,648***	1 280,735*
	(0,04)	(0,02)	(3,08)	(697,29)
Adj R2	0,38	0,90	0,75	0,65
N	384 954	385 043	385 043	384 953
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes

Notes: Dependent variables in columns (1) and (2) were transformed using the inverse hyperbolic sine approach; Our regressor of interest, Treated * Post-Treatment, indicates firms producing in one of the 33 Treated municipalities, during the treatment period (2007-2010). Our analysis includes the 2003-2010 period. Our control group includes the North Region (see Figure 1). Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

Robustness - Coarsened exact matching

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity
	(1)	(2)	(3)	(4)
Panel A: Baseline				
Treated * Post-Treatment	0,058	-0,002	11,071***	1 154,560
	(0,04)	(0,02)	(2,25)	(826,46)
Adj R2	0,38	0,89	0,74	0,73
N	298 555	298 634	298 634	298 554
Panel B: By Sector – Non-Tradable versus Tradable				
Non-Tradable				
Treated * Post-Treatment	0,088**	-0,003	11,101***	1 959,416*
	(0,04)	(0,02)	(2,73)	(1027,61)
Adj R2	0,38	0,87	0,74	0,75
N	198 849	198 895	198 895	198 848
Tradable				
Treated * Post-Treatment	-0,006	0,002	11,047***	-463,228
	(0,06)	(0,02)	(2,72)	(790,16)
Adj R2	0,38	0,90	0,73	0,66
N	99 706	99 739	99 739	99 706
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes

Notes: Dependent variables in columns (1) and (2) were transformed using the inverse hyperbolic sine approach; Our regressor of interest, Treated * Post-Treatment, indicates firms producing in one of the 33 Treated municipalities, during the treatment period (2007-2010). Our analysis includes the 2003-2010 period. Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

Robustness - Excluding municipalities closer to Lisbon

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity
	(1)	(2)	(3)	(4)
Panel A: Baseline				
Treated * Post-Treatment	0,091	-0,009	10,941***	1 455,967*
	(0,06)	(0,02)	(2,30)	(707,41)
Adj R2	0,36	0,88	0,73	0,71
N	417 949	418 069	418 069	417 948
Panel B: By Sector – Non-Tradable versus Tradable				
Non-Tradable				
Treated * Post-Treatment	0,116*	-0,009	11,181***	1 682,024*
	(0,06)	(0,02)	(3,45)	(815,07)
Adj R2	0,36	0,87	0,73	0,74
N	275 910	275 982	275 982	275 909
Tradable				
Treated * Post-Treatment	0,027	-0,008	9,979***	282,790
	(0,07)	(0,02)	(2,90)	(937,14)
Adj R2	0,37	0,90	0,73	0,64
N	139 851	139 897	139 897	139 851
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes

Notes: Dependent variables in columns (1) and (2) were transformed using the inverse hyperbolic sine approach; Our regressor of interest, Treated * Post-Treatment, indicates firms producing in one of the 33 Treated municipalities, during the treatment period (2007-2010), with the exception of firms in one of the 5 closest municipalities to Lisbon (Arruda dos Vinhos, Sobral de Monte Agraço, Benavente, Alenquer, Torres Vedras. Our analysis includes the 2003-2010 period. Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

Robustness - Winsorize at the 95% level

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity
	(1)	(2)	(3)	(4)
Panel A: Baseline				
Treated * Post-Treatment	0,073*	-0,003	9,988***	1 054,536*
	(0,04)	(0,02)	(1,93)	(516,42)
Adj R2	0,35	0,86	0,75	0,74
N	451 318	451 442	451 442	451 317
Panel B: By Sector – Non-Tradable versus Tradable				
Non-Tradable				
Treated * Post-Treatment	0,092**	-0,004	10,446***	1 444,680**
	(0,04)	(0,02)	(2,70)	(556,93)
Adj R2	0,35	0,86	0,75	0,77
N	297 737	297 811	297 811	297 736
Tradable				
Treated * Post-Treatment	0,024	-0,001	8,965***	96,152
	(0,06)	(0,02)	(1,85)	(736,24)
Adj R2	0,36	0,88	0,75	0,68
N	151 226	151 274	151 274	151 226
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes

Notes: Dependent variables in columns (1) and (2) were transformed using the inverse hyperbolic sine approach; Our regressor of interest, Treated * Post-Treatment, indicates firms producing in one of the 33 Treated municipalities, during the treatment period (2007-2010). Our analysis includes the 2003-2010 period. Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: *** 1%, ** 5%, * 10%.

Concluding Remarks

- Our paper exploits a unique natural experiment where increased access to EU regional funds was administratively attributed to some municipalities by artificially splitting a "non-convergence" region.

- Was there an impact of **increased eligibility** on firm performance?
  - Yes! Increase in sales and average wages
  - No effect on employment
  - Effect on sales driven by the **Non-tradable sector**

Thank you!

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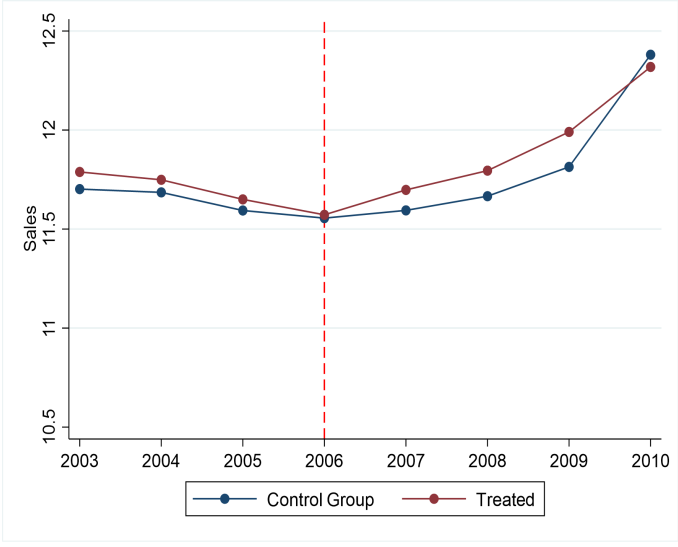
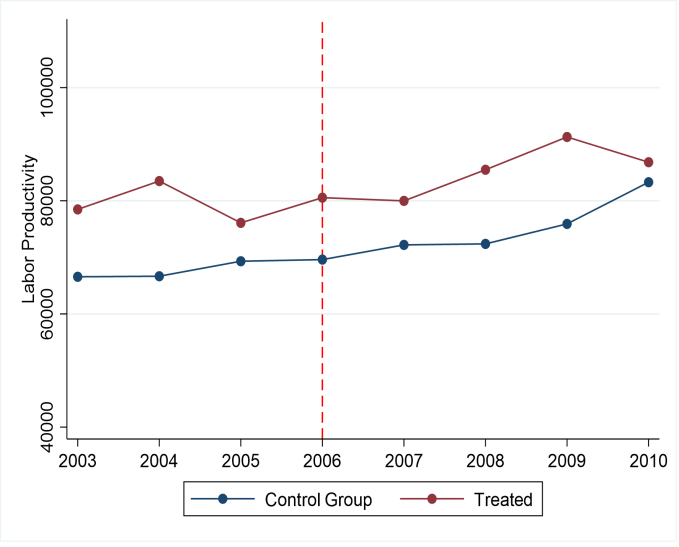
Descriptive evidence: Sales and Labor Productivity





Descriptive evidence: Employment and Average Wages