

# European Funds and Firm Performance: Evidence from a Natural Experiment

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# Overview

EU Cohesion Funds

Literature Review

Identification Strategy

Research Question

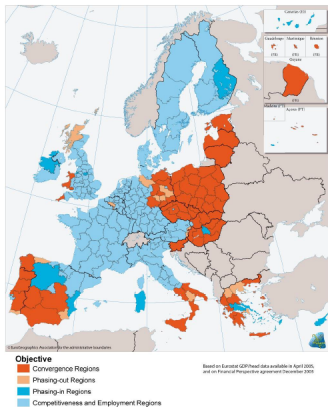
Data and Methodology

Results

Conclusion

# 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

<b>Objective, 2007-2013</b>	<b>Share</b>	<b>Total</b>
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

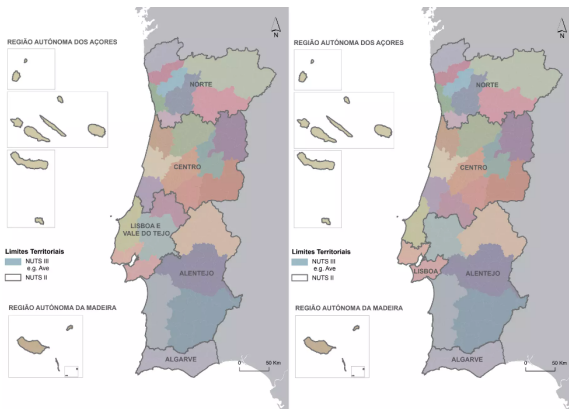
# Literature Review

## 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).

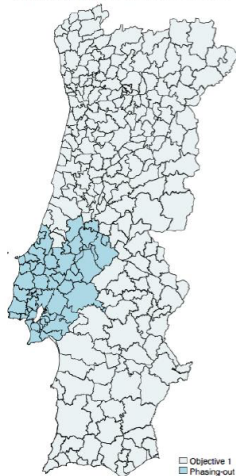
# Identification strategy

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



# Identification strategy

Community Support Framework 2000-2006

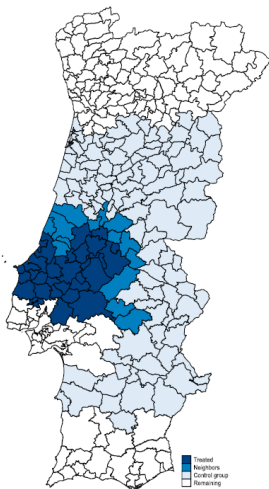


Community Support Framework 2007-2013



# 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	Variable:	N	Mean	SD
<b>Panel A. Firm-level</b>				<b>Panel B. Municipal-level</b>			
<i>Treated</i>				<i>Treated</i>			
<i>Sales (€ / year)</i>	158 912	450 965	1 077 308	<i>Government transfers</i>	264	7 022 024	3 723 572
<i>Total Workers</i>	158 952	5,13	8,97	<i>EU transfers – firms</i>	264	415 352	816 405
<i>Average Wages (€ / month)</i>	158 952	673,88	283,35	<i>EU transfers – municipalities</i>	264	1 197 675	1 174 696
<i>Labor Productivity (Sales / Workers)</i>	158 912	69 924	102 354	<i>Municipalities' current expenses</i>	264	10 873	6 422
<i>Neighbours</i>				<i>Electricity for domestic purposes</i>	264	32 578	23 706
<i>Sales (€ / year)</i>	80 437	490 083	1 103 751	<i>Electricity for industrial purposes</i>	264	43 306	44 015
<i>Total Workers</i>	80 458	5,65	9,60	<i>Neighbours</i>			
<i>Average Wages (€ / month)</i>	80 458	722,58	319,59	<i>Government transfers</i>	112	7 395 859	4 260 908
<i>Labor Productivity (Sales / Workers)</i>	80 437	71 238	101 708	<i>EU transfers – firms</i>	112	1 334 892	2 410 486
<i>Control group</i>				<i>EU transfers – municipalities</i>	112	1 084 268	908 869
<i>Sales (€ / year)</i>	310 185	421 021	1 026 399	<i>Municipalities' current expenses</i>	112	9 371	9 184
<i>Total Workers</i>	310 283	5,32	9,48	<i>Electricity for domestic purposes</i>	112	29 687	41 147
<i>Average Wages (€ / month)</i>	310 283	655,80	277,87	<i>Electricity for industrial purposes</i>	112	70 622	116 876
<i>Labor Productivity (Sales / Workers)</i>	310 184	64 732	93 583	<i>Control group</i>			
				<i>Government transfers</i>	832	6 925 835	3 562 690
				<i>EU transfers – firms</i>	832	1 033 265	3 094 024
				<i>EU transfers – municipalities</i>	832	1 163 089	1 482 077
				<i>Municipalities' current expenses</i>	832	8 334	7 725
				<i>Electricity for domestic purposes</i>	832	21 520	28 730
				<i>Electricity for industrial purposes</i>	832	51 728	141 915

# Descriptive statistics

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

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

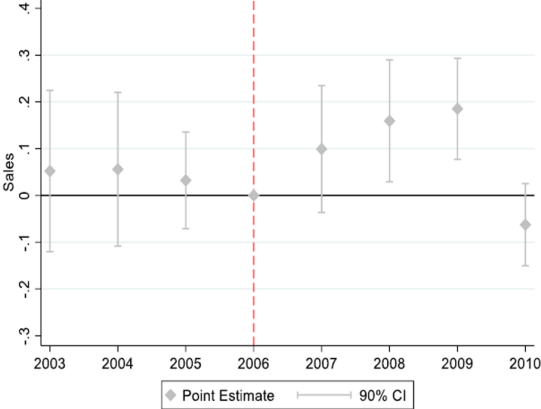
## Results - Was there an impact on firm performance?

	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

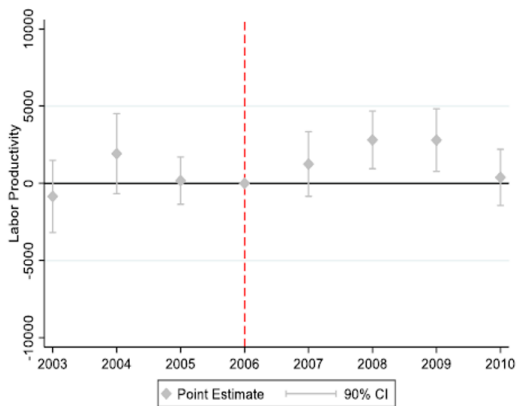
Notes: Dependent variables in columns (1) and (2) were transformed using the inverse hyperbolic sine approach; Our regressor of interest, Treated \* Post-Treatment, indicates firms producing in one of the 33 Treated municipalities, during the treatment period (2007-2010). Our analysis includes the 2003-2010 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

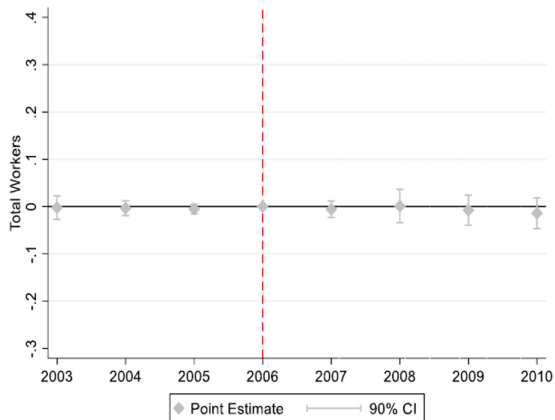


## Event studies - Labor Productivity

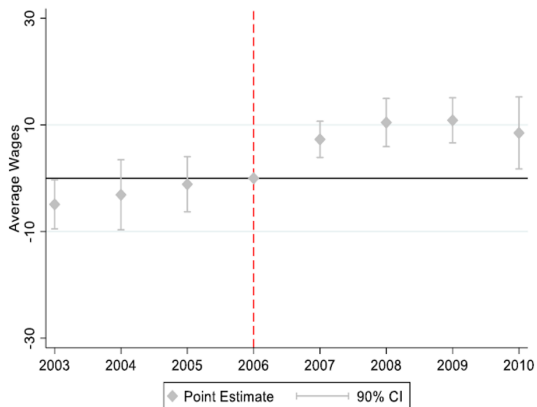




## Event studies - Employment



## Event studies - Wages



## Results - Are there differences across sectors?

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity
	(1)	(2)	(3)	(4)
<b>Panel A: Full Sample</b>				
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
<b>Panel B: By Sector – Non-Tradable versus Tradable</b>				
<i>Non-Tradable</i>				
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
<i>Tradable</i>				
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)
<b>Panel A: Baseline</b>			
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 (0,04)	-0,003 (0,01)	20,147*** (5,13)	2 604,540*** (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)
<b>Panel A: Treated</b>						
Treated * Post-Treatment	1,787** (0,72)	-0,264 (0,76)	0,015 (0,01)	0,014 (0,02)	0,032*** (0,00)	-0,016 (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
<b>Panel B: Neighbours</b>						
Neighbours * Post- Treatment	-0,995 (1,28)	0,141 (0,22)	0,030** (0,01)	0,005 (0,08)	-0,010 (0,01)	-0,073 (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 regressions of interest, Treated \* Post-Treatment and Neighbours \* Post-Treatment indicate firms producing in Treated or Neighbours municipalities, respectively, during the treatment period (2007-2010). Our analysis spans the 2003-2010 period. Clustered standard errors, at the NUTS 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)
<b>Panel A: Full Sample</b>		
Treated * Post-Treatment	0,071*	-0,003
	(0,04)	(0,02)
Adj R2	0,37	0,89
N	451 318	451 442
<b>Panel B: By Sector – Tradable versus Non-Tradable</b>		
<i>Non-Tradable</i>		
Treated * Post-Treatment	0,091**	-0,003
	(0,04)	(0,02)
Adj R2	0,37	0,88
N	297 737	297 811
<i>Tradable</i>		
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)
<b>Panel A: Baseline</b>				
Treated * Post-Treatment	0,036 (0,03)	-0,017 (0,02)	11,947*** (1,92)	1 337,932*** (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
<b>Panel B: By Sector – Tradable versus Non-Tradable</b>				
<i>Non-Tradable</i>				
Treated * Post-Treatment	0,070* (0,04)	-0,022 (0,02)	11,705*** (2,17)	996,115* (482,56)
Adj R2	0,36	0,86	0,75	0,73
N	703 766	703 933	703 933	703 759
<i>Tradable</i>				
Treated * Post-Treatment	-0,048 (0,04)	-0,010 (0,02)	12,648*** (3,08)	1 280,735* (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)
<b>Panel A: Baseline</b>				
Treated * Post-Treatment	0,058 (0,04)	-0,002 (0,02)	11,071*** (2,25)	1 154,560 (826,46)
Adj R2	0,38	0,89	0,74	0,73
N	298 555	298 634	298 634	298 554
<b>Panel B: By Sector – Non-Tradable versus Tradable</b>				
<i>Non-Tradable</i>				
Treated * Post-Treatment	0,088** (0,04)	-0,003 (0,02)	11,101*** (2,73)	1 959,416* (1027,61)
Adj R2	0,38	0,87	0,74	0,75
N	198 849	198 895	198 895	198 848
<i>Tradable</i>				
Treated * Post-Treatment	-0,006 (0,06)	0,002 (0,02)	11,047*** (2,72)	-463,228 (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) (1)	Total Workers (ihs) (2)	Average Wages (3)	Labour Productivity (4)
<b>Panel A: Baseline</b>				
Treated * Post-Treatment	0,091 (0,06)	-0,009 (0,02)	10,941*** (2,30)	1 455,967* (707,41)
Adj R2	0,36	0,88	0,73	0,71
N	417 949	418 069	418 069	417 948
<b>Panel B: By Sector – Non-Tradable versus Tradable</b>				
<i>Non-Tradable</i>				
Treated * Post-Treatment	0,116* (0,06)	-0,009 (0,02)	11,181*** (3,45)	1 682,024* (815,07)
Adj R2	0,36	0,87	0,73	0,74
N	275 910	275 982	275 982	275 909
<i>Tradable</i>				
Treated * Post-Treatment	0,027 (0,07)	-0,008 (0,02)	9,979*** (2,90)	282,790 (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)
<b>Panel A: Baseline</b>				
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
<b>Panel B: By Sector – Non-Tradable versus Tradable</b>				
<i>Non-Tradable</i>				
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
<i>Tradable</i>				
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%.

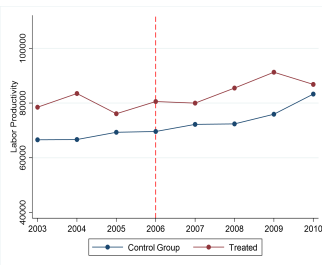
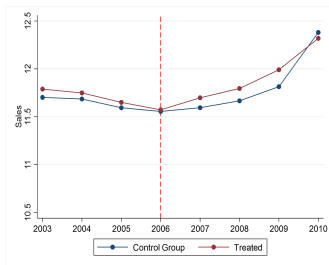
## Concluding Remarks

- ▶ 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

