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## European funds and firm performance: Evidence from a natural experiment

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# Imprint

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José Mesquita, João Pereira dos Santos, and José Tavares<sup>1</sup>

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

## Abstract

*Expanding regional eligibility in the access to grants can have important consequences for the performance of firms. We examine a quasi-natural experiment that consisted of a redrawing of administrative areas intended to increase accessibility to European Union (EU) funds using a rich administrative dataset that covers the universe of Portuguese private firms between 2003 and 2010. Our results uncover a positive causal impact of increased eligibility on firms' sales. In contrast, employment and labour productivity do not seem to be significantly impacted by the reform. The effects are heterogeneous: while sales of firms in the services and non-tradable sectors are positively impacted, sales of firms in more competitive sectors are not affected.*

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*Keywords: Grants; regional policy; private firm; municipalities; Portugal*

*August 2022*

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# I. Introduction

As stated in the Treaty of Lisbon, the European Union (EU) aims to pursue socioeconomic cohesion among its member countries. An important element in attaining cohesion is regional convergence, the objective that structures the channelling of substantial funds from the EU's budget to regions with income per capita below 75 percent of the EU average.<sup>5</sup> The stated objective is to boost regional income, employment growth, and facilitate business creation. However, thus far, the actual results of this policy are hard to assess, suggesting a dire need for micro-based causal empirical evaluations of the impact of EU funds on regional fortunes. 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). Nevertheless, the effects vary considerably 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). In fact, GDP per capita across EU-15 metro regions has been diverging since the mid-2000s (Ehrlich and Overman 2020).

In this paper, we rely on a quasi-natural experiment which takes advantage of a redistricting of the Lisbon NUTS 2 area (Portugal), redrawing administrative areas with the purpose of increasing eligibility to EU funds in specific regions.<sup>6</sup> This decision came in the wake of the Lisbon area reaching income levels well above the 75 percent EU income threshold, thus threatening the flow of funds to several of its poorer municipalities. The region was then split so that those municipalities maintained privileged eligibility status. EU regions tend to progressively lose eligibility, as income per capita grows, so that an administratively mandated increase in eligibility is a rare occurrence. It is notable that, in contrast to most empirical papers, here we analyse the impact of increased eligibility on firm performance.<sup>7</sup>

We further contribute to the literature by using a rich linked employer-employee administrative dataset that covers the universe of Portuguese private firms between 2003 and 2010 to compute intent-to-treat estimates from a difference-in-differences specification – hereafter diff-in-diff. Under parallel trends, we estimate the causal impact of increased

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<sup>5</sup> While relative to national budgets the EU's common budget is small – accounting for close to 1 percent of its GDP. The Structural and Cohesion Funds constitute a major budget line, second only to agriculture-related transfers.

<sup>6</sup> NUTS (Nomenclature of territorial units for statistics) classification is set up by the Eurostat to divide EU's territory and produce regional statistics.

<sup>7</sup> An exception is Becker et al. (2018), who compare the effects of gaining versus losing eligibility.

eligibility of European funds on a series of firm performance indicators. The identification strategy yields unbiased effects if outcomes of Treated firms evolved similarly to those of comparison firms had the redistricting not been implemented. Comparison firms are those that are in high-eligibility status regions, excluding those in municipalities that neighbour Treated firms. The parallel trend assumption is supported by descriptive graphical inspection and event study specifications. Moreover, it is robust to exercises exploiting both the time and the spatial dimensions, including alternative control groups and the exclusion of the crisis period (2009-2010).

We find evidence that increased eligibility to EU funds for a municipality increased, *on average*, private firms' sales by 7.4% in Treated areas *vis-à-vis* firms in municipalities that saw no change in their eligibility status. However, total and college-educated employment numbers as well as labour productivity do not seem to change in response to the shock, whereas average wages marginally increased. Remarkably, the positive effects are solely concentrated in firms in the *Non-Tradable* and *Services* sectors. Lastly, we also show a null impact on the total number of firms and firms' creation in Treated municipalities, as well as in the probability of a firm closing, indicating no significant changes in firms' dynamics.

A full accounting of the effects of the policy must also consider possible spillover effects of treated to neighbouring comparison areas. Therefore, we show that municipalities neighbouring our area of interest do not witness significant changes *vis-à-vis* the same set of comparison municipalities, suggesting that spillover effects were not present.

We shed light on the possible mechanisms of adjustment using the geographic exposure to the policy with municipal-level data. First, we show that there is no change in central government's transfers to Treated municipalities, nor in local government current expenses, suggesting the increase in firm sales is indeed the result of increased eligibility of EU funds. In addition, while increased eligibility leads to an increase in local wealth, as proxied by families' electricity consumption, suggesting that the increased sales may stem from greater access to funds by individuals, industrial electricity spending does not display higher activity levels, consistent with our findings on the *Manufacturing* sector.

Our results have important policy implications for policymakers willing to improve the design of place-based policies. First, we highlight the importance of relying on firm-level data. For example, we underline that the effects of increased EU eligibility are heterogenous as the effect on sales is driven solely by firms producing in the *Non-Tradable* and *Services* sectors. Second, the null effect on firms' productivity gains and employment numbers (including of more educated workers) suggest that EU regional funds acted as a



distributional, rather than a productivity enhancing policy. These lessons are especially important in a period when European regions that have been strongly supported by the EU's Cohesion Policy have witnessed an increase in voting for Eurosceptic political parties (Fidrmuc et al. 2019; Crescenzi et al. 2020; Rodríguez-Pose and Dijkstra 2021).

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature on the effect of regional funds, Section 3 presents the estimation methodology and the data, and Section 4 the results. Section 5 concludes.

## II. Related literature

Growth and convergence across European regions have been a political priority of the EU for decades. It gained importance over time, as relatively prosperous countries in Southern and then Eastern Europe adhered. Hampered by several econometric issues, empirical evidence on the success of EU regional policy is mixed. The first contributions to the debate, such as Sala-i-Martin (1996), and Boldrin and Canova (2001), detected no statistically significant effects of EU regional policy on per-capita-income growth of recipient regions, conditional on standard drivers of economic growth. Positive effects on agglomeration and industry location issues are reported in Midelfart-Knarvik and Overman (2002).<sup>8</sup> The ambiguity of results may stem from econometric issues that stand in the way of clear estimates. The first such issue is reverse causality, whereby regional characteristics condition access to EU funds. A second issue resides in how dynamics are considered in the estimation procedure. A third difficulty is the possibility of omitted variables, variables that affect economic performance but are not, or cannot be, explicitly considered. In addition, the selection of appropriate control variables is an issue.<sup>9</sup>

Becker et al. (2010) first exploited the fact that Objective 1 funding is based on a simple assignment rule, with a clear and simple threshold that affects a region's eligibility: NUTS 2 regions are eligible for funding if their GDP per capita is less than 75% of the EU average. These authors exploited a fuzzy regression discontinuity design (RDD) with data from three programming periods (from 1989 to 2006), to find that, *on average*, Treated regions

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<sup>8</sup> Basile et al. (2008) find that Structural and Cohesion funds allocated by the EU to laggard regions have helped to attract subsidiaries of multinationals from both within and outside Europe.

<sup>9</sup> Other empirical approaches have been attempted such as instrumental variable estimates - Ramajo et al. (2008); (dynamic) panel data techniques - Rodríguez-Pose and Fratesi (2004); a combination of the two - Bouayad-Agha et al. (2013); bayesian methods - Cuaresma et al. (2012); or spatial growth models - Fiaschi et al. (2017). However, the empirical evidence is mixed and remains controversial (Dall'erba and Fang, 2015).

grow significantly faster than do regions just above the 75% threshold.<sup>10</sup> No effects on employment growth were uncovered. Becker et al. (2012) distinguished average and marginal effects, in which the former may be positive but the latter negative, implying that the optimal funding has been surpassed. Becker et al. (2013) show that regions with high levels of human capital and good institutions were able to use funds more efficiently.

Four more recent papers analyse the impacts of funds for different regions within a single country with regional data. Barone et al. (2016) focused on the post-expiry period to examine the persistence of the economic boost to “convergence” regions after the termination of access to EU Regional Funds. Their findings highlighted that exiting the program has a negative impact on regional per-capita GDP growth. Giua (2017) examined municipalities contiguous to the municipalities affected by a policy-change to identify the effects of EU Regional Policy in a panel of Italian regions. She finds a positive impact on employment levels produced by EU Regional Policy. Di Cataldo (2017) estimated the impact of EU funds in Cornwall and South Yorkshire, regions which were among the greatest beneficiaries of EU funds in the UK. Using synthetic control methods, they show that the income gap across regions has fallen with EU funding and labour market prospects have improved. Cerqua and Pellegrini (2018) use a regression discontinuity design and conclude that, despite portraying an average positive effect on regional growth, exceeding funds could have been allocated to other lagging regions more efficiently.

We contribute to the literature evaluating cohesion policy funds using the universe of private firms as units of observation, rather than municipalities or NUTS 2. Fattorini et al. (2020), using propensity score matching techniques and focusing exclusively on manufacturing firms, report a positive effect of EU Regional Funds aimed at investments in R&D on firms’ total factor productivity, particularly amongst the least efficient firms in the region. However, regarding EU Regional Funds that promote overall business, no effects were uncovered. Bondonio and Greenbaum (2006), analysing firms in Northern and Central Italy’s *Objective 2 regions*, find a positive impact of EU Regional Funds on employment growth, however estimating relatively high costs per job created.

Our paper further relates to the literature on the causal impact of place-based policies, surveyed in Kline and Moretti (2014a). Leveraging on rejected and future applicants to the US Empowerment Zones program as comparison groups, Busso et al. (2013) show that neighbourhoods receiving considerable Federal assistance in the form of tax breaks and job subsidies observed an increase in employment and local workers’ real wages. Kline and

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<sup>10</sup> Pellegrini et al. (2013) largely confirm the results of Becker et al. (2010) using Eurostat data.

Moretti (2014b) study the long-run effects from the Tennessee Valley Authority policy using as controls similar institutions proposed but never approved by the US Congress, showing how manufacturing employment increased after federal transfers had fallen.<sup>11</sup>

Place-based policies, such as the EU Structural and Cohesion funds, can possibly deliver effects that go beyond those found in the targeted area (Glaeser and Gottlieb, 2009).<sup>12</sup> 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). However, 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). In this paper, we also consider possible spillover effects by analysing the effects of treatment on neighbouring municipalities.

### III. Empirical approach

#### 3.1 Natural experiment

Portugal has been a recipient of European funding in the context of several Community Support Framework (CSF) phases. Regions whose per capita GDP lies below the threshold of 75% of the European average were eligible for Objective 1 funding (before 2006) or Convergence region funding (after 2007). Differences in regional eligibility imply that more (less) developed regions face a lower (higher) likelihood of having a given project accepted and receive less (more) resources from the EU cohesion and structural funds.

After 2007, Mainland Portugal has three distinct regional groups as far as eligibility to EU funds is concerned, as illustrated in Figure A1 in the Appendix. The first comprises the North, Centre, and Alentejo regions, which are part of the Convergence objective, associated with the most favourable access to funding. The second is the Algarve, in the south, part of the phasing out regime, with per capita GDP above the 75% income threshold – when the 25 EU countries at the time are considered, but still below the 75% of average income for EU-15. Finally, the smaller NUTS 2 Lisbon region that resulted from the

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<sup>11</sup>Gobillon et al. (2012) and Mayer et al. (2017) discuss similar schemes in France, while Einiö and Overman (2020) and Criscuolo et al. (2019) do it for two cases in the UK. Examining manufacturing firms in Italy, Bernini and Pellegrini (2011) investigated the impact of state regional policy to subsidized firms, finding higher growth rate of sales, employment, and investments, although with a negative impact on total factor productivity.

<sup>12</sup> For a discussion on the importance of spillovers in other contexts see Isem (2014).

administrative breakup stands as the only area above the 75% average for EU-15, and thus part of the lower eligibility Competitive objective, with lower eligibility.<sup>13</sup>

### 3.2 Data

For the empirical analysis in this study, we benefit from a longitudinal administrative linked employer-employee dataset, *Quadros de Pessoal*, conducted by the ministry responsible for employment affairs and, for that reason, of a mandatory nature. *Quadros de Pessoal* covers virtually all firms with at least one wage earner in the whole of mainland Portugal.<sup>14</sup> 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.<sup>15</sup>

We complement our analysis with municipal-level administrative data. Information on the electricity consumption, both for domestic and industrial purposes (in thousands of kilowatt hours), is obtained from the government agency for Energy and Geology (DGEG). Data regarding transfers from the central government to municipalities, as well as concerning the current expenses of municipalities (in Euros), is obtained from the Directorate general of local government (DGAL).

We select five firm-level indicators to evaluate firm performance in the regions that underwent a change in eligibility to EU regional funds. Those indicators are total sales (in € per year), the number of total workers and workers with a bachelor's degree (hereinafter, BSc), labour productivity (measured as the sum of sales per worker), and monthly average wages (which includes the fixed and the variable wage components).

We take the inverse hyperbolic sine (ihs) transformation of the first three dependent variables. This approach has the advantage of allowing us to consider non-positive values. Following Bellemare and Wichman (2019), with the hyperbolic sine, the interpretation of marginal effects approximates the natural logarithm of that variable when the untransformed means of such variables are large enough.

We test whether treatment has an impact on firm dynamics looking into the probability of exit using a dummy variable that takes value one if the firm closes and zero

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<sup>13</sup> As can be seen in Figure A1 in the Appendix, between 2003 and 2006, the region of Lisbon and the Tagus valley surpassed the threshold of 75% of EU average income per capita and jumping to a transitory regime called phasing-out. This area was severely reduced with the incorporation of some NUTS 3 regions in NUTS 2 Centre and Alentejo. Oeste and Médio Tejo are now part of the new NUTS 2 Centre, whereas Lezíria do Tejo is now part of the new NUTS 2 Alentejo.

<sup>14</sup> Cases of self-employment are excluded. In addition, organizations falling outside the partnership or sole proprietorship legal definitions were also omitted due to their non-profit nature.

<sup>15</sup> We imposed four data restrictions. First, we excluded employees whose registered age was under 17 or over 65 years old. Second, we focused solely on workers with a monthly wage higher than the mandatory national minimum wage. Third, we excluded firms with no sales in every year they appear in the dataset. Finally, we excluded firms with more than one establishment, as information on sales is not available at that level.

otherwise. Moreover, we aggregate firm data at the municipal level to examine the effect on the number of total firms and on the number of firms entering the market. Finally, we assess the impact of the redistricting using the previously described municipal outcomes.

Table A1 displays the descriptive statistics for the variables used in the analysis.

### 3.3 Identification strategy and econometric analysis

Considering that each firm's likelihood of access to EU funds depends on a range of observed and unobserved variables, we argue that a mere comparison between subsidized and non-subsidized firms in a certain region will produce biased results. Instead, we rather assess the impact of higher eligibility on firm performance using a natural experiment, a change that is entirely exogenous from the point of view of firms, in an intention to treat setting.

We explore the spatial discontinuity in access to European funds which occurred between 2006 and 2007 and derived from the redistricting of the Lisbon NUTS 2 area.<sup>16</sup> The municipalities to the north of Lisbon were singled out so as to gain access to higher eligibility and further benefit from EU funds, experiencing a break between the pre-treatment period, 2003 to 2006, and the post-treatment period, from 2007 to 2010.<sup>17</sup> Our identification strategy uses private firms located in the 33 municipalities pertaining to the NUTS 3 regions of Oeste, Médio Tejo, and Lezíria do Tejo, those gaining greater access to EU funds due to the administrative territorial redrawing.

Methods that compare outcomes in a treated region to those in adjacent regions may yield biased estimates for policies that have spillover effects (Jardim et al. 2022). Hence, we exclude neighbouring firms of Treated areas in a “buffer-zone” or “donut-hole” approach to mitigate the possibility of spillover effects from treatment. These municipalities have not seen any reduction in their eligibility therefore, absent possible spillover effects, we expect that they are untreated by the redistricting shock. We also check this possibility in this paper.

The comparison group is composed of firms in any of the 104 municipalities pertaining to Centre and Alentejo regions who have experienced no change whatsoever either in their nor their neighbours' eligibility to EU Regional Funds, as shown in Figure 1. We also add the more distant NUTS 2 North region in the control group as a robustness exercise.

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<sup>16</sup> Unlike what happens in some EU member states, including Belgium and the Netherlands, NUTS 2 regions do not inherit political power and their administrative competences are extremely limited. This was the only change since NUTS 2 were defined in 1989.

<sup>17</sup> We stop in 2010 as 2011 marks the year when Portugal requested financial assistance from the IMF, the European Commission, and the European Central Bank, dramatically changing its economic policies.

## [Insert Figure 1 here]

Our baseline diff-in-diff regressions estimate the average intent-to-treat effects derived from a standard ordinary least squares (OLS) model as follows:

$$Y_{imt} = \delta Post_t \cdot Treated_m + \gamma_t + \alpha_i + \alpha_m + e_{imt} \quad (1)$$

where  $Y_{imt}$  are the outcome variables for a firm  $i$ , in a municipality  $m$ , in year  $t$ .  $Post_t$  accounts for the treatment period (2007-2010) and  $Treated_m$  is a binary variable signalling firms producing in municipalities that gained greater *Objective 1/convergence* eligibility status.  $\gamma_t$  are year fixed effects, and  $\alpha_i$  and  $\alpha_m$  are firm and municipalities fixed effects (i.e., those controls for characteristics of firms and municipalities that are time-invariant).<sup>18</sup>  $e_{it}$  accounts for clustered standard errors per NUTS 3, the level of assignment to treatment, as in Bertrand et al. 2004, and Abadie et al. 2017. The outcome of interest is  $\delta$ , measuring the impact on a firm located in a region whose eligibility to access EU funds increases.

We also implement a difference-in-differences event study design, with several advantages. First, we can test the exogeneity of the treatment by examining pre-trends in a more detailed manner. In the absence of a pre-trend, the identifying assumption requires no systematic factors driving both the shock and the outcomes of interest. Second, the event study makes it possible to evaluate the impact of the shock in the outcome variables in the very short and medium run - up to four years. Denoting  $Y_{imt}$  as the outcome variable in firm  $i$ , municipality  $m$ , and year  $t$ , the regression model reads as follows:

$$Y_{imt} = \sum_{k=2003}^{2005} \delta_k Treated_m + \sum_{k=2007}^{2010} \delta_k Treated_m + \gamma_t + \alpha_i + \alpha_m + e_{imt} \quad (2)$$

where  $\delta_k$  is our outcome of interest measuring the year-by-year effect of producing in a Treated region, and the remaining variables are defined as before. The omitted year is 2006, the last year before treatment.

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<sup>18</sup> Our results are robust to the exclusion of the municipality fixed effects.

## IV. Results

### 4.1 Baseline Results

We start by presenting the event study diff-in-diff estimates from computing eq. (2) in Figure 2 for the five main dependent variables using 90% confidence intervals. As can be seen for all cases, we find evidence indicating that the parallel trends' assumption is not rejected in this setting.<sup>19</sup> We also observe a positive causal effect of the increase in eligibility on sales. The effect is, however, not persistent and drops to zero in 2010. As to the remaining dependent variables, we find very small (as in the case of average wages) or non-significant treatment effects.

**[Insert Figure 2 here]**

Our baseline diff-in-diff specification estimates from eq. (1) are presented in Table 1 – panel A and confirm the statistically significant positive impact of the eligibility on firms' sales (see column 1), corresponding to an increase of about 7.4 percent *vis-à-vis* firms in comparison municipalities. We uncover estimates that are statistically indistinguishable from zero for the effect of the treatment on the number of workers, suggesting that, while Treated firms sell significantly more, this does not create more employment. Results in Table 1 for the hiring of workers with a BSc degree by firms in Treated municipalities also show this pattern. If anything, the number of college-educated workers slightly decreases in Treated firms. As for average wages, our estimates in column (3) advocate for a significant increase, albeit of small magnitude, so that producing in a region that gains access is associated, *on average*, with a wage increase of around 12€ per month, or about 2% of the average value of monthly average wages in the treatment and control groups. We also find no evidence of a significant rise in efficiency, as measured by labour productivity (in column 4), in line with most of previous literature (Cerqua and Pellegrini, 2014).

**[Insert Table 1 here]**

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<sup>19</sup> Figure A2 in the Appendix presents descriptive graphical evidence that further corroborates the plausibility of the parallel trend assumption, for all outcome variables, in this context (Angrist and Pischke, 2009).

We next turn our attention to the possibility that EU regional funds may spur sales and have purely distributional effects, at the sector of activity level, without any real effects on firm performance through productivity and efficiency.

## 4.2 Heterogeneous Effects

In Table 1 – panel B, we find that the impetus behind the sales increase is driven solely by the *Non-Tradable* sector, with a statistically significant increase in sales for firms in this sector of around 10%, on average.<sup>20</sup> There is no effect whatsoever on sales on the *Tradable* sector, i.e., for firms competing in the international markets, suggesting that increased access to EU regional funds does not promote a more efficient entrepreneurial context, rather it increases sales by firms sheltered from competition (as proxied by their sector of activity). The monthly average wages increase relatively uniformly across sectors, though slightly more so in *Non-Tradable* – 13€, *vis-à-vis* 9€ in the *Tradable* sector. In what regards employment and labour productivity, we find no evidence of a significant effect estimated in both sectors.

Furthermore, we consider the sectoral differences in the impact of increased eligibility for firms in the secondary and tertiary sector in Table 1 – panel C. We again uncover heterogeneous effects: firms in the *Services* sector benefit from a 13% increase in sales after a rise in eligibility, while firms in *Manufacturing*, on the contrary, experience a non-statistically significant increase in sales, with the point estimate at around 3%. Effects on employment and labour productivity are close to zero in both sectors, while average wages are positively impacted on the secondary and tertiary sector, with increases of similar magnitude as in our baseline results – of 15€ and 10€, respectively.

Heterogeneous effects seem to be quite important, quantitatively, when assessing the impact of higher grant eligibility on private firms. Our contribution is therefore especially relevant given that most recent studies investigating the impact of EU cohesion funds on firm performance, at the firm level, focus exclusively on manufacturing firms (Fattorini et al. 2020; Bachtrögler et al. 2020).

## 4.3 Robustness

Our diff-in-diff strategy is convincing if and only if it occurs in the presence of no confounding shocks other than the policy (Mayer et al. 2017). The absence of pre-trends, as

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<sup>20</sup> The *Tradable* sector was defined according to the statistical classification of economic activities in the European Community and covers agriculture, forestry and fishing; mining and quarrying; manufacturing; transportation and storage; professional, scientific and technical activities; and administrative and support service activities.



shown in the event studies in Figure 2, are reassuring. However, there could still exist contemporaneous shocks that may threaten our identification strategy. Therefore, we present the following robustness checks.

First, as 2009 and 2010 correspond to one of the greatest recessions in economic history, a possible cause of concern is that Treated municipalities were differently affected by shocks during our post-treatment period. If this recession did have differential effects across regions in a way correlated with our Treated and comparison breakdown, it would introduce confounding effects in our estimates. The event studies in Figure 2 uncover a sudden drop in the positive effect found in firms' sales in 2010, the last year of the analysis.<sup>21</sup> We investigate whether this event is driving our diff-in-diff results by re-estimating eq. (1) after excluding the years of 2009 and 2010 from the sample.<sup>22</sup> Our results, reported in Table A3 in the Appendix, are very similar to baseline.

Second, another concern related with the identification of causal effects from place-based policies is to construct a valid counterfactual in the absence of the policy. As mentioned in the methodology section, our control group includes firms from all Portuguese mainland municipalities close to Treated areas whose eligibility status – as well as their neighbours', remain unchanged. However, as shown in Table A4 in the Appendix, even if we add the more distant, and potentially more different, *North* region in the comparison group, our results remain unchanged for *Non-Tradable* and *Services* sectors.

Third, we tested whether our results were robust to a more refined comparison group using coarsened exact matching (CEM). The advantage of CEM is that it creates a new control group resembling the Treated firms more closely in terms of pre-treatment observable characteristics (see Appendix B for more details).<sup>23</sup> Consequently, concerns relating to confounding effects biasing our estimates are reduced, assuming that the more firms are alike in terms of observables before treatment, the more plausible is the parallel trends assumption that had there not been any treatment, the evolution of firms' performance would be the same. In Table A5 of the Appendix, we present estimates combining the CEM and diff-in-diff. Once again, our main significant results remain roughly unaffected, except for sales in our baseline estimation. However, the significant increase in

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<sup>21</sup> Possible explanations might be in line with Becker et al. (2018) who show that eligibility effects weakened during the financial crisis, and with Fantino and Cannone (2013) who find that the impact of policies designed to boost innovation in small firms in an Italian region were effective exclusively in the short run.

<sup>22</sup> This also prevents possible confounding effects from an important shock to firms after October 2010: the introduction of tolls in the SCUT highway system (Audrestch et al. 2020; Branco et al. 2022).

<sup>23</sup> Iacus, King and Porro (2012) show that this method produces lower model dependence, estimation error, variance, bias, and reduces imbalance *vis-à-vis* remaining commonly employed matching methods.

sales for the *Non-Tradable* and *Services* sectors persists, as well as the positive effect on average wages in every sector. Employment and labour productivity impacts remain statistically indistinguishable from zero.

Finally, proximity to Lisbon can be a further confounding factor, if and only if the magnitude of possible spillover effects from this region changed after the implementation of the new EU eligibility status after 2007. We show in Table A6 in the Appendix a further robustness test in which we exclude all firms in the 5 treated municipalities that are closest to the capital. Our central findings remain unchanged, with the differences of point estimates across sectors being, if anything, slightly exacerbated – and so, not explained by the proximity to Lisbon. Our estimated effect on sales for the entire sample, on the other hand, albeit with a higher magnitude in comparison with our baseline results, is measured with noise.

#### **4.4 Firm dynamics**

Another important aim of our study is to identify whether access to a higher eligibility status had an impact on firm dynamics at Treated municipalities, particularly in the total number of firms, firm' entry and exit.<sup>24</sup> Table A7 in the Appendix reports our results regarding the evolution of the total number of firms and number of new firms at the municipality level, as well as a more granular analysis, at the firm level, concerning the probability of firms exiting the market, by employing a linear probability model where the outcome variable takes value one if the firm exits.

In all three cases, we present coefficients statistically indistinguishable from zero, indicating null eligibility effects on firm dynamics. Importantly, the fact that firm dynamics have not been significantly altered in the treatment period is also a good indicator that our baseline results are not biased due to composition effects. Indeed, had treatment influenced firms' entry or exit rates, part of our results could have been driven by a change in the composition of Treated or the control groups. For example, higher eligibility status could have prevented some below-average firms from leaving the market in Treated municipalities, which in turn could have generated a negative bias on the average performance of firms in Treated municipalities. However, this does not seem to be a cause for concern in this case.

#### **4.5 Are there spillover effects to neighbouring municipalities?**

We now investigate if there are spillover effects from firms in Treated areas to neighbouring untreated areas (Glaeser and Gottlieb, 2009). To do so, we define our treatment

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<sup>24</sup> Figueiredo et al. (2002) and Carias et al. (2022) show that Portuguese entrepreneurs tend to locate their businesses in their place of residence.

group in this subsection to include only neighbouring municipalities – termed Neighbours’, which experienced no change in eligibility, but saw, at least, one of their neighbours being treated. This new treatment group includes firms from 14 different municipalities (see Figure 1). The control group stays unchanged.

As one can observe in Table 2, the coefficients of interest are all small and non-statistically significant, except for the average wages, corroborating that even firms close to the Treated areas do not seem to receive spillover effects.

**[Insert Table 2 here]**

#### **4.6 Mechanisms**

Lastly, we discuss possible potential alternative mechanisms or confounding factors which could explain our findings using municipal-level administrative data. One possible candidate is transfers from the central government. Indeed, if the amount of transfers the government grants to Treated municipalities increases sizably in the period following the treatment, our initial results could derive from such actions, and not only by increased eligibility to EU funding. In Table 3 column (1), we show that government transfers have not increased in Treated municipalities *vis-à-vis* our control group municipalities. In addition, it could be the case that Treated municipalities increased their expenses through debt financing or local taxes, not necessarily due to transfers from the central government. In column (2), we show that municipalities’ current expenses have not increased in Treated municipalities. In sum, we find no evidence in favour of explaining our results by increased spending by the central or local governments.

In addition, Veiga (2012), in her study of the determinants of the assignment of EU funds in Portugal, argues that more funds are transferred to municipalities where the ruling national party had been supported by voters. We present descriptive evidence that this is unlikely to affect our results: in the pre-treatment period (2003-2006), 39% of the municipalities in the treated group are aligned with the party in the central government, while this figure is 42% for the comparison group while in the post-treatment period (2007-2010), these percentages remain remarkably constant, and the difference is, once again, non-statistically significant (39% in treatment vs. 36% in control).

In Table 3, we further analyse whether other indicators at the municipal level have experienced different growth rates for Treated and non-Treated municipalities. We focus on

electricity consumption as a proxy for municipalities' income.<sup>25</sup> While electricity for domestic consumption increases by more than 3%, on average, in Treated versus comparison municipalities, no effect is found for consumption of electricity for industrial purposes. We consider this additional evidence in favour of the idea that, while Treated municipalities benefitted from higher income, access to EU regional funds did not affect firm output or productivity in the secondary sector.

**[Insert Table 3 here]**

## V. Conclusion

The EU sets up policy initiatives that generate large public transfers to lower income regions across the continent. This paper exploits a unique quasi-natural experiment resulting from a redistricting decision meant to increase eligibility to EU funding, whereby a “convergence” region was administratively created in Portugal. We investigate, for the first time, the impact of regional eligibility EU cohesion funds on firm performance relying on a diff-in-diff framework that uses administrative microdata from the universe of firms in the country. We place our paper in a stream of research meant to empirically assess the impact of place-based policies, such as the EU regional policy, on economic convergence.

We find evidence of a strong demand effect that raises sales, on average, by more than 7% on firms in Treated vis-à-vis firms in comparison municipalities, but no evidence of a solid impact on labour productivity. The sales increase is driven entirely in the *Non-Tradable* – as opposed to *Tradable*, and in the *Services* – as opposed to the *Manufacturing* sectors. Furthermore, access to EU funds did not produce a significant increase in employment, or in the number of workers with a BSc degree, and only a marginal, though significant, increase equivalent to 2% of the average value in monthly average wages, raising questions regarding the efficacy and the sustainability of these effects in the long-term.

Our results point to the urgency of a rigorous assessment, at the firm-level and across sectors, of the impact of European funds on private firm performance. Exploiting specific, well-defined policy episodes, can enlighten us as to the nature, the quantitative impact, and the causal mechanisms associated with increased eligibility to access EU funds.

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<sup>25</sup> Unfortunately, there are no good GDP or personal income tax measures, at the municipal level, during our sample period.

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# Tables

Table 1. Diff-in-diff baseline results (Panel A) and sectoral analysis (Panels B and C)

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity	Workers with a BSc (ihs)
	(1)	(2)	(3)	(4)	(5)
<b>Panel A: Baseline</b>					
Treated * Post-Treatment	0,074*	-0,003	11,786***	3 245,363	-0,010*
	(0,04)	(0,02)	(2,88)	(4 188,18)	(0,01)
Adj R2	0,36	0,88	0,53	0,45	0,85
N	451 318	451 442	451 442	451 317	451 442
<b>Panel B: By Sector – Tradable versus Non-Tradable</b>					
<i>Non-Tradable</i>					
Treated * Post-Treatment	0,096**	-0,004	12,605***	5 065,980	-0,011**
	(0,04)	(0,02)	(3,61)	(6 466,73)	(0,00)
Adj R2	0,36	0,87	0,52	0,45	0,85
N	297 737	297 811	297 811	297 736	297 811
<i>Tradable</i>					
Treated * Post-Treatment	0,021	-0,001	9,480**	-2 404,872*	-0,009
	(0,06)	(0,02)	(4,02)	(1 212,69)	(0,01)
Adj R2	0,38	0,90	0,55	0,33	0,86
N	151 226	151 274	151 274	151 226	151 274
<b>Panel C: By Sector – Services versus Manufacturing</b>					
<i>Services</i>					
Treated * Post-Treatment	0,127***	-0,001	10,261***	5 465,534	-0,011**
	(0,04)	(0,02)	(2,76)	(8 087,44)	(0,00)
Adj R2	0,37	0,88	0,53	0,47	0,85
N	276 243	276 306	276 306	276 242	276 306
<i>Manufacturing</i>					
Treated * Post-Treatment	0,034	-0,014	14,649***	-1 087,061	-0,012
	(0,05)	(0,03)	(3,61)	(2130,16)	(0,01)
Adj R2	0,35	0,89	0,53	0,39	0,87
N	140 931	140 969	140 969	140 931	140 969
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Municipal Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variables in column (1), (2), and (5) have suffered an inverse hyperbolic sine 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%.

**Table 2. Diff-in-diff spillover results**

	Sales (ihs) (1)	Total Workers (ihs) (2)	Average Wages (3)	Labour Productivity (4)	Workers with a BSc (ihs) (5)
Neighbors * Post-Treatment	0,017 (0,04)	-0,003 (0,01)	42,747*** (9,75)	3 259,363 (1 917,38)	0,003 (0,01)
Adj R2	0,37	0,89	-0,01	0,24	0,86
N	376 606	376 719	376 719	376 605	376 719
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Municipal Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variables in column (1), (2), and (5) have suffered an inverse hyperbolic sine transformation; Our regressor of interest, Neighbors \* Post-Treatment, indicates firms producing in one of the 14 municipalities neighbors 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%.

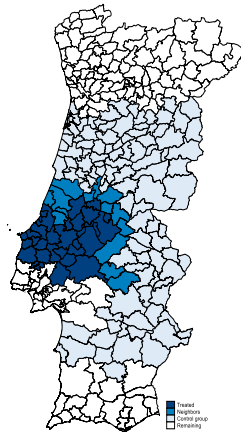
**Table 3. Alternative Mechanisms**

	Government transfers (log) (1)	Municipalities' current expenses (log) (2)	Electricity	
			For domestic purposes (log) (3)	For industrial purposes (log) (4)
<b>Panel A: Treated</b>				
Treated * Post-Treatment	0,015 (0,02)	0,014 (0,02)	0,032*** (0,01)	-0,016 (0,07)
Adj R2	0,96	0,97	1,00	0,98
N	1 096	1 096	1 096	1 096
<b>Panel B: Neighbors</b>				
Neighbors * Post-Treatment	0,030** (0,01)	0,005 (0,02)	-0,010 (0,01)	-0,073 (0,06)
Adj R2	0,97	0,97	1,00	0,98
N	944	944	944	944
Year Fixed Effects	Yes	Yes	Yes	Yes
Municipality Fixed Effects	Yes	Yes	Yes	Yes

Notes: Our regressors of interest, Treated \* Post-Treatment and Neighbors \* Post-Treatment indicate firms producing in Treated or Neighbors municipalities, respectively, 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%.

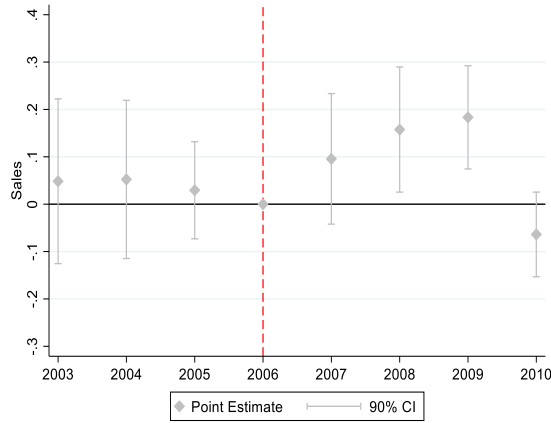
# Figures

**Figure 1.**  
**Geographical Distribution of the Neighbors and Comparison**  
**Municipalities**

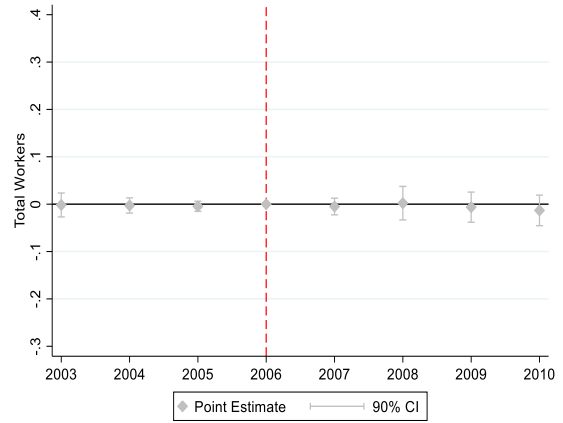


**Figure 2. Event studies**

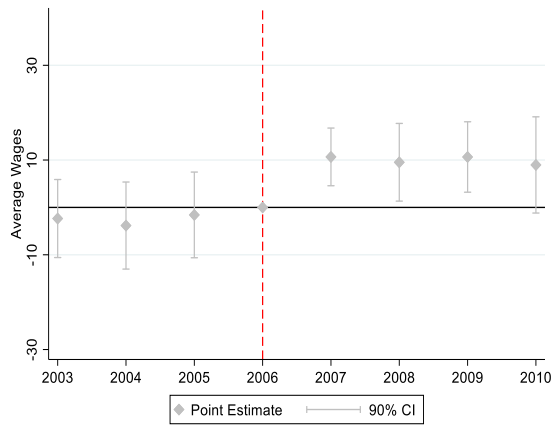
*Sales (€ / year)*



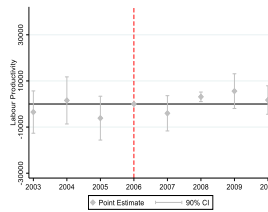
*Total Workers*



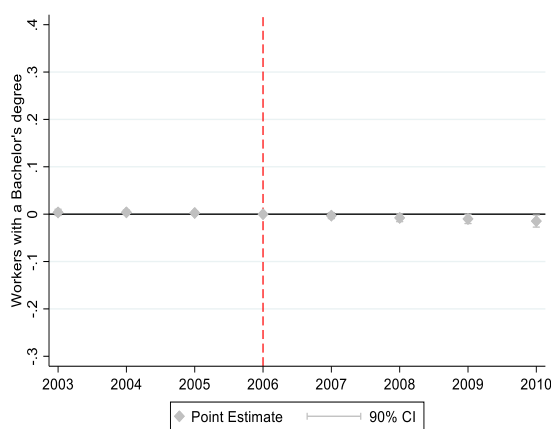
*Average Wages (€ / month)*



*Labour Productivity (Sales / Workers)*



*Workers with a Bachelor's degree*



Notes: This Figure presents the results of equation (2), with a confidence interval of 90%. Sales, Total Workers, and Workers with a bachelor's degree were transformed using the inverse hyperbolic sine approach.

# Appendix – Tables

**Table A1. Descriptive statistics**

Variable:	N	Mean	SD	Range
<b>Panel A</b>				
<i>Treated</i>				
<i>ibs Sales (€ / year)</i>	158 912	11,81	3,50	0 - 20,61
<i>ibs Total Workers</i>	158 952	1,78	0,94	0,88 - 7,07
<i>Average Wages (€ / month)</i>	158 952	678,67	355,57	357 - 31 744,40
<i>Labour Productivity (Sales / Workers)</i>	158 912	82 833,93	574 505,00	0 - 128 000 000
<i>ibs Workers with a BSc</i>	158 952	0,25	0,62	0 - 7,61
<i>ibs Total Wages (€ / month)</i>	158 952	8,15	1,17	6,57 - 14,37
<i>ibs Number of firms (Municipality)</i>	264	6,74	0,88	4,70 - 8,45
<i>ibs Number of new firms (Municipality)</i>	264	4,30	0,90	1,82 - 6,05
<i>ibs Number of exiting firms (Municipality)</i>	264	4,32	0,95	1,82 - 6,56
<i>Neighbours</i>				
<i>ibs Sales (€ / year)</i>	80 437	11,92	3,50	0 - 19,63
<i>ibs Total Workers</i>	80 458	1,85	0,97	0,88 - 7,06
<i>Average Wages (€ / month)</i>	80 458	738,03	2 765,64	357 - 775 646
<i>Labour Productivity (Sales / Workers)</i>	80 437	80 092,20	227 306	0 - 18 700 000
<i>ibs Workers with a BSc</i>	80 458	0,26	0,61	0 - 5,58
<i>ibs Total Wages (€ / month)</i>	80 458	8,28	1,23	6,57 - 14,25
<i>ibs Number of firms (Municipality)</i>	832	6,15	0,93	4,09 - 8,80
<i>ibs Number of new firms (Municipality)</i>	832	3,61	0,99	0,88 - 6,41
<i>ibs Number of exiting firms (Municipality)</i>	832	3,63	1,04	0,88 - 6,85
<i>Control group</i>				
<i>ibs Sales (€ / year)</i>	310 185	11,74	3,49	0 - 20,75
<i>ibs Total Workers</i>	310 283	1,79	0,96	0,88 - 8,07
<i>Average Wages (€ / month)</i>	310 283	1,40	0,81	0,69 - 7,38
<i>Labour Productivity (Sales / Workers)</i>	310 184	660,69	373,87	357 - 79 160,50
<i>ibs Workers with a BSc</i>	310 283	0,25	0,62	0 - 7,61
<i>ibs Total Wages (€ / month)</i>	310 283	8,13	1,18	6,57 - 15,56
<i>ibs Number of firms (Municipality)</i>	112	6,52	1,16	4,61 - 9,10
<i>ibs Number of new firms (Municipality)</i>	112	3,91	1,20	1,44 - 6,70
<i>ibs Number of exiting firms (Municipality)</i>	112	4,00	1,21	1,44 - 7,01
<b>Panel B</b>				
<i>Treated</i>				
<i>log Government transfers</i>	264	15,64	0,48	14,84 - 16,89
<i>log Municipalities' current expenses</i>	264	9,13	0,57	7,87 - 10,60
<i>log Electricity for domestic purposes</i>	264	10,11	0,79	8,21 - 11,56
<i>log Electricity for industrial purposes</i>	264	10,02	1,30	6,41 - 12,03
<i>Neighbours</i>				
<i>log Government transfers</i>	112	15,70	0,46	15,09 - 16,92
<i>log Municipalities' current expenses</i>	112	8,86	0,69	7,78 - 10,75

<i>log Electricity for domestic purposes</i>	112	9,68	1,05	8,03 – 12,07
<i>log Electricity for industrial purposes</i>	112	9,55	1,94	6,62 – 12,83
<hr/>				
<b>Control group</b>				
<i>log Government transfers</i>	832	15,65	0,43	14,35 – 17,14
<i>log Municipalities' current expenses</i>	832	8,80	0,61	7,19 – 11,17
<i>log Electricity for domestic purposes</i>	832	9,49	0,91	7,37 – 12,33
<i>log Electricity for industrial purposes</i>	832	9,27	1,66	5,40 – 14,02
<hr/>				

**Table A2. Robustness: Employing a logarithmic transformation**

	Sales (log) (1)	Total Workers (log) (2)	Average Wages (3)	Labour Productivity (4)	Workers with a Bsc (log) (5)
<b>Panel A: Baseline</b>					
Treated * Post-Treatment	0,071* (0,04)	-0,002 (0,02)	11,786*** (2,88)	3 245,363 (4 188,18)	-0,008* (0,00)
Adj R2	0,37	0,90	0,53	0,45	0,85
N	451 318	451 442	451 442	451 317	451 442
<b>Panel B: By Sector – Tradable versus Non-Tradable</b>					
<i>Non-Tradable</i>					
Treated * Post-Treatment	0,093** (0,04)	-0,002 (0,02)	12,605*** (3,61)	5 065,980 (6 466,73)	-0,009** (0,00)
Adj R2	0,37	0,88	0,52	0,45	0,85
N	297 737	297 811	297 811	297 736	297 811
<i>Tradable</i>					
Treated * Post-Treatment	0,020 (0,06)	-0,001 (0,02)	9,480** (4,02)	-2 404,872* (1 212,69)	-0,008 (0,01)
Adj R2	0,39	0,91	0,55	0,33	0,87
N	151 226	151 274	151 274	151 226	151 274
<b>Panel C: By Sector – Services versus Manufacturing</b>					
<i>Services</i>					
Treated * Post-Treatment	0,121*** (0,03)	0,000 (0,02)	10,261*** (2,76)	5 465,534 (8 087,44)	-0,009** (0,00)
Adj R2	0,38	0,89	0,53	0,47	0,85
N	276 243	276 306	276 306	276 242	276 306
<i>Manufacturing</i>					
Treated * Post-Treatment	0,033 (0,05)	-0,011 (0,02)	14,649*** (3,61)	-1 087,061 (2 130,16)	-0,010 (0,01)
Adj R2	0,37	0,90	0,53	0,39	0,87
N	140 931	140 969	140 969	140 931	140 969
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Municipal Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variables in column (1), (2), and (5) have 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%.

**Table A3. Robustness: without crisis period (2003-2008)**

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity	Workers with a BSc (ihs)
	(1)	(2)	(3)	(4)	(5)
<b>Panel A: Baseline</b>					
Treated * Post-Treatment	0,101*	0,002	11,915***	1 089,194	-0,008
	(0,06)	(0,02)	(2,71)	(3 740,42)	(0,00)
Adj R2	0,41	0,89	0,55	0,40	0,86
N	335 063	335 063	335 063	335 063	335 063
<b>Panel B: By Sector – Tradable versus Non-Tradable</b>					
<i>Non-Tradable</i>					
Treated * Post-Treatment	0,108*	0,004	12,202***	1 452,584	-0,009*
	(0,06)	(0,02)	(3,90)	(5 576,23)	(0,00)
Adj R2	0,41	0,88	0,54	0,40	0,86
N	220 039	220 039	220 039	220 039	220 039
<i>Tradable</i>					
Treated * Post-Treatment	0,069	-0,001	12,497**	-1 455,795	-0,007
	(0,08)	(0,02)	(4,49)	(1 295,75)	(0,01)
Adj R2	0,42	0,91	0,56	0,34	0,87
N	112 686	112 686	112 686	112 686	112 686
<b>Panel C: By Sector – Services versus Manufacturing</b>					
<i>Services</i>					
Treated * Post-Treatment	0,144**	0,006	11,962***	2 302,704	-0,009**
	(0,06)	(0,02)	(2,93)	(6 875,10)	(0,00)
Adj R2	0,42	0,89	0,57	0,41	0,86
N	202 031	202 031	202 031	202 031	202 031
<i>Manufacturing</i>					
Treated * Post-Treatment	0,057	-0,004	12,182***	-1 570,155	-0,010
	(0,08)	(0,03)	(3,84)	(1 546,34)	(0,01)
Adj R2	0,39	0,90	0,49	0,37	0,87
N	107 735	107 735	107 735	107 735	107 735
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Municipal Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variables in column (1), (2), and (5) have suffered an inverse hyperbolic sine 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 2003-2008 period. Clustered standard errors, at the NUT3 level, are presented in parenthesis; Significance level at which the null hypothesis is rejected: \*\*\* 1%, \*\* 5%, \* 10%.



**Table A4. Robustness: including North Region in the control group**

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity	Workers with a BSc (ihs)
	(1)	(2)	(3)	(4)	(5)
<b>Panel A: Baseline</b>					
Treated * Post-Treatment	0,036 (0,03)	-0,017 (0,02)	10,722*** (2,58)	2 936,537 (3 821,66)	-0,008* (0,00)
Adj R2	0,36	0,89	0,43	0,70	0,85
N	1 094 724	1 094 982	1 094 982	1 094 716	1 094 982
<b>Panel B: By Sector – Tradable versus Non-Tradable</b>					
<i>Non-Tradable</i>					
Treated * Post-Treatment	0,071* (0,04)	-0,021 (0,02)	11,725*** (2,13)	4 074,272 (5 985,58)	-0,011*** (0,00)
Adj R2	0,36	0,87	0,51	0,71	0,85
N	703 766	703 933	703 933	703 759	703 933
<i>Tradable</i>					
Treated * Post-Treatment	-0,048 (0,04)	-0,010 (0,02)	8,582* (4,20)	-624,620 (827,20)	-0,001 (0,01)
Adj R2	0,38	0,91	0,35	0,40	0,86
N	384 954	385 043	385 043	384 953	385 043
<b>Panel C: By Sector – Services versus Manufacturing</b>					
<i>Services</i>					
Treated * Post-Treatment	0,126*** (0,02)	-0,010 (0,02)	8,755*** (2,67)	4 103,906 (7 618,36)	-0,011*** (0,00)
Adj R2	0,37	0,87	0,57	0,44	0,85
N	652 832	652 979	652 979	652 827	652 979
<i>Manufacturing</i>					
Treated * Post-Treatment	-0,075 (0,06)	-0,043 (0,03)	15,295*** (2,43)	1 279,651 (2 422,58)	-0,003 (0,01)
Adj R2	0,36	0,89	0,25	0,75	0,86
N	393 614	393 698	393 698	393 611	393 698
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Municipal Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variables in column (1), (2), and (5) have suffered an inverse hyperbolic sine 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. 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%.

**Table A5. Robustness: Coarsened Exact Matching**

	Sales (ihs)	Total Workers (ihs)	Average Wages	Labour Productivity	Workers with a BSc (ihs)
	(1)	(2)	(3)	(4)	(5)
<b>Panel A: Baseline</b>					
Treated * Post-Treatment	0,058 (0,04)	-0,002 (0,02)	9,751*** (2,74)	-2 006,952 (2 020,11)	-0,010** (0,00)
Adj R2	0,39	0,89	0,50	0,23	0,86
N	297 643	297 722	297 722	297 642	297 722
<b>Panel B: By Sector – Tradable versus Non-Tradable</b>					
<i>Non-Tradable</i>					
Treated * Post-Treatment	0,088** (0,04)	-0,003 (0,02)	10,201** (3,50)	-1 462,967 (2 874,30)	-0,012*** (0,00)
Adj R2	0,38	0,87	0,49	0,22	0,85
N	198 225	198 271	198 271	198 224	198 271
<i>Tradable</i>					
Treated * Post-Treatment	-0,007 (0,05)	0,001 (0,02)	8,880** (3,44)	-3 174,229** (1 243,73)	-0,006 (0,01)
Adj R2	0,39	0,91	0,52	0,28	0,86
N	99 418	99 451	99 451	99 418	99 451
<b>Panel C: By Sector – Services versus Manufacturing</b>					
<i>Services</i>					
Treated * Post-Treatment	0,105** (0,04)	0,000 (0,02)	7,008** (2,87)	-2 836,289 (3 057,77)	-0,011*** (0,00)
Adj R2	0,39	0,89	0,50	0,21	0,86
N	176 646	176 684	176 684	176 645	176 684
<i>Manufacturing</i>					
Treated * Post-Treatment	0,002 (0,05)	-0,011 (0,02)	14,871*** (3,12)	-1 277,289 (1 166,38)	-0,010 (0,01)
Adj R2	0,37	0,89	0,50	0,36	0,87
N	99 321	99 345	99 345	99 321	99 345
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Municipal Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variables in column (1), (2), and (5) have suffered an inverse hyperbolic sine 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%.

**Table A6. Robustness: Excluding the 5 closest municipalities to Lisbon**

	Sales (ihs) (1)	Total Workers (ihs) (2)	Average Wages (3)	Labor Productivity (4)	Workers with a BSc (ihs) (5)
<b>Panel A: Baseline</b>					
Treated * Post-Treatment	0,091 (0,06)	-0,008 (0,02)	10,421*** (3,20)	4 371,478 (4 497,36)	-0,009 (0,01)
Adj R2	0,36	0,89	0,54	0,45	0,85
N	417 949	418 069	418 069	417 948	418 069
<b>Panel B: By Sector – Tradable versus Non-Tradable</b>					
<i>Non-Tradable</i>					
Treated * Post-Treatment	0,118** (0,06)	-0,008 (0,02)	10,553** (4,21)	6 538,339 (7 061,66)	-0,010* (0,01)
Adj R2	0,36	0,87	0,53	0,45	0,85
N	275 910	275 982	275 982	275 909	275 982
<i>Tradable</i>					
Treated * Post-Treatment	0,026 (0,07)	-0,008 (0,02)	9,142** (4,13)	-2 100,728 (1 277,42)	-0,010 (0,01)
Adj R2	0,38	0,91	0,57	0,32	0,86
N	139 851	139 897	139 897	139 851	139 897
<b>Panel C: By Sector – Services versus Manufacturing</b>					
<i>Services</i>					
Treated * Post-Treatment	0,150** (0,05)	-0,003 (0,02)	7,402* (3,82)	7 802,198 (8 939,34)	-0,010* (0,00)
Adj R2	0,37	0,88	0,54	0,46	0,85
N	255 383	255 443	255 443	255 382	255 443
<i>Manufacturing</i>					
Treated * Post-Treatment	0,043 (0,07)	-0,024 (0,02)	15,116*** (3,86)	-2 105,830 (2 134,12)	-0,012 (0,01)
Adj R2	0,35	0,89	0,56	0,39	0,87
N	130 730	130 767	130 767	130 730	130 767
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Municipal Fixed Effects	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variables in column (1), (2), and (5) have suffered an inverse hyperbolic sine transformation; 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%.

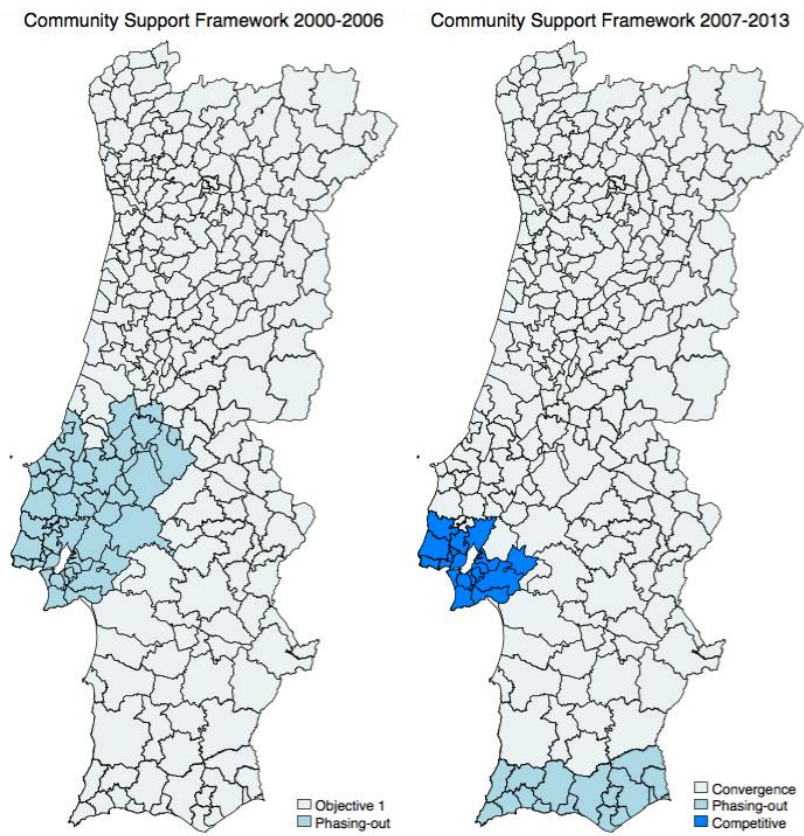
**Table A7. Firm dynamics**

	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%.

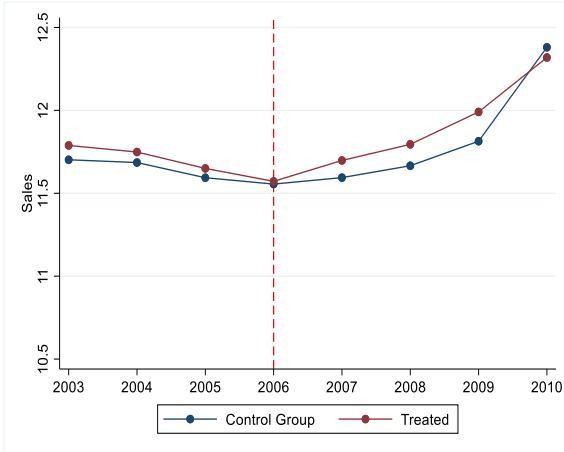
# Appendix – Figures

Figure A1.  
Geographical dispersion

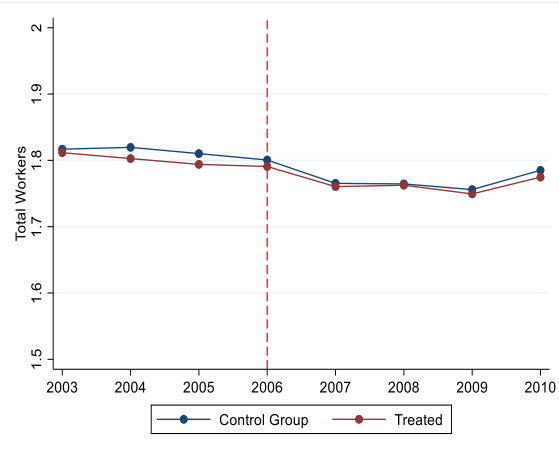


**Figure A2.**  
**Descriptive graphical evidence**

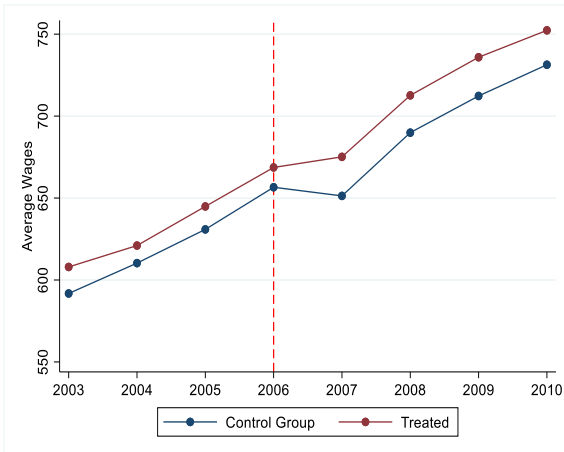
*Sales (€ / year)*



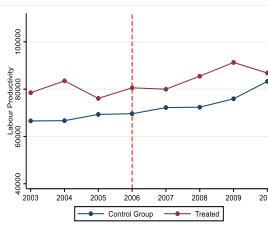
*Total Workers*



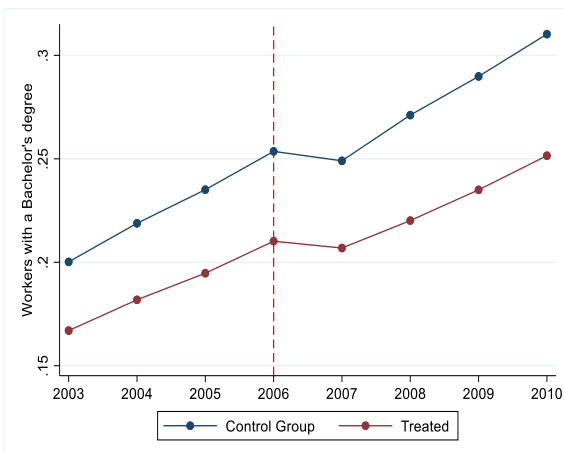
*Average Wages (€ / month)*



*Labour Productivity (Sales / Workers)*



*Workers with a Bachelor's degree*



Notes: This Figure presents the evolution of our five main outcome variables, for the Treated and control group. Sales, Total Workers, and Workers with a bachelor's degree were transformed using the inverse hyperbolic sine approach.

## **Appendix – B. Further details on the CEM method**

The first phase of the CEM method is to stratify firms according to their observables. In our case, we form groups of firms that are in the same decile regarding the distribution of sales, number of workers, and average wages in the year preceding treatment (i.e., 2006). This way, we create a total of 1000 strata, so that firms in the same stratum belong to the same decile in the distribution of sales, number of workers and average wages. Out of those 1000 strata, in only 12 are firms in both the Treated and control groups, so firms in the remaining strata were excluded from this analysis for not having a compatible enough counterfactual. From our initial baseline specification, about a third of the observations were excluded – taking us from around 451 000 to 297 000 observations.

The second part of the method is to estimate our DiD equation on this new reduced sample, with the CEM weights. The CEM weights guarantee that within each stratum, the sum of the weights of Treated and control group firms are the same, and that each Treated observation is weighted the same, regardless of its stratum.