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IMPORTANCE OF EU REGIONAL SUPPORT PROGRAMMES FOR FIRM PERFORMANCE

CONTENTS

ABBREVIATIONS

CF – Cohesion Fund
CSB – Central Statistical Bureau of Latvia
DiD – difference-in-difference
EU – European Union
ERDF – European Regional Development Fund
ESF – European Social Fund
GDP – gross domestic product
GNI – gross national income
OECD – Organisation for Economic Co-operation and Development
PSM – propensity score matching
R&D – research and development
TFP – total factor productivity
vs – versus

ABSTRACT

This paper investigates the effects of EU regional support on firms' productivity, the number of employees and other firm performance indicators. For this purpose, a rich firm-level dataset for Latvia, a country where investment activities are affected by the availability of EU funding, is used. The paper finds that participation in activities co-funded by the ERDF raises firms' input and output soon after they embark on them, while the effect on labour productivity and TFP appears only with a time lag of three years. However, this positive productivity premium is not homogenous across firms and is more likely to materialise in the case of initially less productive and medium-sized/large firms. Furthermore, statistical significance of positive productivity gains is not particularly robust across different estimation procedures. The study also shows that after controlling for investment expenditures, EU sponsored projects are as efficient as the privately financed ones, irrespective of where private financing comes from.

Keywords: EU funds, productivity, firm-level data, propensity score matching

JEL code: C14, D22, R11

The views expressed in this paper are those of the authors – Konstantīns Beņkovskis (Latvijas Banka, The Stockholm School of Economics in Riga (SSE Riga)), Oļegs Tkačevs (Latvijas Banka) and Naomitsu Yashiro (OECD) – and do not necessarily reflect the stance of Latvijas Banka, the SSE Riga or OECD. The authors assume responsibility for any errors and omissions.

1. INTRODUCTION

Against the background of substantial gaps in economic developments across different regions of the EU, the European Commission spends almost a third of the total EU budget to facilitate convergence among EU Member States. To achieve this goal, the European Commission designed the EU regional (or cohesion) policy and adopted three cohesion funds as its main instruments.

Given the high priority and political sensitivity of the EU regional support policy, its impact on growth and regional cohesion has been the issue of many empirical studies. The results of this body of literature have thus far been rather mixed as the positive effect of EU funding on national/regional growth appears to be far from certain. Recently, the literature has started to be increasingly focused on the relevance of various factors in relation to the effectiveness of EU funding in achieving its goals. Among other factors, the presence of strong institutions and higher degree of decentralisation have been shown to foster the positive impact of the cohesion policy. However, due to a lack of firm-level data the analysis of the effects of EU funding has been mainly carried out at the aggregated (i.e. regional or national) level, while the assessment of the impact on firm productivity, employment and other firm performance characteristics has been limited so far.

To narrow this gap in the literature, we consider the effectiveness of EU funding at a firm level with an emphasis on firm productivity improvements using a detailed firm-level dataset for Latvia. More specifically, we focus on a set of projects financed by the ERDF. They are tailored to boost innovation and competitiveness of individual companies in the EU's lagging regions. Latvia appears to be a very appropriate country for such an investigation as it is one of the largest recipients of EU funds in relative terms. We contribute to the existing literature by examining the impact of ERDF funding at the micro-level as well as by investigating the heterogeneity of the effectiveness of ERDF funding across different firm and project characteristics. This would allow us to identify types of firms and projects gaining most from the implementation of ERDF co-funded projects, thus presumably providing policy advice on improvements of EU regional support. Furthermore, the paper analyses the impact of two different sources of investment financing (EU support vs private funding) on firm performance. Private funding is further split into predominantly own resources and loans.

We use a non-experimental matching approach that involves four stages. First, we estimate conditional probability of starting an ERDF co-funded project for each firm in the dataset using the probit setup. In the second stage, we use the estimated probability, i.e. the propensity score, to match participants in ERDF co-funded projects with non-participants with respect to the variety of observable characteristics, thus controlling for a selection bias. We employ several matching strategies (drawing different number of the nearest neighbours, without and with a caliper to avoid poor matching) to ensure robustness of our estimates. Third, we compute the DiD estimator for several firm performance characteristics. Finally, we consider the possibility of heterogeneity in the effects of EU funding, i.e. we examine whether a magnitude of the DiD estimator is associated with certain firm characteristics or project features.

Our results show that a company's capital-to-labour ratio, the number of employees and therefore also output and sales increase following the receipt of EU support from the ERDF. This result is far from surprising as many of the EU co-funded activities

we consider in our study are ERDF sponsored investment projects. Interestingly, the effect on productivity is not significant in the first two years, although companies manage to raise their productivity starting from the third year. However, statistical significance of the latter result is not robust to changes in the matching strategy. Finally, productivity gains in the third year (even if with low significance on average) are estimated to be larger for initially bigger and less productive firms.

When comparing EU co-funded projects with privately financed ones, we conclude that the above companies tend to employ a larger number of additional employees. At the same time, productivity gains are not statistically different across two sources. Splitting private financing further into predominantly own resources and loans from credit institutions does not reveal any additional evidence of superiority of one of the funding sources. Nevertheless, we find that firms receiving ERDF grants have bigger wage increases than those implementing projects financed from own resources, while this difference is not significant when compared to debt financed projects.

All in all, our findings point to lags in newly acquired capital utilisation due to several possible reasons signalling an avenue for future research. One of them could be the presence of knowledge gaps, i.e. employees' lack of necessary skills to gain most of the newly acquired capital. It may take time for them to accrue expertise. Another possible explanation we suggest in our study is an inadequate market size and smaller than necessary degree of firms' internationalisation. Finally, our findings may indicate poor design of operational programmes in the financial framework studied in this paper. However, when interpreting the results of this study, one should bear in mind that many of the activities co-funded by the ERDF take considerable time to get fully implemented, hence the economic effects of such projects may not be yet materialised.

The remainder of our study is organised as follows. The next section briefly explains the main tenets of the EU regional support policy, its design, objectives and the main figures of the recently concluded EU multiannual financial framework 2007–2013. It explains the role of ERDF funding within this framework. Section 3 summarises the previous research at national and regional level as well as takes a look at the related literature that uses micro level data. Section 4 explains the construction of the dataset we use in the analysis. In Section 5 we describe the methodology employed in this study in more detail. Among other things, we explain the way total factor productivity is estimated for each firm in the dataset. Section 6 presents our estimation results. Finally, Section 7 concludes and provides policy recommendations.

2. EU REGIONAL SUPPORT POLICY TOOLS

2.1 Multiannual financial framework 2007–2013: design, objectives and the main figures

Given substantial disparities within the EU, its regional policy is aimed at improving quality of life in the least developed regions, thus rendering the EU a more developed and economically balanced political entity. The legal basis for the EU's regional policy was provided in the Single European Act in 1986 that created a large internal market and deepened political and economic cooperation of the EU Member States. In 1989, the European Commission introduced multiannual planning and has ever since approved several multiannual budgets that allocated resources to various objectives,

among them regional support and cohesion.[1] The regional policy's objectives (their number and names), resource allocation rules and instruments have only slightly changed since 1989, while the volume of funds allocated and their share in total EU budget expenditure increased substantially reflecting the process of EU enlargement.[2]

The latest concluded multiannual financial framework 2007–2013 we analyse in this study and whose total financing in constant 2004 prices amounted to 308 billion euro, was adopted in 2006 and envisaged three objectives of the EU regional policy: 1) convergence, 2) regional competitiveness and employment, and 3) European territorial cooperation.[3] The three instruments used for the implementation of these objectives are as follows: the ERDF, ESF and CF. The first two instruments are largely employed to invest in growth enhancing infrastructure projects, innovation, communication (the ERDF) and social policies (the ESF). In turn, the CF was introduced only in the mid-1990s and has been used for large transport-related network and environmental projects (European Commission (2014)).

By far the most important and generously funded objective is convergence (80% of total financing provided for regional support). Its main purpose is to stimulate growth and employment in the lagging regions, thus reducing gaps in economic and social development and fostering cohesion within the EU. To be eligible for the convergence financing from the ERDF and ESF, a region's GDP per capita should be less than 75% of the Community's average.[4] This rule does not apply to the CF whose resources are designated to the EU Member States with GNI per capita not exceeding 90% of the EU average. For Latvia, the compliance with these eligibility criteria effectively means that the whole country is entitled to all three instruments under the convergence objective. More prosperous EU regions not eligible for the convergence objective may receive funding under the objective of regional competitiveness and employment financed by the ERDF and ESF. The third objective, i.e. territorial cooperation, whose only instrument is the ERDF, is designed to promote cooperation at the cross-border, transnational and interregional level (European Commission (2007)). Hence the whole EU is covered by the regional support policy, yet the bulk of financing is dedicated to the least developed regions, thus constituting a tool for redistribution of welfare across EU Member States.

Every multiannual financial framework addresses certain strategic EU priorities relevant at the moment of its approval. The three priorities of the multiannual financial framework 2007–2013, as laid out in the European Council (2006) guidelines, are: a) expanding and improving transport infrastructure, while preserving the environment, b) encouraging entrepreneurship and promoting innovation, and c) investment in human capital to create more jobs and improve adaptability of employees.

[1] The EU Regional Cohesion Policy along with the Common Agricultural Policy are the EU's most important policy areas and are the biggest spending items of the EU budget (86% of total EU budget expenditure in 2014).

[2] Budgetary allocation to structural policies increased from 5.7 billion ECU (16% of total expenditure) in 1986 to 25.5 billion euro (31% of total expenditure) in 2000 and 64.0 billion euro (45% of total expenditure) in 2014. For more historical data on EU budget spending see European Commission (2009) as well as information provided on http://ec.europa.eu/budget/annual/index_en.cfm?year=2014.

[3] See Council Regulation No. 1083/2006 for details of the multiannual financial framework 2007–2013.

[4] More specifically, a region's GDP per capita should be less than 75% of the average GDP of the EU25 during the period 2000–2002.

There are several conditionalities related to the absorption of EU funding. First, EU funding is supposed to be complemented by national resources (public or private, depending on the entity implementing the respective project). The rate of national financing is conditional upon the objective and project varying, on average, between 15% (for projects financed by the CF) and 50% (for projects within the framework of the regional competitiveness and employment objective). Second, EU funding should not replace national spending. Third, the committed funds may be called up until two years after the end of the programming period, i.e. in the case of the multiannual financial framework 2007–2013 funding could be drawn upon by the end of 2015.

As the main concern of this study is the effect of EU regional support on firm performance, including productivity and competitiveness, in what follows we consider only the projects financed by the ERDF. The initial objective of this EU regional policy instrument established in 1975 was to assist declining industrial regions. From the outset, it was also the first instrument of the EU policy to redistribute income within the Community. Ever since the scope of this fund has become much broader, and currently it is the only instrument that supports all three abovementioned objectives of the EU regional policy which effectively makes all EU countries eligible for ERDF resources. This instrument, among other goals, is designed to support entrepreneurship and foster competitiveness of private firms in the least developed EU regions.

2.2 EU funding in Latvia in 2007–2013

Latvia, whose GDP per capita is 64% of the EU28 average[5], is one of the largest recipients of EU regional support in relative terms. On average it amounts to around 3.0% of GDP per year.[6] Most of the supported projects fall into the convergence objective and are designed along three operational programmes. One of them is the operational programme "Human Resources and Employment" (0.6 billion euro) funded by the ESF. It is aimed at raising the quality of human resources in Latvia by improving access to employment via active labour market policies, fostering education and social inclusiveness and reducing poverty. During the financial and economic crisis, activities carried out within this operational programme provided essential financial support to most vulnerable groups of the Latvian population particularly strongly hurt during the crisis. Another operational programme funded solely by the ERDF is "Entrepreneurship and Innovation" (0.7 billion euro). Its numerous activities are focused on promotion of innovation and spreading of knowledge ultimately aimed at increasing competitiveness of the Latvian economy. By far the largest operational programme funded by both the ERDF and CF (3.2 billion euro) is "Infrastructure and Services". It has broad priorities and it is aimed at advancing infrastructure, developing the transport network and improving the business environment.

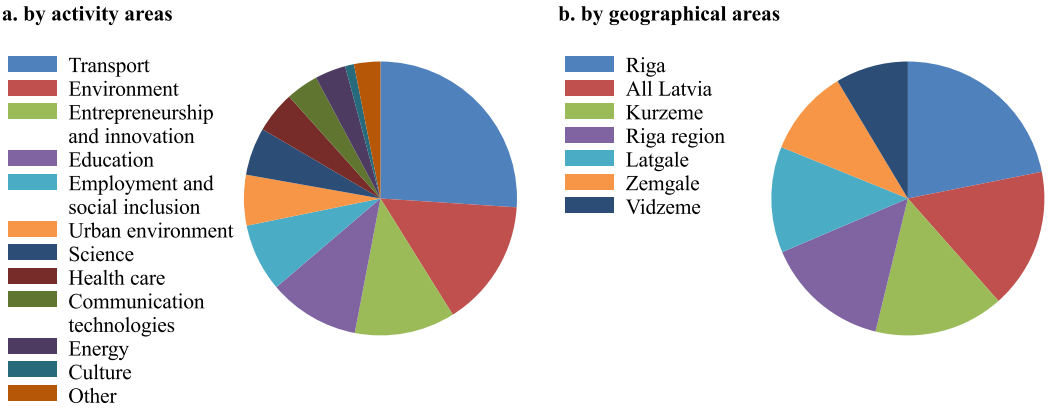
Two thirds of the firms we consider in our analysis fall into the operational programme "Entrepreneurship and Innovation" and its activity "Entrepreneurship Support", constituting around 60% of all such companies. Most of the entrepreneurship support takes the form of promotion of firms in foreign markets or aim at facilitating

[5] http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tec00114.

[6] This figure does not account for funding available from the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund which are EU regional support instruments in agriculture and fishing respectively.

development of micro, small and medium-sized enterprises in lagging regions. 13% of the companies we consider in the study receive financial support for investments with high value added and innovation-related activities. The remaining third of firms under consideration implement projects classified under the operational programme "Infrastructure and Services", largely investments in human capital as well as environmental projects. Even though this operational programme is the biggest one in terms of total financing available, the bulk of it is supervised by public institutions that are out of scope of this study.[7]

Figure 1
Allocation of the 2007–2013 programming period's EU funding in Latvia



Source: www.esfondi.lv.

The composition of EU funding in Latvia by activity areas and regions is summarised in Figure 1. Around a quarter of all projects are implemented in the field of transport, followed by the environment (15%), entrepreneurship and innovation (12%) and education (11%). Looking at the regional dimension of the EU supported projects, around a third of them are carried out in Riga or Riga district. Therefore, there is clear evidence of regional aspect as each part of Latvia gets its share of the pie (roughly in accordance with the share of total population).

3. ASSESSING EFFECTIVENESS OF EU REGIONAL POLICY: REVIEW OF STUDIES

The convergence effect of EU regional support has been extensively examined in a number of econometric studies using aggregated national or regional level data (see Hagen and Mohl (2011) for a survey). The results of this body of literature have thus far been rather mixed as the positive effect of EU funding on national/regional growth appears to be far from certain. However, while these studies differ with respect to the choice of the sample, time period, econometric approach and other parameters, some of them find evidence of a positive effect of EU support on regional convergence provided there are strong institutions in the recipient region/country that increase the quality of planning and implementation of projects (e.g. Ederveen et al. (2006); Gruševaja and Pusch (2011), high openness of the economy (Ederveen et al. (2003)) and a higher degree of decentralisation (Bähr (2008)). The growth effect of EU funds has also been shown to be larger when spending is more evenly spread across different items (Becker et al. (2016)), but appears to have been lower during the period of the

[7] A few of these projects are very big infrastructure projects, and each of them alone amounts to more than 100 million euro.

Great Recession (Bachtrögler (2016)), i.e. over the programming period 2007–2013 we consider in our paper.

The impact of EU funding on firm performance has not been thoroughly investigated yet, probably due to a lack of detailed firm-level data. Yet, those few studies that evaluate the EU policy intervention effects apply a non-experimental setting to assess the impact of participation on firms' mean output, employment and/or productivity. They follow standard microeconometric methods usually employed in impact evaluation of participation in various national or regional support programmes: active labour market policies (see e.g. Lechner (2002)), financial support of local enterprises (Bia and Mattei (2012)), tax credits (Bozio et al. (2014)), environmental public policies (List et al. (2003)) and other public interventions. Thus, Pufahl and Weiss (2009) reveal a positive effect of enrolment in EU farm programmes on individual farm sales in Germany. However, the authors do not find any evidence of a positive effect on farm productivity. EU support for R&D is shown by Moral Arce and Paniagua San Martín (2016) to have a positive effect on Spanish companies' internal investments in R&D and employment. As regards the effect of the EU regional policy on regional firm performance, De Zwaan and Merlevede (2013) consider firm-level data for manufacturing firms in all EU Member States in 2000–2006. They show that EU regional support has no impact on employment or productivity. However, the authors do not have data on the recipient status of firms and hence employ a two-tiered matching procedure. They use the propensity score approach to match regions that receive EU funding with those that do not, and then firms in a former group of regions are compared with those that are registered in the latter group. The recent paper by Bachtrögler et al. (2017) is the first one to consider the EU-wide dataset of over two million individual projects co-financed by EU regional funds in the programming period 2007–2013. They provide an econometric analysis of the determinants of project values, using this rich dataset and combining it with business data from the ORBIS database. The largest individual projects are found to be those that a) are co-funded by the ERDF, b) fall within the convergence objective, c) are transport-related activities and d) are implemented by very large companies (as classified by ORBIS).

Thus, to the best of our knowledge this study is the first one to assess the effectiveness of the EU regional policy, in particular ERDF funding, in fostering productivity and competitiveness of firms in less developed regions.

4. DATA

4.1 Dataset of EU funds

For the purpose of the study, we combine several firm-level datasets. The key ingredient of our empirical analysis is a detailed anonymised dataset of entities[8] receiving EU funding from the ERDF, ESF and CF provided by the Ministry of Finance of the Republic of Latvia. This dataset contains information on the amounts received, starting date and end date, economic sector and location of projects as well as the degree of project risk. The dataset covers the EU programming period 2007–2013. However, the first year when entities started making use of the funds available in this period was the year 2009 since the committed funds of the previous

[8] Enterprises, state agencies, local governments and other legal entities.

programming period 2004–2006 could still be used up until 2008. Similarly, due to the presence of this $N+2$ rule, in 2014, the end year of our dataset, entities continued undertaking activities and receiving funding related to the 2007–2013 period. Overall, we have 2 165 entities getting regional support from the ERDF, 534 – from the ESF and 205 – from the CF. As one entity may be involved in several projects, the total number of projects included in the dataset is larger, i.e. 6 493.

As the purposes of these funds differ so does the average project size (in terms of the funding received) and the average length of a project. By far the longest and largest projects are those financed by the CF as these are mainly activities related to improvements in large transport networks. Relatively smaller activities are those co-funded by the ERDF as this instrument was designed to aim at raising competitiveness of small and medium-sized enterprises.

Ultimately, around half of entities had to be dropped from the analysis. First, we had to exclude the activities co-financed by the ESF and CF as most of them were projects whose direct beneficiaries were state institutions (the Employment Agency, local government, etc.), hence their inclusion does not comply with the purpose of this study. Many ERDF beneficiaries are also public sector institutions and therefore are also excluded. Second, there are cases where we lack some of firm performance indicators we analyse, hence such firms are automatically omitted. Thus, we end up with ERDF co-financed projects carried out by 994 companies. In fact, however, the number of firms used in the empirical analysis is even smaller as the subsequent performance of the companies that started receiving ERDF funding in 2013 or later is not yet observed, and the sample is restricted to years until 2013. Furthermore, outlying observations are automatically excluded from the empirical analysis.

4.2 Latvia's firm-level database

To perform the analysis of the EU support effectiveness, we need a counterfactual comprising non-beneficiaries of EU programmes and a set of impact variables for both groups of firms. To this end, we make use of few other anonymised firm-level datasets provided by the CSB and Latvijas Banka. They contain a myriad of firm-specific characteristics for a representative sample of Latvian commercial enterprises in most areas of activities.[9] These datasets are described in the Appendix. By bringing all these datasets together, we obtain a large firm-level database that contains information for the period 2006–2014, with the number of firms varying between 61 159 in 2006 and 99 466 in 2014.

Table 1 below shows that the firm-level dataset at hand in comparison with population aggregates from Structural Business Statistics (published by the CSB) provides a very high coverage of Latvian enterprises in terms of their number, value added or employment. The coverage remains high even for small firms.

[9] We excluded firms from the sectors of agriculture, forestry and fishing (A), financial and insurance activities (K), public administration and defence (O), education (P), health (Q), arts, entertainment and recreation (R), and other services activities (S, except S95, repair of computers and personal and household goods) due to the lack of data or specific nature of the sector.

Table 1
Distribution of firms by size according to Structural Business Statistics and firm-level dataset in 2014 (B–N, S95, excluding K)

Size classes (number of employees)	Number of firms			Value added (thousands of EUR)			Number of employees		
	Structural business statistics	Firm-level dataset	Coverage (%)	Structural business statistics	Firm-level dataset	Coverage (%)	Structural business statistics	Firm-level dataset	Coverage (%)
0–9	91 085	72 236	79.3	2 056.2	1 981.4	96.4	198.0	194.4	98.2
10–19	4 739	3 360	70.9	833.8	701.3	84.1	63.3	45.1	71.3
20–49	2 979	2 502	84.0	1 432.3	1 348.0	94.1	89.1	75.6	84.8
50–249	1 486	1 551	104.4	2 798.2	2 947.8	105.3	140.6	150.0	106.6
250–…	202	263	130.2	2 966.1	3 286.1	110.8	128.7	166.5	129.4
Total	100 491	98 506	98.0	10 086.7	10 412.0	103.2	619.7	631.6	101.9

Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. The sum of variables for the five size classes does not correspond to the number in the last row due to missing data on the number of employees for some firms.

We eliminate outlying observations following Lopez-Garcia et al. (2015) who apply a multi-step exclusion procedure based on the values of various ratios (capital, turnover, labour costs, intermediate inputs and value added to labour or capital) and their numerator and denominator.[10] Thus, we remove slightly more than 2% of observations for value added, turnover, capital and wages, while only less than 1% of observations were removed for the number of employees or intermediate inputs. More important data losses come from non-reporting of several variables (e.g. the number of employees or size of fixed assets), a problem that is more pronounced for small enterprises. All in all, after excluding the outliers and accounting for missing values, we end up with data on 25–30 thousand firms annually.

Finally, several variables were deflated to obtain real values. We deflate value added and intermediate inputs by industry-specific value added and intermediate inputs deflators reported by the CSB. Capital stock is deflated by the investments deflator.

5. METHODOLOGY

5.1 Propensity score matching approach

For the purpose of this study and in line with other related literature on the effects of participation in various public intervention programmes, we employ a non-experimental matching technique.

We let the term $eu_{i,t} \in \{0,1\}$ indicate whether the firm i (the treated firm) starts an ERDF co-financed project in the year t; the variable $\Delta Y^1_{i,t+s}$ denotes the growth rate of a performance indicator (e.g. a change in productivity) of the treated firm at time $t + s$,[11] while $\Delta Y^0_{i,t+s}$ defines the hypothetical growth rate of the performance indicator of the same firm, had it not participated in the ERDF co-financed project. According

[10] First, the given ratio is replaced by the missing one in case of an abnormal growth – more than two interquartile ranges above or below the median growth in the respective sector and year. Moreover, the procedure identifies the source of the extreme growth (the numerator or denominator) and replaces it with the missing one. Second, the variable is replaced with the missing one if its ratio with respect to labour or capital falls into top 1 and 99 percentile of the distribution for the respective ratio.
[11] $s \geq 0$, so that we analyse the performance after launching an EU supported project.

to Heckman et al. (1997), the average casual effect following the involvement into the ERDF co-funded project can be represented as:

$$E\left[\Delta Y^1_{i,t+s} - \Delta Y^0_{i,t+s} \middle| eu_{i,t} = 1\right] = E\left[\Delta Y^1_{i,t+s} \middle| eu_{i,t} = 1\right] - E\left[\Delta Y^0_{i,t+s} \middle| eu_{i,t} = 1\right] \quad (1).$$

Obviously, the counterfactual outcome $\Delta Y^0_{i,t+s}$ is unobservable (the second term in (1)). To construct a reliable counterfactual we rely on the performance of the firms (non-treated or control firms) that do not receive ERDF funding, i.e. $E\left[\Delta Y^0_{i,t+s} \middle| eu_{i,t} = 0\right]$. These firms can serve as an appropriate counterfactual if the treated firms and firms that do not participate in ERDF co-funded projects have very similar initial characteristics. In such a case, we can expect that the selection bias gets insignificant.

In order to approximate the counterfactual $E\left[\Delta Y^0_{i,t+s} \middle| eu_{i,t} = 0\right]$ accurately, one can employ a matching technique, i.e. pairing each treated firm (receiving EU support) with a similar firm from a valid control group on the basis of some observable characteristics. Hence, the idea is to select such non-treated firms that exhibit the distribution of factors as similar as possible to those of the treated companies. To remove the selection bias, the set of such factors should include all possible determinants of participation in an ERDF co-financed project (the initial productivity, size, age, experience in absorption of EU funds, exporting status, etc.).

In this study, we employ the PSM approach (see Rosenbaum and Rubin (1983)). Matching is performed based on a single index that measures the probability of a firm to start an ERDF co-funded project conditional upon initial characteristics of a firm. To identify this probability a probit model of the following form is estimated:

$$Pr\left[eu_{i,t} = 1\right] = \Phi\left[X_{i,t-1}, Sec_i, Year_t\right] \quad (2)$$

where $X_{i,t-1}$ denotes the set of initial characteristics (in the prior period $t - 1$ to ensure exogeneity). Some of the non-linear terms and interactions are also included to avoid inappropriate constraints on the functional form of Φ, alongside a set of dummies to control for the sector in which the firm operates (Sec_i defined at the 2-digit NACE level) and the year ($Year_t$).

We denote an estimated probability of starting an ERDF co-financed project for the firm i at time t in the sector k as $P_{i,k,t}$. The control firm j with the closest propensity score (i.e. the closest predicted probability) is selected as a match for the treated firm. Thus, we ensure that firms have similar characteristics before obtaining ERDF funding and are comparable. We employ the nearest-neighbour matching method both with and without a caliper that requires the control firm j to be chosen within a certain probability distance:

$$\lambda > \left|P_{i,k,t} - P_{j,k,t}\right| = \min_{j \in \{eu_{j,k,t}=0\}} \left(\left|P_{i,k,t} - P_{j,k,t}\right|\right) \quad (3)$$

where λ is a caliper, i.e. a pre-specified scalar that determines the maximum allowed difference in the predicted propensity score. If no firm is found in λ proximity to match the treated firm, the treated firm is excluded from further analysis. Matching occurs only within a specified year and NACE sector to ensure comparability of variables between firms. Alongside one nearest-neighbour matching, we also use a two and five nearest-neighbour matching technique and search for two and five control firms (accordingly) with the closest propensity score.

Having selected the control group (C) of non-treated matched firms that are similar to the EU support receiving treated firms (T), we adopt the standard DiD methodology. It follows the two-step procedure. First, the growth rate in a firm performance indicator is calculated with respect to the pre-entry year for both treated and non-treated firms. Then, the means of growth rates are compared and statistical significance of their differences is estimated:

$$\delta_{DiD,s} = \frac{1}{N_T}\sum_{i,t\in T}\left(\Delta Y_{i,t+s} - \sum_{j,t\in C} w_{ij}\Delta Y_{j,t+s}\right),\ s \in \{0,1,2\} \quad (4)$$

where $\delta_{DiD,s}$ represents the DiD estimator s – the years following the project launch, N_T denotes the number of treated firms, but w_{ij} are the weights of controls generated by the matching algorithm.

The effects of ERDF co-financed project implementation on firm performance may vary depending on the initial firm characteristics (productivity and size prior to participation) or parameters of a project (the amount of funds received, degree of project risk, region where a project is undertaken, etc.). To gauge the heterogeneous effects on firm performance, we estimate the following equation determining the DiD estimator s years after the start of a project as a function of pre-treatment characteristics and project parameters:

$$\left(Y_{i,t+s} - \sum_{j,\tau\in C} w_{ij}Y_{j,\tau+s}\right) = \alpha_o + \alpha_1 F_i + \alpha_2 Z_i + \alpha_3 Macsec_i + \alpha_4 Year_i + e_{i,t} \quad (5)$$

where F_i denotes firm characteristics and Z_i – project parameters. We control for a broad macroeconomic sector ($Macsec_i$)[12] in which a firm operates and the year when it launches a project ($Year_i$).

As mentioned above, one firm can participate in several ERDF co-funded projects. But we cannot distinguish between the effect of each individual project as projects may overlap. Thus, we are interested in the effect of receiving EU support *per se* and add together all projects for each individual firm. Dummy variable $eu_{i,t} = 1$ when a firm launches its first ERDF co-funded project during the multiannual financial framework 2007–2013.[13] For example, if the first project starts in June 2009, $eu_{i,2009} = 1$, we analyse the performance of the firm in 2009, 2010 and 2011, comparing it with the control firm that was matched based on the performance in 2008.[14]

5.2 Total factor productivity estimates

Not all of firm performance variables are observable and part of the dataset. In particular, we are interested in the effect of participation in ERDF co-funded projects on TFP, which should itself be estimated. Here we follow the approach by Galuščák and Lízal (2011) who use a more elaborated version of Wooldridge (2009)

[12] We classify 2-digit NACE industries into the following 11 broad macroeconomic sectors: (1) mining and quarrying, (2) manufacturing, (3) energy and water supply, (4) construction, (5) wholesale and retail trade, (6) transportation and storage, (7) accommodation and food service activities, (8) information and communication, (9) real estate activities, (10) professional, scientific and technical activities, (11) administrative and support service activities.

[13] We cannot observe whether a firm received EU funding during the previous multiannual financial framework 2000–2006 due to the lack of necessary data. However, the amount of such firms is smaller since Latvia joined the EU only in May 2004.

[14] Note that the starting date of the project is not the same as the date of the first transfer of EU funds to the firm; they are usually received later.

methodology. Assuming that the production function is of Cobb–Douglas form, we estimate its coefficients by running the following pooled IV regression:

$$lnVA_{i,t} = \beta_0 + \beta_1 lnK_{i,t} + \beta_2 lnL_{i,t} + h^{-1}\left(lnK_{i,t-1}, lnM_{i,t-1}\right) + \gamma Year_t + \varepsilon_{i,t} + u_{i,t} \quad (6)$$

where $VA_{i,t}$, $K_{i,t}$, $M_{i,t}$ are real value added, real capital and real intermediate inputs respectively for the firm i, $L_{i,t}$ stands for the number of employees, $\varepsilon_{i,t}$ is an unexpected shock to the productivity process (that follows random walk with a drift), while $u_{i,t}$ represents the *iid* error term. Function h^{-1} is approximated with a polynomial of order three. Since the number of employees and TFP are determined simultaneously but capital takes time to build up, the log of employees is instrumented by its own lagged values.

We compute firm-level TFP ($TFP_{i,t}$) as a residual:

$$\widehat{lnTFP}_{i,t} = lnVA_{i,t} - \hat{\beta}_0 - \hat{\beta}_1 lnK_{i,t} - \hat{\beta}_2 lnL_{i,t} - \hat{\gamma} Year_t \quad (7).$$

Similar to Lopez-Garcia et al. (2015), the estimation is performed at a 2-digit industry level. However, β and γ coefficients are replaced by estimated values obtained at a corresponding macrosector if the sector has less than 25 observations per year. Estimation results can be found in Table A1.

6. EMPIRICAL RESULTS

6.1 Assessing the impact of participation in ERDF supported activities on firm performance

6.1.1 Conditional probability of participation

First, we calculate firms' propensity scores, i.e. conditional probabilities to launch an ERDF co-funded project. As mentioned above, we accomplish this by estimating a probit regression where we account for the following factors: firm's productivity (measured as value added per employee), firm's age (the number of years since its establishment), the number of employees, capital-to-labour ratio, liquidity ratio (represented by the cash-to-assets ratio), indebtedness indicator (the debt-to-assets ratio), the ratio of goods and services exports to turnover, the share of employees (managers) having experience of working for a firm that carried out ERDF co-funded projects in the past. We also include square terms of some of these variables. Finally, we control for the year and economic sector the firm operates in. To avoid problems associated with reverse causality, all the covariates used are taken with one-period lag.

Prior to focusing on the results of the empirical estimation we perform a simple comparison of several firm characteristics between ERDF beneficiaries and non-beneficiaries. Table A2 shows that ERDF beneficiaries are, on average, older, they employ a larger number of employees and exhibit higher productivity as compared to the sector's average. Furthermore, it is also evident from the visual inspection of kernel density of the log of labour productivity and the log of TFP of beneficiaries and non-beneficiaries of the ERDF (see Figure A2) as well as from the results of the Kolmogorov–Smirnov test[15] that productivity distributions of participants in ERDF

[15] Not reported here, but available upon request.

co-funded projects tend to stochastically dominate those of non-participants. Importantly, the number of observations in the lower tail of the productivity distribution of beneficiaries is much smaller. ERDF beneficiaries also tend to be more oriented towards foreign markets as indicated by a higher share of exports of both goods and services in their turnover.

Some of these regularities are confirmed by the estimation results of the probit regression (equation (2)) reported in Table 2. In the first specification that includes all observations in the dataset, labour productivity appears positive and statistically significant, implying that more productive firms indeed have *a priori* higher probability to participate in an ERDF co-funded activity. In the second specification, the sample is restricted to years until 2012 as the subsequent performance (in $t + 1$ and $t + 2$) of those companies that started receiving ERDF funding in 2013 or later is not observed, and these are therefore automatically excluded from further analysis. In this restricted sample we still confirm a positive labour productivity effect, but it appears now of a non-linear nature and is more pronounced for more productive firms.

Table 2

Factors affecting the probability of launching an ERDF co-funded project (probit estimates, 2008–2014 for a full sample and 2008–2012 for a PSM sample)

Variables	Full sample	PSM sample
	(1)	(2)
Log of labour productivity	0.049**	0.015
Log of labour productivity square	0.007	0.028***
Age	–0.047***	–0.070***
Age square	0.002***	0.003***
Log of employment	0.289***	0.380***
Log of employment square	–0.003	–0.009
Log of capital-to-labour ratio	0.069***	0.100***
Log of capital-to-labour ratio square	–0.012***	–0.024***
Liquidity ratio	0.149*	0.135
Indebtedness ratio	–0.000	0.000
Exports of goods to turnover	0.487***	0.490***
Exports of services to turnover	0.075	–0.120
Owner from OECD countries (dummy)	–0.212***	–0.307***
Owner from non-OECD countries (dummy)	–0.040	–0.178
Share of employees with EU funds experience	0.429**	0.338
Share of managers with EU funds experience	0.638***	0.517
Year effect	Yes	Yes
Sector effect	Yes	Yes
Number of observations	212 242	57 836
Pseudo R^2	0.22	0.25

Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. The full sample is comprised of all observations in the dataset, the PSM sample is restricted to firms that started to receive EU funds prior to 2013 since we need to observe their performance for the next two years. *(**)[***] denotes significance at 0.1(0.05)[0.01] level.

Being a younger firm (rather than an older one as suggested by merely comparing the mean values in Table A2), having a larger firm size and higher capital-to-labour ratio is associated with a higher participation probability although the latter effect appears

smaller for companies with very high capital-to-labour ratio. Also, the share of exports of goods in a firm's turnover is positively associated with participation, probably meaning that being a player in the global market allows reaping the benefits of investments more easily and encourages firms to apply for EU funding, but also merely reflecting the fact that export potential is one of the criteria for assessing applicants. As companies by rule are required to cover a certain share of total costs of an EU co-funded project from their own resources, we expect the coefficient on the liquidity ratio to be positive and statistically significant. However, this coefficient, even though positive, is not statistically significant in the second sample probably due to the short length of the restricted sample period. Similarly, while the coefficients before the share of employees and managers with prior experience in EU co-financed projects appear positive, they are not statistically significant at any conventional level in a restricted sample (perhaps the role of experience appears to be important only at the end of the sample period). Finally, the companies which are part of multinational groups that originate in one of the OECD countries do not seem to be particularly interested in applying for EU regional support as the coefficient is negative and statistically insignificant in both samples.

As already indicated above, some of these results corroborate with the assessment criteria for participation in ERDF co-funded activities. Thus, applications for funding activities, e.g. "Promotion in the foreign markets" or "Creation of new products and technologies", submitted by companies are assessed based on a firm's (or an industry's average) exports intensity.[16] Labour productivity measured as value added per employee is one of the key ingredients in assessing applicants for participation in the activity "High value added investments".[17] Employees' wage level is an evaluation criterion for participation in the activities "Creation of new products and technologies" and "High value added investments". Few activities, e.g. organisation of international conferences on exports promotion, also require firms to have their turnover level above a certain threshold.[18]

6.1.2 Matching using the nearest neighbour approach

Propensity scores computed using the coefficients derived from the probit regression (using column (2) from Table 2) are the key elements to perform matching for each treated firm. The quality of matching is considered successful if it eliminates pre-treatment differences (evident in the first column of Table 3) between characteristics of firms that participate and do not participate in EU regional support. As mentioned above, matching is implemented using the nearest neighbour approach by additionally requiring that all combinations of firms come from the same year and economic sector. Letting the opposite occur may have a distortive effect on the evaluation of treatment effects given substantial fluctuations in Latvian economic developments across years and sectors. To ensure robustness of our results, we perform matching with 1, 2 and 5 nearest control firms as well as without and with a caliper (with the value of 0.05), i.e. the highest allowed propensity score difference between the treated companies and their matched controls, to get rid of potentially bad matches. Finally, we use only the observations that comply with the common support condition, thus excluding the treated firms with the propensity score lower than the smallest one among control

[16] https://m.likumi.lv/doc.php?id=194223 (Chapter 47.1), https://likumi.lv/doc.php?id=219070 (Annex 3).
[17] https://likumi.lv/doc.php?id=238461#p46&pd=1 (Annex 4).
[18] https://m.likumi.lv/doc.php?id=194223 (Chapter 21).

firms and eliminating the control firms whose propensity score exceeds the maximum one of the treated firms.

Matching quality is satisfactory for most variables using the nearest neighbour matching technique without a caliper as differences in means of firm characteristics among the treated and control firms prior to starting a project are statistically insignificant. The only exception refers to the number of employees when five nearest neighbours are used. However, setting a propensity caliper solves this problem and improves the quality of matching at a cost of losing a few observations.

Table 3
Quality of matching for various methods

Variables	Difference in means of characteristics of treated and control companies (%) using various methods of matching						
	Un-matched	1 nearest neighbour	2 nearest neighbours	5 nearest neighbours	1 nearest neighbour with caliper	2 nearest neighbours with caliper	5 nearest neighbours with caliper
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log of labour productivity	39.6***	–4.7	–4.2	–2.5	–5.3	–4.2	–3.6
Log of labour productivity square	38.1***	0.9	–1.9	0.3	0.4	–1.6	–0.9
Age	19.9***	0.0	2.5	0.9	–1.5	0.4	–1.6
Age square	22.0***	0.9	3.3	1.2	–0.9	0.7	–1.5
Log of employment	118.5***	6.4	9.4	14.0**	3.1	4.4	6.8
Log of employment square	106.6***	10.5	13.2	19.4**	5.6	5.8	9.4
Log of capital-to-labour ratio	29.7***	1.7	0.6	1.8	–0.3	–1.4	–1.2
Log of capital-to-labour ratio square	7.9	4.5	0.4	0.9	2.6	–1.4	–1.5
Liquidity ratio	–6.1	8.8	3.8	0.5	8.9	4.0	0.6
Indebtedness ratio	–2.9	0.2	0.0	–0.2	0.2	0.4	–0.2
Exports of goods to turnover	75.3***	2.4	1.7	4.9	0.1	–2.5	–2.5
Exports of services to turnover	8.8*	–13.4	–8.5	–6.2	–13.7	–8.8	–7.0
Owner from OECD countries (dummy)	23.6***	7.8	5.9	7.0	5.4	2.0	3.3
Owner from non-OECD countries (dummy)	14.8***	0.0	–5.1	0.0	0.0	–7.3	–2.3
Share of employees with EU funds experience	7.4	4.9	–3.0	–0.1	5.3	–3.0	–0.2
Share of managers with EU funds experience	15.6***	5.1	4.4	0.6	5.4	4.1	–0.2
Number of treated firms		390	390	390	380	380	380
Number of control firms		360	684	1 570	351	661	1 490

Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. *(**)[***] denotes significance at 0.1(0.05)[0.01] level. The caliper is set to 0.05 in columns (5)–(7).

6.1.3 DiD estimators

We estimate DiD by comparing changes in mean values of firm characteristics in three consecutive years with respect to the year prior to involvement in ERDF co-funded projects (thus we compare performance in the periods t, t +1 and t + 2 with respect to

$t-1$ to account for differences in initial values). Table 4 reports DiD estimators for all six different matching methods.

It is evident from Table 4 that companies participating in ERDF co-funded activities raise their employment and capital (the latter at even higher rate, so that there is an increase in the capital-to-labour ratio). These indicators start growing soon after firms embark on projects and keep on growing until they reach $t+2$. Firms participating in ERDF co-funded projects increase their size (the number of employees) by approximately 14%–18% in three years comparing with the control group's firms, while their capital-to-labour ratio rises by 35%–40%. Increasing input allows ERDF beneficiaries to expand their output and hence turnover in three years by around 25%–27% in comparison to non-beneficiaries.

Table 4
DiD estimators for various methods of matching

Indicator	Period	1 nearest neighbour	2 nearest neighbours	5 nearest neighbours	1 nearest neighbour with caliper	2 nearest neighbours with caliper	5 nearest neighbours with caliper
		(1)	(2)	(3)	(4)	(5)	(6)
Log of TFP	*t*	–0.013	–0.018	–0.017	–0.015	–0.027	–0.026
	t + 1	0.063	0.060	0.057	0.070	0.059	0.056
	t + 2	0.199**	0.160**	0.148**	0.202**	0.167*	0.162***
Log of labour productivity	*t*	0.005	–0.001	–0.004	0.003	–0.011	–0.015
	t + 1	0.101	0.089	0.078	0.105	0.082	0.071
	t + 2	0.244***	0.198**	0.183***	0.244**	0.193**	0.180***
Log of the average wage	*t*	0.005	0.010	0.011	0.005	0.011	0.010
	t + 1	0.055*	0.076**	0.065***	0.058	0.080***	0.065***
	t + 2	0.063*	0.083**	0.077***	0.066	0.089***	0.081***
Log of the capital-to-labour ratio	*t*	0.155***	0.147***	0.133***	0.156***	0.145***	0.131***
	t + 1	0.272***	0.272***	0.259***	0.275***	0.268***	0.252***
	t + 2	0.380***	0.401***	0.361***	0.379***	0.394***	0.349***
Log of employment	*t*	0.058*	0.072***	0.069***	0.058*	0.075***	0.070**
	t + 1	0.099**	0.123***	0.118***	0.098**	0.128***	0.124***
	t + 2	0.137***	0.172***	0.164***	0.137***	0.182***	0.175***
Log of turnover	*t*	0.073*	0.080**	0.075***	0.076**	0.085**	0.075**
	t + 1	0.161***	0.181***	0.158***	0.167***	0.187***	0.159***
	t + 2	0.242***	0.261***	0.242***	0.245***	0.272***	0.249***
Exports-to-turnover ratio	*t*	0.006	0.004	0.002	0.006	0.005	0.005
	t + 1	0.011	0.008	0.013	0.012	0.009	0.012
	t + 2	0.014	0.007	0.013	0.016	0.011	0.014

Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. *(**)[***] denotes significance at 0.1(0.05)[0.01] level. The caliper is set to 0.05 in columns (4)–(6). To find the statistical significance of DiD estimators we use the bootstrap procedure with 250 replications.

However, the growing capital-to-labour ratio does not translate into higher TFP and labour productivity immediately. The estimated effect on TFP and labour productivity is close to zero in the first period and is positive but insignificant in the second period. Productivity gains appear positive and statistically significant only in the third period after launching a project. Table 4 indicates that labour productivity of participating companies grows by 18%–24% faster compared to non-participating counterparts.

Higher labour productivity also pushes compensation of employees up as treated firms increase the nominal wage by 5%–8% in two years after starting an ERDF co-funded project[19].

The immediate positive effect on capital endowment without a concomitant rise in firm's productivity is *prima facie* surprising. This is possible only if newly installed capital is not fully utilised in the first two periods. Low capital utilisation after its instalment may be a sign of the lack of necessary knowledge and experience of using the acquired capital. Alternatively, it may also signal that firms has no access to wider markets to realise their full potential. To this end, the estimation results also suggest that there is no positive effect on the exports-to-turnover ratio, implying that firms do not expand their involvement in the global market to the extent necessary to fully utilise new capital despite the fact that several ERDF co-funded activities are explicitly aimed at exports promotion.

6.1.4 Heterogeneity of the treatment effects

It is conceivable that the estimated effects exhibit heterogenous patterns across firms, regions and projects. Therefore, in this section we examine whether the above reported DiD estimates vary with different characteristics of firms and projects. To this end, we run cross-sectional regressions for DiD estimators in the period $t + 2$ for seven different firm performance indicators: TFP, labour productivity, the wage level, capital-to-labour ratio, employment, turnover and the exports-to-turnover ratio (see Table 5).

Control variables are divided into three categories. First, initial levels of firm performance indicators are considered. DiD estimators for both TFP and labour productivity appear larger for initially less productive and larger firms, i.e. these firms benefit from participation in ERDF co-funded projects to a larger extent than more productive and smaller firms. The effect on the capital-to-labour ratio is found to be larger for firms with a smaller capital-to-labour ratio, while the effect on employment is higher for initially more productive and smaller firms. Second, the regional aspect is addressed by including dummies for geographical areas where projects are implemented. Interestingly, none of the regional dummies included appears statistically significant, which implies that productivity gains or employment increases are similar across the country. Finally, the last aspect of heterogeneity considered relates to activity. We would expect larger heterogeneity of DiD estimates across different ERDF co-funded activities than the one identified in the regressions. The effect on wages is lower for projects in the activity "Science and Innovation", presumably reflecting the requirement that the granted resources in this activity should not be spent to boost personnel salaries.

What is also somewhat puzzling is the absence of any effect on the exports-to-turnover ratio. We have already shown that launching an ERDF co-funded project does not result in firms becoming more internationally oriented. However, we would expect

[19] We admit that there might be companies among non-recipient control firms that benefit from other tools of the EU regional policy (the ESF, CF, excluded part of the ERDF), thus possibly resulting in a selection bias during matching. A bulk of projects co-financed by these tools are large transport-related network and environmental projects. The direct beneficiaries of such projects are public institutions, but the projects are normally outsourced to private companies, mostly from the construction sector. To test for the robustness of the baseline DiD estimators, we perform our exercise excluding companies classified in the construction sector. The results confirm our baseline estimates and are available upon request.

that this is merely an average estimate and exporting gains might be more visible in the case of activities explicitly aimed at exporting promotion such as direct marketing activities in the global market. Unfortunately, this assumption has not been empirically confirmed.

Table 5

Factors affecting DiD estimators in the period $t + 2$ (DiD, two nearest neighbours with a caliper of 0.05)

Variables	Difference-in-difference estimators (DiD) of:						
	TFP	Labour productivity	Wage	Capital-to-labour	Employ-ment	Turnover	Exports-to-turnover
Initial productivity (log of TFP)	–0.583***	–0.561***	–0.041	0.105	0.097**	–0.097*	0.023
Initial size (log of employment)	0.291***	0.256***	0.055	–0.083	–0.134*	–0.026	–0.023
Age	–0.015	–0.014	–0.011*	–0.001	–0.006	–0.011	0.000
Initial capital-to-labour ratio	–0.009	–0.032	–0.018	–0.245***	0.038	0.055	–0.010
Initial exports-to-turnover ratio	0.240	0.154	–0.059	–0.260	0.203	0.187	–0.111
Risk of the project	–0.030	–0.022	–0.001	–0.056	–0.034	0.044	–0.038
Size of the project	0.021	0.016	0.015	0.001	–0.002	0.075	–0.009
Riga	–0.411	–0.382	–0.085	0.068	0.221	0.367	0.028
Riga region	–0.057	0.060	–0.068	0.231	0.013	0.026	0.048
Kurzeme	–0.054	–0.026	–0.107	–0.012	–0.077	0.035	0.050
Latgale	0.354	0.504	–0.001	0.400	–0.065	0.167	0.114
Vidzeme	0.002	–0.079	–0.056	0.009	–0.010	0.142	–0.008
Zemgale	–0.082	0.046	–0.049	0.529	–0.173	0.091	0.039
Science and innovation	–0.170	–0.010	–0.263*	–0.014	–0.110	–0.437	–0.028
Entrepreneurship support	0.139	0.287	0.040	0.138	–0.240	–0.202	0.067
Exporting promotion	–0.126	–0.531	–0.065	–1.522	0.131	0.298	0.039
Environment protection	0.109	–0.100	–0.108	–1.262*	0.249	–0.099	0.023
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic sector effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	362	362	362	362	362	362	362
R^2	0.343	0.329	0.113	0.254	0.160	0.132	0.088

Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. *(**)[***] denotes significance at 0.1(0.05)[0.01] level. Dependent variables are DiD estimators in $t + 2$ when matching is performed with two nearest neighbours with a caliper = 0.05 (column 5 in Table 4).

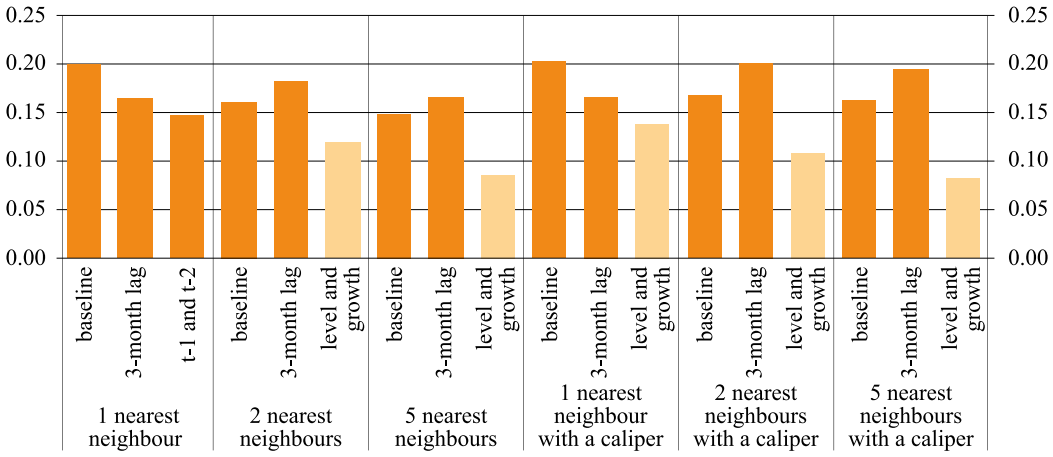
6.1.5 Robustness section

Finally, we perform two robustness checks of the above DiD estimates. First, we consider timing of a project launch. When a firm embarks on an ERDF co-funded project closer to the end of the year, it may not be able to start reaping the benefits until at least the beginning of the next year. In such a case, looking at the outcome in the same year t when a firm launches a project may be misleading. Therefore, we perform an alternative matching of the ERDF beneficiaries that start a project during the last three months of the year with non-beneficiaries in the next year and gauge their relative performance considering the next year as year t. The quality of matching appears satisfactory, and the results of DiD estimation confirm our baseline estimation results (see Figure 2 for the effect on TFP and Table A3 for a broader range of results).

Another robustness check is related to the possibility that the treated firm and the control one may have a similar initial level of productivity, but their productivity growth may still differ. If the treated firm experienced a more pronounced productivity growth in the past and occasionally caught up the control firm in the period $t-1$, it should not come as a surprise that its productivity would grow faster in the future, with productivity level eventually outpacing that of the control firm. To account for such a scenario, we search for the nearest neighbours that are similar in terms of productivity in both the year $t-1$ and year $t-2$ so that at least in the year $t-1$ they experience similar productivity growth. The DiD estimates show that productivity gains become smaller and their significance weaker, suggesting that our previously identified productivity gains in the third year may be the result of the selection bias not properly addressed by the chosen matching procedure (see Figure 2 and Table A4). The estimation results of cross-sectional regressions for DiD estimators are broadly in line with the baseline and therefore are not reported for the sake of brevity.

Figure 2

Comparison of DiD estimators for TFP in the period $t+2$ across different matching strategies and selections of control firms



Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. The light columns represent insignificant estimates (not significant at 0.1 level). The first column refers to the baseline DiD estimator for TFP in $t+2$ ("baseline"), the second – to the DiD estimator that analyses performance of firms launching a project during the last three months of the next year rather than of the same one (a "3-month lag"), and the third – to the DiD estimator that is based on matching that considers both the initial level of TFP and its initial growth ("level and growth").

6.2 Assessing the impact of investment financing source on firm performance

Despite the no-crowding out requirement for receiving EU funding, it was shown by Ederveen et al. (2003) that it still, to a certain extent, replaces the private one. Therefore, it is useful to analyse the impact of EU funding on firm performance in comparison to private funding. In this subsection, we investigate whether the source of investments plays a role in further performance of a company. To the best of our knowledge, this is the first attempt of its kind to compare the effect of both funding

sources on firm performance, though there are some studies comparing the effect of different sources of spending on R&D and innovation (including EU support).[20]

To answer the question posed, we made some adjustments to our matching procedure. More specifically, we ensured that the paired control firm has experienced an increase in the capital-to-labour ratio (a rough proxy for the like investments) similar to that of the treated firm during the three-year period (comparing $t + 2$ with $t - 1$). Thus, we look again at relative performance of similar companies (ERDF beneficiaries and non-beneficiaries) where this similarity also involves magnitudes of investments made.

Technically, this is done by modifying the nearest-neighbour matching described in equation (3). Now the control firm j is chosen based on the following criteria:

$$\lambda > \left|P_{i,k,g,t} - P_{j,k,g,t}\right| = \min_{j \in \{eu_{j,k,g,t}=0\}} \left(\left|P_{i,k,g,t} - P_{j,k,g,t}\right|\right) \quad (8)$$

where $P_{i,k,g,t}$ denotes the predicted probability of receiving ERDF funding at time t for the firm i in the sector k and in the capital-to-labour growth group g. While the capital-to-labour ratio growth over three years is a continuous variable, we follow Iacus et al. (2012) and classify firms into several groups. We apply two strategies here. First, firms are classified into five groups according to the quintiles of the capital-to-labour ratio growth distribution. Second, firms are classified into 10 groups according to the deciles of the same distribution. Afterwards, the nearest-neighbour matching occurs within the specified year, NACE sector and capital-to-labour growth group.

Table 6 reports quality assessment for this modified matching strategy. It can be observed that matching over the same year, sector and capital-to-labour growth rate is rather restrictive since the number of available controls is scarce. That is why the quality of matching is lower compared with Table 3, especially with respect to the initial number of employees, capital-to-labour ratio and exports. However, using the caliper of 0.05, although reducing the number of observations by around 10%, improves the quality significantly, especially with regard to the case of five groups of capital growth. It is important that an increase in the capital-to-labour ratio over the three-year period for treated firms is not statistically significantly different from that of non-participating control firms.[21] Thus, all differences in firm performance should be attributed to the difference between EU funding and private financing, rather than to the magnitude of undertaken investments.

[20] For example, Czarnitzki and Lopes-Bento (2014) look at the effects of national subsidies for innovation in Germany compared to, or in combination with, the effects of European subsidies on innovation and R&D intensity. The study finds that EU subsidies have smaller impact on firms' sales.

[21] Although it is not reported in Table 3, treated and control firms were significantly different in terms of capital-to-labour growth before. The results are available upon request.

Table 6
Quality of matching for various methods

Variables	Difference in means of characteristics of treated and control companies (%) using various methods of matching				
	Unmatched	2 nearest neighbours, 5 groups	2 nearest neighbours, 5 groups, caliper	2 nearest neighbours, 10 groups	2 nearest neighbours, 10 groups, caliper
	(1)	(2)	(3)	(4)	(5)
Log of labour productivity	39.6***	8.8	3.0	11.3	5.5
Log of labour productivity square	38.1***	12.0*	7.6	13.5*	8.6
Age	19.9***	2.3	–3.5	3.5	–5.8
Age square	22.0***	2.6	–3.8	4.3	–5.7
Log of employment	118.5***	25.9***	11.6	38.1***	19.1**
Log of employment square	106.6***	32.7***	15.2*	43.1***	21.3**
Log of capital-to-labour ratio	29.7***	11.6*	9.4	12.1*	10.1
Log of capital-to-labour ratio square	7.9	8.6	4.8	8.6	5.0
Liquidity ratio	–6.1	–1.7	0.0	–7.3	–3.5
Indebtedness ratio	–2.9	–0.6	–0.7	–0.5	–0.2
Exports of goods to turnover	75.3***	10.0	–8.8	20.3**	–2.7
Exports of services to turnover	8.8*	–9.3	–11.6	–1.3	–3.7
Owner from OECD countries (dummy)	23.6***	8.0	6.0	4.1	–3.1
Owner from non-OECD countries (dummy)	14.8***	7.2	3.5	10.5	–4.9
Share of employees with EU funds experience	7.4	–2.2	–2.3	2.1	–0.4
Share of managers with EU funds experience	15.6***	0.6	3.6	5.6	1.3
Growth of capital-to-labour ratio ($t+2$ over $t-1$)	39.6***	2.6	3.5	1.8	2.8
Number of treated firms		382	339	376	326
Number of control firms		670	596	668	570

Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. *(**)[***] denotes significance at 0.1(0.05)[0.01] level. The caliper is set to 0.05 in columns (3) and (5).

DiD estimators displayed in Table 7 show that in situations where investments are kept constant there are no major differences in the impact estimates of ERDF funding vs private financing. If we compare productivity performance, ERDF co-funded projects result in a larger increase in labour productivity and TFP in the third year; however, this difference is not statistically significant across all matching strategies.

The only striking feature of the EU Regional support programme appears in the effect on employment, i.e. participation in ERDF co-funded projects leads to a significantly larger increase in the number of employees compared to private funding (by around 20% after three years). This might be related to the assessment process for participation in ERDF co-funded activities if firms with a potential to increase labour and turnover have a preference[22]. There is also limited evidence of a higher increase of the wage rate for ERDF beneficiaries.

[22] For example, participation in the activity "Creation or reconstruction of industrial premises" is *inter alia* assessed in relation to future employment prospects (https://likumi.lv/doc.php?id=257096).

Table 7
DiD estimators for various methods of matching

Indicator	Period	2 nearest neighbours, 5 groups	2 nearest neighbours, 5 groups, caliper	2 nearest neighbours, 10 groups	2 nearest neighbours, 10 groups, caliper
		(1)	(2)	(3)	(4)
Log of TFP	*t*	–0.026	–0.031	–0.033	–0.038
	t + 1	0.056	0.085	0.050	0.047
	t + 2	0.157**	0.192**	0.114	0.116
Log of labour productivity	*t*	–0.051	–0.054	–0.048	–0.042
	t + 1	0.012	0.039	0.011	0.015
	t + 2	0.100	0.136	0.078	0.087
Log of average wage	*t*	–0.006	–0.005	0.007	0.010
	t + 1	0.056*	0.064*	0.044	0.057
	t + 2	0.072**	0.088**	0.049	0.056
Log of the capital-to-labour ratio	*t*	0.005	0.013	0.016	0.024
	t + 1	0.007	0.029	0.001	0.014
	t + 2	0.031	0.042	0.021	0.033
Log of employment	*t*	0.105***	0.103***	0.096***	0.091***
	t + 1	0.157***	0.154***	0.158***	0.151***
	t + 2	0.218***	0.219***	0.196***	0.195***
Log of turnover	*t*	0.085**	0.082**	0.077**	0.072**
	t + 1	0.179***	0.187***	0.150***	0.136***
	t + 2	0.255***	0.261***	0.195***	0.178***
Exports-to- turnover ratio	*t*	0.006	0.009	0.012	0.012
	t + 1	0.011	0.014	0.024*	0.026*
	t + 2	0.021	0.028*	0.028**	0.034**

Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. *(**)[***] denotes significance at 0.1(0.05)[0.01] level. The caliper is set to 0.05 in columns (2) and (4). To find the statistical significance of DiD estimators, we use the bootstrap procedure with 250 replications.

Private financing of capital acquisition usually comes from two alternative sources, i.e. own resources and loans from credit institutions. Therefore, we also estimate the effect of EU funding vis-à-vis these two sources separately. To capture the case of loans, treated ERDF beneficiaries are matched with those ERDF non-beneficiaries whose capital increase occurs simultaneously with an increase in a firm's stock of long-term debt (over the same period of time) amounting to at least 50% of acquired capital value.[23] To compare ERDF beneficiaries with the non-beneficiaries that predominantly cover the acquired capital from own resources, treated firms are matched with the firms whose rise in the capital-to-labour ratio is comparable but whose increase in indebtedness is below the 50% threshold.

[23] We do not know for sure whether a firm took a loan to finance capital acquisition or for any other purpose. We make this assumption as the data on the source of investment financing are not available.

Table 8
DiD estimators for various sources of capital financing

Indicator	Period	ERDF financing vs predominantly loans	ERDF financing vs predominantly own resources
		(1)	(2)
Log of TFP	*t*	0.027	0.003
	t + 1	0.043	0.063
	t + 2	0.124	0.156*
Log of labour productivity	*t*	0.002	–0.008
	t + 1	–0.014	0.035
	t + 2	0.064	0.110
Log of the average wage	*t*	–0.000	–0.009
	t + 1	0.051	0.046
	t + 2	0.074	0.070**
Log of the capital-to-labour ratio	*t*	0.044	0.052
	t + 1	0.069	0.034
	t + 2	0.083*	0.002
Log of employment	*t*	0.127***	0.090***
	t + 1	0.216***	0.132***
	t + 2	0.294***	0.202***
Log of turnover	*t*	0.142**	0.090**
	t + 1	0.239***	0.158***
	t + 2	0.315***	0.240***
Exports-to-turnover ratio	*t*	0.020	0.028***
	t + 1	0.021	0.035**
	t + 2	0.022	0.039**
Number of treated firms		276	322
Number of control firms		411	575

Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. *(**)[***] denotes significance at 0.1(0.05)[0.01] level. The caliper is set to 0.05, two nearest neighbours, five groups of capital-to-labour growth. To find the statistical significance of DiD estimators, we use the bootstrap procedure with 250 replications.

Table 8 shows the DiD estimation results for the case when firms are classified into five groups according to the quintiles of the capital-to-labour ratio growth distribution and the caliper is set to 0.05 as this matching strategy entails better quality.[24] No remarkable differences between these two cases are uncovered, apart from the fact that the impact on the increase in the exports-to-turnover ratio appears to be statistically significant when investments are financed by the ERDF rather than own resources. There is also an evidence (although with a weak significance) of productivity and wage improvements in this case.

[24] The results are available upon request.

7. CONCLUSIONS

This paper examines the effect of participating in EU co-funded projects on firm performance using a rich dataset of Latvian firms. The analysis considers ERDF beneficiaries as this EU regional policy instrument is particularly fit to enhance competitiveness of private companies and therefore is in line with the goal of this paper.

To evaluate the impact of participation in ERDF co-funded projects, we employ the propensity score matching approach, which is widely used in microeconometric research on the outcome of participation in various publicly sponsored programmes. We find that participation in ERDF co-funded activities raises a firm's capital-to-labour ratio and employment soon after the start of a project, while a positive effect on labour productivity takes a longer time to kick in. We also find that there is no statistically significant productivity premium associated with private vs public (the ERDF) financing of investment projects, though in the latter case firms tend to increase the number of their employees more rapidly, presumably reflecting selection criteria for participation in ERDF co-funded projects. Finally, we show that the positive effect on TFP and labour productivity is more likely to materialise for companies that are bigger and less productive prior to participation in EU supported programmes, while the effect on employment is larger for more productive and relatively smaller firms.

The immediate positive effect on capital endowment without a concomitant rise in a firm's productivity is surprising and represents an avenue for future research. This is possible only if newly installed equipment or facilities are not fully utilised in the initial periods. Lags in acquired capital utilisation may point to the presence of knowledge gaps, i.e. employees lack the necessary skills to gain most from the installed capital. Alternatively, to attain the EU funding productivity premium, firms may need to considerably expand their production by spreading their sales outside the domestic market which may not happen immediately.

When interpreting these results, one should bear in mind that we consider a participation moment to occur in the year when a firm starts a project. However, in the case of long-lasting projects taking years, firms may indeed be unable to reap their benefits until project completion. As the end year of our dataset is 2014, we may still be unable to see the full effect of the EU multiannual financial framework 2007–2013. Moreover, firms that applied for EU support in 2013 or 2014 are effectively out of our investigation. In the future, accumulating longer data series would allow observing the effect of EU funding over a longer time period and drawing more precise conclusions regarding their effectiveness.

On the policy side, we see some room for improvements in the effectiveness of design and allocation of EU funds depending on the objectives pursued by policymakers. If the objective is to create more jobs and raise capital, authorities should presumably target more productive firms. However, it was shown that such firms might gain relatively less in terms of subsequent productivity performance. Policy activities that promote companies internationally would contribute to raising capital utilisation and therefore allow companies to benefit more from newly installed capital co-funded by the EU. To this end, the fact that participation in external promotion activities affects the subsequent exporting along the same lines as participation in other ERDF co-

funded programmes, where explicit promotion of exports is not considered as the main objective, is striking and might indicate that such activities should be better designed.

Since a positive effect on employment appears as a highly robust finding across various matching strategies, it would be interesting to analyse the origins of extra labour attracted in future research. If labour comes from a pool of unemployed or inactive persons, ERDF projects improve national employment figures. However, if new employees come from other enterprises, the ERDF may have an adverse effect on allocation of labour.

APPENDIX

Firm-level datasets used in the study

In this study, apart from the dataset containing information on EU co-financed projects, the following firm-level datasets are used.

Firms' indicators comprehensive database that contains records from companies' balance sheets and profit and loss statements as well as provides data on value added, the number of employees, personnel costs, production value and the use of intermediate inputs. Data are collected on the basis of the CSB annual statistical report "1-annual", "Complex report on activities" and reports to the State Revenue Service.

Goods external trade database that includes data on merchandise flows (exports and imports) where merchandise is classified according to the 8-digit Combined Nomenclature (CN8) classification. This database is based on data coming from two sources: INTRASTAT surveys for Latvia's trade with other EU Member States and custom declarations for trade with countries outside the EU.

Services external trade database compiled by Latvijas Banka provides data on export and import flows for all types of services apart from travel, construction, insurance and government services for which detailed firm-level information is not collected and other sources are used for the balance of payments purpose.

Firms' foreign assets and liabilities dataset, also compiled by Latvijas Banka, provides information on external assets and liabilities of firms. This dataset allows detecting companies with direct foreign owners (including the country of origin of an owner).

Employer-employee data provided by the CSB and based on the State Revenue Service information from companies' social insurance tax declarations allows tracking employees experienced in working on projects co-funded by EU regional support instruments.

Table A1
Coefficients of the Cobb–Douglas production function

Sector	Coefficient before labour ($\hat{\beta}_1$)	Coefficient before capital ($\hat{\beta}_2$)	Number of observations
05 Mining of coal and lignite	0.669***	0.302***	718†
06 Extraction of crude petroleum	0.669***	0.302***	718†
07 Mining of metal ores	0.669***	0.302***	718†
08 Other mining and quarrying	0.668***	0.302***	711
09 Mining support service activities	0.669***	0.302***	718†
10 Manufacture of food products	0.611***	0.183***	2 814
11 Manufacture of beverages	0.743***	0.392***	267
12 Manufacture of tobacco products	0.681***	0.197***	24 406†
13 Manufacture of textiles	0.658***	0.172***	639
14 Manufacture of wearing apparel	0.894***	0.162***	1 584
15 Manufacture of leather and related products	1.044***	0.129**	190
16 Manufacture of wood and products of wood and cork	0.502***	0.257***	4 335
17 Manufacture of paper and paper products	0.638***	0.162**	389
18 Printing and reproduction of recorded media	0.785***	0.200***	1 581
19 Manufacture of coke and refined petroleum products	0.681***	0.197***	24 406†
20 Manufacture of chemicals and chemical products	0.629***	0.192***	656
21 Manufacture of basic pharmaceutical products	0.681***	0.197***	24 406†
22 Manufacture of rubber and plastic products	0.843***	0.171***	975
23 Manufacture of other non-metallic mineral products	0.519***	0.157***	1 242
24 Manufacture of basic metals	0.681***	0.197***	24 406†
25 Manufacture of fabricated metal products	0.729***	0.207***	2 796
26 Manufacture of computer, electronic and optical products	0.719***	0.182***	474
27 Manufacture of electrical equipment	0.824***	0.177***	329
28 Manufacture of machinery and equipment not elsewhere classified	0.629***	0.238***	680
29 Manufacture of motor vehicles, trailers and semi-trailers	0.681***	0.197***	24 406†
30 Manufacture of other transport equipment	0.681***	0.197***	24 406†
31 Manufacture of furniture	0.633***	0.205***	2 011
32 Other manufacturing	0.861***	0.155***	880
33 Repair and installation of machinery and equipment	0.774***	0.180***	2 005
35 Electricity, gas, steam and air conditioning supply	0.284***	0.109**	1 503
36 Water collection, treatment and supply	0.416***	0.181***	2 717†
37 Sewerage	0.728***	0.020	247
38 Waste collection, treatment and disposal activities	0.695***	0.210***	727
39 Remediation activities and other waste management services	0.416***	0.181***	2 717†
41 Construction of buildings	0.543***	0.170***	4 873
42 Civil engineering	0.705***	0.247***	1 855
43 Specialised construction activities	0.766***	0.204***	10 621
45 Wholesale and retail trade and repair of motor vehicles	0.695***	0.146***	10 455
46 Wholesale trade, except of motor vehicles and motorcycles	0.518***	0.163***	28 831
47 Retail trade, except of motor vehicles and motorcycles	0.687***	0.112***	30 926
49 Land transport and transport via pipelines	0.535***	0.188***	11 809
50 Water transport	0.680***	0.166***	18 240†
51 Air transport	0.680***	0.166***	18 240†
52 Warehousing and support activities for transportation	0.773***	0.157***	6 004

Sector	Coefficient before labour ($\hat{\beta}_1$)	Coefficient before capital ($\hat{\beta}_2$)	Number of observations
53 Postal and courier activities	0.680***	0.166***	18 240†
55 Accommodation	0.550***	0.194***	2 014
56 Food and beverage service activities	0.693***	0.134***	5 653
58 Publishing activities	0.928***	0.126***	1 487
59 Video programme production, sound recording and music publishing	0.914***	0.181***	665
60 Programming and broadcasting activities	0.916***	0.201***	9 448†
61 Telecommunications	0.846***	0.243***	1 320
62 Computer programming, consultancy and related activities	0.972***	0.188***	4 170
63 Information service activities	0.991***	0.221***	1 410
68 Real estate activities	0.500***	0.093***	16 264
69 Legal and accounting activities	0.919***	0.126***	10 305
70 Activities of head offices; management consultancy activities	0.846***	0.144***	3 816
71 Architectural and engineering activities	0.859***	0.201***	5 143
72 Scientific research and development	0.703***	0.061	377
73 Advertising and market research	0.847***	0.182***	4 866
74 Other professional, scientific and technical activities	0.736***	0.195***	2 445
75 Veterinary activities	0.824***	0.161***	27 344†
77 Rental and leasing activities	0.525***	0.226***	2 465
78 Employment activities	0.894***	0.236***	712
79 Travel agency, tour operator and related activities	0.954***	0.124***	1 764
80 Security and investigation activities	0.911***	0.101***	1 214
81 Services to buildings and landscape activities	0.881***	0.110***	1 845
82 Office administrative, office support and other activities	0.874***	0.061	770

Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. *(**)[***] denotes significance at 0.1(0.05)[0.01] level. † reflects that estimates were made on a broad macroeconomic sector level.

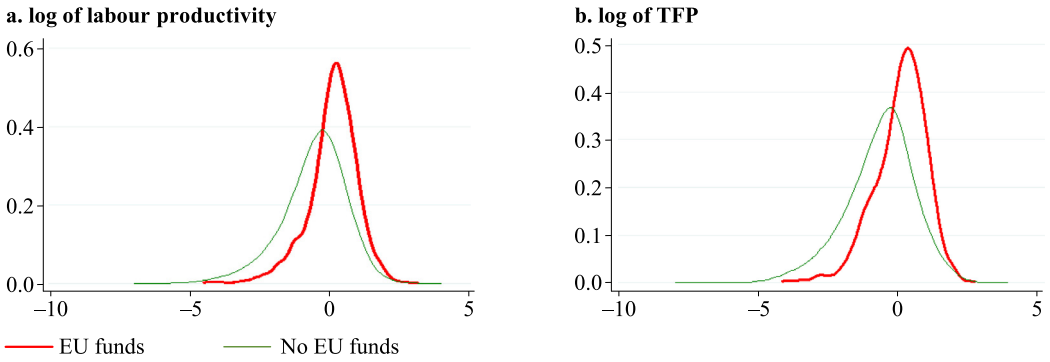
Table A2
Comparison of ERDF beneficiaries and non-beneficiaries

Firm characteristics	ERDF beneficiaries (N = 994)		ERDF non-beneficiaries (N = 547 470)	
	Mean	Standard deviation	Mean	Standard deviation
Age	9.04	6.67	7.18	5.91
Number of employees	59.85	167.05	10.64	76.11
Log of relative labour productivity*	0.61	1.12	0.00	1.30
Log of relative TFP*	0.71	1.12	0.00	1.24
Ln of relative capital-to-labour ratio*	0.80	1.88	0.00	2.05
Exporter of goods and/or services (dummy)	0.43	0.50	0.07	0.26
Exports of goods to turnover	0.17	0.29	0.02	0.10
Exports of services to turnover	0.02	0.13	0.01	0.07

* Relative to the average in the sector and year.

Figure A1

Distribution of productivity of firms receiving ERDF funding compared with other firms



Sources: CSB, Latvijas Banka and the authors' calculations.

Table A3

Did estimators for various methods of matching (addressing the problem of the end of the year)

Indicator	Period	1 nearest neighbour	2 nearest neighbours	5 nearest neighbours	1 nearest neighbour with a caliper	2 nearest neighbours with a caliper	5 nearest neighbours with a caliper
		(1)	(2)	(3)	(4)	(5)	(6)
Log of TFP	*t*	–0.033	–0.018	0.014	–0.037	–0.019	0.013
	t + 1	–0.002	0.043	0.071	0.005	0.051	0.083
	t + 2	0.164*	0.182**	0.165***	0.166*	0.201***	0.193***
Log of labour productivity	*t*	–0.007	0.001	0.025	–0.014	–0.005	0.019
	t + 1	0.020	0.073	0.098*	0.018	0.074	0.099
	t + 2	0.170*	0.211***	0.197***	0.166*	0.220***	0.210***
Log of the average wage	*t*	0.035	0.034	0.010	0.031	0.030	0.008
	t + 1	0.091***	0.091***	0.063***	0.088**	0.090***	0.062**
	t + 2	0.079**	0.101***	0.085***	0.075*	0.102***	0.088***
Log of the capital-to-labour ratio	*t*	0.150***	0.133***	0.126***	0.132**	0.118**	0.106**
	t + 1	0.216***	0.238***	0.258***	0.192**	0.225***	0.234***
	t + 2	0.260***	0.297***	0.334***	0.234***	0.282***	0.311***
Log of employment	*t*	0.099***	0.091***	0.094***	0.098***	0.091***	0.096***
	t + 1	0.170***	0.135***	0.130***	0.173***	0.134***	0.136***
	t + 2	0.237***	0.182***	0.184***	0.239***	0.184***	0.190***
Log of turnover	*t*	0.085**	0.092***	0.090***	0.084**	0.093***	0.089***
	t + 1	0.148***	0.155***	0.150***	0.153***	0.159***	0.156***
	t + 2	0.254***	0.244***	0.233***	0.256***	0.252***	0.243***
Exports-to- turnover ratio	*t*	0.008	0.017	0.013	0.009	0.018*	0.015*
	t + 1	0.006	0.018	0.018	0.008	0.019	0.019
	t + 2	0.002	0.011	0.013	0.004	0.012	0.014

Sources: CSB, Latvijas Banka and the authors' calculations.

Notes. *(**)[***] denotes significance at 0.1(0.05)[0.01] level. The caliper is set to 0.05 in columns (4)–(6). To find the statistical significance of DiD estimators, we use the bootstrap procedure with 250 replications.

Table A4

DiD estimators for various methods of matching (matching with firms having similar labour productivity in both *t* – 1 and *t* – 2)

Indicator	Period	1 nearest neighbour	2 nearest neighbours	5 nearest neighbours	1 nearest neighbour with a caliper	2 nearest neighbours with a caliper	5 nearest neighbours with a caliper
		(1)	(2)	(3)	(4)	(5)	(6)
Log of TFP	*t*	0.029	–0.023	0.005	0.016	–0.035	–0.003
	t + 1	0.070	0.057	0.062	0.062	0.042	0.047
	t + 2	0.146*	0.118	0.085	0.137	0.108	0.082
Log of labour productivity	*t*	0.039	–0.015	0.020	0.028	–0.026	0.013
	t + 1	0.101	0.079	0.091	0.092	0.065	0.078
	t + 2	0.152*	0.139*	0.115*	0.144	0.124	0.108
Log of the average wage	*t*	0.002	0.010	0.008	0.002	0.010	0.010
	t + 1	0.066*	0.064**	0.062**	0.062*	0.061**	0.059**
	t + 2	0.088**	0.088**	0.083***	0.086**	0.088***	0.085***
Log of the capital-to-labour ratio	*t*	0.128**	0.115***	0.133***	0.132***	0.115**	0.136***
	t + 1	0.264***	0.258***	0.270***	0.272***	0.260***	0.270***
	t + 2	0.329***	0.347***	0.353***	0.341***	0.351***	0.357***
Log of employment	*t*	0.074**	0.065***	0.058***	0.074**	0.066**	0.057**
	t + 1	0.141***	0.122***	0.110***	0.140***	0.127***	0.115***
	t + 2	0.229***	0.181***	0.160***	0.229***	0.195***	0.169***
Log of turnover	*t*	0.081**	0.073**	0.071**	0.078*	0.070**	0.064**
	t + 1	0.172***	0.159***	0.145***	0.168***	0.151***	0.135***
	t + 2	0.269***	0.234***	0.212***	0.265***	0.231***	0.203***
Exports-to-turnover ratio	*t*	0.012	0.009	0.006	0.015	0.011	0.010
	t + 1	0.034**	0.027*	0.018	0.036**	0.029	0.021*
	t + 2	0.043***	0.029**	0.023*	0.045**	0.032*	0.025**

Sources: CSB, Latvijas Banka and the authors' calculations.
Notes. *(**)[***] denotes significance at 0.1(0.05)[0.01] level. The caliper set to 0.05 in columns (4)–(6). To find the statistical significance of DiD estimators, we use the bootstrap procedure with 250 replications.

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